

Technical Bulletin

The Conservation of Indigenous Fishes of Goa



**ICAR-Central Coastal Agricultural
Research Institute (ICAR-CCARI)**
Ella, Old Goa, Goa - 403 402





Technical Bulletin 80/2026

Technical Bulletin

The Conservation of Indigenous Fishes of Goa



**ICAR-Central Coastal Agricultural Research Institute
(ICAR-CCARI),
Ella, Old Goa, Goa - 403 402**

Citation:

Mayekar Trivesh, G.B. Sreekanth, Prajapati Vishwajeet, Shetye Harshvardhan. The Conservation of Indigenous Fishes of Goa. ICAR – Central Coastal Agricultural Research Institute, Ela, Old Goa – 403402, Goa, India, p40.

Published by:

Dr. Parveen Kumar

Director

ICAR - Central Coastal Agricultural Research Institute

Ela, Old Goa – 403 402

Fax: 0832-2285649

Phone: 0832-2284678, 2284679

E-mail: director.ccari@gmail.com

Website: www.ccari.res.in

Compiled and Edited:

Trivesh Mayekar, Sreekanth G.B., Vishwajeet Prajapati,
Shetye Harshvardhan

Copyright @ 2026, ICAR-Central Coastal Agricultural
Research Institute

All Rights Reserved for reproduction of this document or any part thereof, Permission of ICAR-Central Coastal Agricultural Research Institute, Old Goa must be obtained.

Foreword

Freshwater ecosystems of Goa, though limited in geographical extent, harbour a rich diversity of indigenous fish species, many of which are endemic to the Western Ghats and of significant ecological, ornamental, and livelihood importance. These species play a vital role in maintaining aquatic ecosystem balance, supporting rural livelihoods, and contributing to food and nutritional security. However, anthropogenic activities, habitat degradation, pollution, introduction of invasive species and climate-induced changes pose serious threats to their survival, necessitating immediate and systematic conservation efforts. In this context, I am pleased to introduce this technical bulletin titled “The Conservation of Indigenous Fishes of Goa”, brought out by the scientists of ICAR–Central Coastal Agricultural Research Institute (ICAR-CCARI), Goa. This technical bulletin comprehensively documents the institute’s multi-dimensional efforts towards the conservation and utilization of Small Indigenous Fishes (SIFs) through a combination of in situ and ex situ strategies. The integration of scientific research with community participation, educational outreach and innovative models such as agro-eco-tourism and bamboo aquariums makes this publication both impactful and socially relevant. The work presented in this bulletin not only strengthens the scientific foundation for freshwater biodiversity conservation in Goa but also provides practical and replicable models for other regions with similar ecological and cultural settings. It is my sincere hope that this document will serve as a valuable resource for researchers, students, fisheries professionals, policy makers and conservation practitioners engaged in safeguarding indigenous aquatic biodiversity of Goa.

I congratulate the authors and the entire team for their dedicated efforts in bringing out this meaningful publication and appreciate their contribution towards conserving the rich freshwater fish heritage of Goa for future generations.



Dr. Parveen Kumar

Director, ICAR-CCARI

Acknowledgements

The authors sincerely acknowledge the support and guidance of the Indian Council of Agricultural Research (ICAR), New Delhi, and the Director, ICAR–Central Coastal Agricultural Research Institute (ICAR-CCARI), Goa, for providing institutional support and facilities for implementing this programme and bringing out this technical bulletin. We gratefully acknowledge the support and cooperation extended by the Department of Fisheries, Government of Goa, Forest Department (Government of Goa), Goa State Biodiversity Board (GSBB), and other associated line departments for facilitating field surveys, biodiversity documentation, and conservation interventions. We thank the management committees of Shri Mangeshi Temple, Mardol, and Shri Shantadurga Temple, Kavalem, for supporting the establishment of temple pond live gene banks. Our sincere appreciation is extended to scientists, technical staff, young professionals, project staff and contractual staff of ICAR-CCARI who were directly or indirectly involved in planning, field sampling, captive breeding, live gene bank development, data collection, and documentation. We also acknowledge the support of local communities, fishermen, school authorities, students, and enthusiast participants for actively participating in conservation awareness programmes and outreach activities. Their involvement played a crucial role in strengthening community ownership and stewardship for indigenous fish conservation in Goa. Lastly, we thank all individuals, institutions, and stakeholders who have contributed directly or indirectly to this initiative but could not be mentioned individually. Their collective support has been instrumental in advancing the mission of conserving the invaluable indigenous freshwater fish diversity of Goa.

Trivesh Mayekar
Sreekanth G.B.
Vishwajeet Prajapati
Shetye Harshvardhan

Contents

Executive summary	1
Introduction	2
Objectives	6
Study Area and Methodology	7
Indigenous Fish Ranching in Temple Pond at Mangeshi Temple, Mardol	9
Indigenous Fish Ranching in Temple Pond at Shantadurga Temple, Kavalem	10
Indigenous Fish Ranching in Goan Rivers	11
Development of Live Gene Banks	13
Conservation and Breeding of Small Indigenous Freshwater Fishes (SIFs) of Goa	15
Assessment of Freshwater Fish Diversity in Goa's Riverine Ecosystems	19
Fish Biodiversity Documentation from Protected Forest Areas of Goa	21
Conservation and management of Ramsar Site: Nanda Lake fish biodiversity	25
Promotion of Mola-IMC Polyculture	27
Utilization of Farm-Propagated SIFs as Live Feed for Asian Seabass	30
Indigenous Fish Conservation in Agro-Eco-Tourism Unit, Goa	32
Promotion of Indigenous Ornamental Fish Culture through Innovative Bamboo Aquarium	33
Community Engagement and Education	35
Significant Achievements	40
Recommendations	41

Executive summary

The ICAR–Central Coastal Agricultural Research Institute (ICAR–CCARI), Goa, has implemented an integrated conservation programme for freshwater biodiversity, focusing on Small Indigenous Fishes (SIFs). The strategy combines in situ and ex situ measures such as river ranching, temple pond stocking, live gene banking, captive breeding, habitat restoration, and biodiversity documentation. Temple ponds at Mangeshi and Shantadurga have been converted into live gene banks supporting up to 12 SIF species, while river ranching in the Valvanti and other rivers has helped restore seven indigenous species. Captive breeding of threatened species like *Haludaria pradhani*, *Pethia setnai*, and *Rasbora dandia* ensures a sustainable seed supply.

Surveys across 16 freshwater ecosystems recorded 84 fish species, guiding targeted conservation actions. Studies at Ramsar and protected sites, including Nanda Lake and six wildlife sanctuaries, identified threatened taxa and informed restoration plans. The Butterfly Garden & Conservatory Project in Benaulim linked conservation with agro-eco-tourism, while outreach through community engagement and institutional collaborations strengthened awareness. Overall, the programme aligns with national priorities and Sustainable Development Goals, offering a replicable, science-based model for biodiversity conservation with socio-economic benefits.

Introduction

Freshwater ecosystems in Goa, though modest in geographical extent, are rich in aquatic biodiversity and form a critical component of the state's ecological, cultural, and economic landscape. Among these, Small Indigenous Fishes (SIFs) hold significant ecological value as indicators of habitat health, contributors to aquatic food webs, and resources for ornamental and subsistence fisheries. However, increasing anthropogenic pressures, habitat degradation, water pollution, invasive species, and climate change have placed many of these species at risk, with several now classified as threatened or vulnerable.

At the national level, India harbours 765 native freshwater fish species, of which approximately 450 can be classified as small indigenous freshwater fishes. The highest diversity of SIFs is recorded from the North-East region, followed by the Western Ghats and Central India—placing Goa within a globally significant biodiversity hotspot. According to the National Bureau of Fish Genetic Resources (NBFGR), about 23% (104 species) of these SIFs are of high importance for food, ornamental trade, and local livelihood security. Of these, 62 species are valued primarily as food fishes, while 42 species hold ornamental value. Nutritionally, several species such as *Amblypharyngodon mola*, *Osteobrama cotio cotio*, *Esomus danricus*, and *Corica soborna* are exceptionally rich in vitamin A, iron, and other micronutrients, contributing significantly to food and nutritional security, particularly in rural and economically

disadvantaged communities. Studies in Bangladesh and Cambodia have shown that small fish species can constitute 50–80% of all fish consumed during the production season, underscoring their importance in diets and livelihoods (Sarkar & Lakra, 2010).

SIFs represent exceptional nutritional resources with protein content ranging from 12.49% to 18.30% (wet weight), including complete essential amino acid profiles with concentrations of 1,319–2,940 $\mu\text{mol/L}$. These fish provide remarkable micronutrient density, containing calcium levels of 807–2,470 mg/100g, phosphorus up to 2,470 mg/100g, iron ranging 2.70–38.04 mg/100g, and zinc content of 2.48–54.46 mg/100g, alongside vitamin A content of 378.96 $\mu\text{g}/100\text{g}$. The lipid composition of 0.7–19.63% includes valuable omega-3 fatty acids such as EPA and DHA, with oleic acid content of 1.94 g/100g supporting cardiovascular health. SIS offer superior nutrient bioavailability due to whole fish consumption including bones, organs, and scales, providing energy density of 374–445 Kcal/100g while maintaining low carbohydrate content of 0.33–15.73 g/100g. A 100g serving can provide $\geq 100\%$ of vitamin B12 requirements and $\geq 25\%$ of six or more essential nutrients, making them critical for addressing iron deficiency anemia, zinc deficiency, vitamin A deficiency, and calcium deficiency, particularly in economically disadvantaged populations where their low cost and high nutritional density ensure accessibility to complete animal protein sources (Islam et al., 2023; Pegu & Baruah, 2025).

Threats to Freshwater Fish Biodiversity in Goa

The freshwater fish fauna of Goa faces multiple converging threats.

Table: Key threats to indigenous freshwater fish species in Goa

Threat Category	Specific Pressures	Severity
Habitat Loss	River channelisation, sand mining, wetland reclamation	High
Water Pollution	Agricultural runoff, sewage discharge, industrial effluents	High
Invasive Species	Tilapia, African catfish — competition and predation	High
Overfishing	Fine mesh nets, electric fishing, poisoning	Medium
Climate Change	Altered monsoon patterns, stream drying, temperature rise	Medium
Dam Construction	Disrupted migration, altered hydrology	Medium

Recognizing the urgent need for action, ICAR–Central Coastal Agricultural Research Institute (CCARI) has initiated a series of targeted interventions to conserve and restore freshwater biodiversity in Goa. These efforts combine in situ and ex situ conservation strategies. Ex situ conservation involves maintaining living specimens of threatened or ecologically important species in controlled environments outside their natural habitats such as live gene banking and captive breeding. In situ conservation involves protecting species within their natural habitats such as river ranching and temple pond stocking. The institute’s approach integrates scientific research, traditional knowledge, and participatory management, aligning local conservation needs with national and global frameworks such as the National Biodiversity Action Plan and the United Nations Sustainable Development Goals. This report presents the actions taken, achievements made, and outcomes realised, serving as both a record of progress and a foundation for scaling up conservation measures in the coming years.



Objectives

We aim to conserve and enhance the freshwater biodiversity of Goa through an integrated approach combining habitat restoration, species protection, and sustainable utilization. Efforts focus on safeguarding Small Indigenous Fishes (SIFs) through both *in situ* measures—such as river ranching, stocking in temple ponds, and habitat management—and *ex situ* strategies, including live gene banking, broodstock development, and captive breeding. Regular documentation and monitoring of fish diversity across rivers, lakes, reservoirs, and Ramsar sites provide the scientific basis for conservation planning, while community awareness programmes, stakeholder engagement, and livelihood-linked initiatives such as ornamental fish culture and eco-tourism foster local stewardship. These actions are aligned with national priorities and global commitments, particularly the Sustainable Development Goals, to ensure long-term ecological resilience and socio-economic benefits for the region.

01	02	03
To conserve and enhance freshwater biodiversity	To strengthen conservation capacities & community stewardship	To align conservation actions with national priorities and global sustainability goals

Study Area

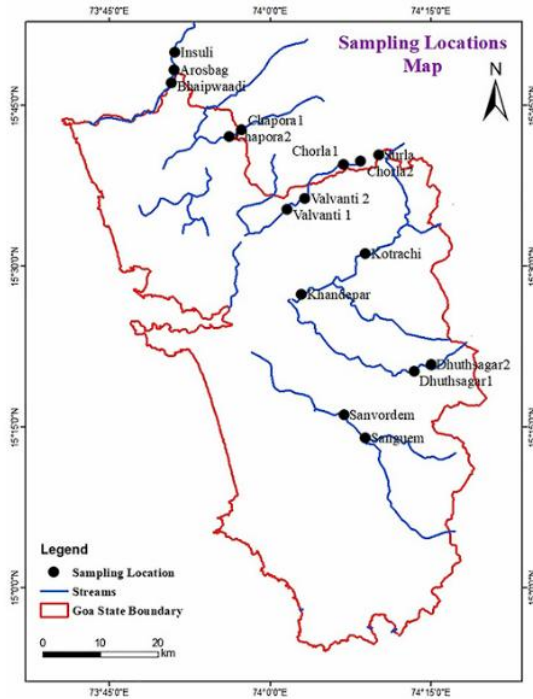
Goa, India's smallest state by area (3,702 km²), is situated on the western coast of India between latitudes 14°53'54" N and 15°47'59" N and longitudes 73°40'33" E and 74°20'13" E. The state lies within the Western Ghats biodiversity hotspot, one of only 36 globally recognised hotspots, characterised by high species richness and endemism. The state receives an average annual rainfall of 2,900–3,000 mm, predominantly during the southwest monsoon (June–September).

Major river systems include the Mandovi, Zuari, Terekhol, Chapora, Sal, Betul, and Valvanti. These rivers originate in the Western Ghats and flow westward to the Arabian Sea, supporting diverse freshwater habitats including hill streams, riffles, pools, backwaters, and estuaries. Goa's sole Ramsar Wetland of International Importance is Nanda Lake (Quepem taluka), spanning 64.5 hectares of intermittent freshwater marshes adjacent to the Zuari River tributary.

Biodiversity surveys were conducted at 16 freshwater sites across four major river basins (Mandovi, Zuari, Terekhol, and Chapora) and at Nanda Lake, during 2020–2022. Conservation interventions were implemented at Mangeshi Temple pond (Mardol), Shantadurga Temple pond (Kavalem, Ponda), and the Valvanti River (Keri, Sattari).

Methodology

Systematic fish biodiversity surveys were conducted over a two-year period (October 2020 – September 2022) in major river basins of Goa. A total of 16 sampling stations were established in the Mandovi, Zuari, Terekhol, and Chapora rivers. Sampling was carried out seasonally using cast nets (mesh size 10–20 mm), gill nets (mesh size 25–50 mm), and drag nets. Collected specimens were identified using standard taxonomic keys and verified against FishBase (Froese and Pauly, 2024).



Sampling locations in selected rivers of Goa

Indigenous fish ranching in temple pond at Mangeshi temple, Mardol

To highlight the significance of the conservation of SIF, ICAR-CCARI organised a campaign on “Conservation and Management of Small Indigenous Fishes of Goa” at Mangeshi temple, Mardol, Goa. A total of 500 individuals of seven indigenous fish species were released into the temple pond,



Release of fish fingerlings at Mangeshi Temple, Mardol

which is considered as a method of in situ conservation. To spread the awareness about fish conservation, tourists, students, and local villagers were also invited for the campaign. On this occasion, an extension folder entitled “Promoting indigenous ornamental fishes of Goa: Breeding & seed production of the melon barb, *Haludaria pradhani* for conservation and management” was released by the dignitaries. Posters displaying the freshwater fishes of Goa were also distributed to tourists, students, villagers, staff of Mangeshi Devasthan.

Release of fish fingerlings at Mangeshi Temple, Mardol



Indigenous Fish Ranching in Goan Rivers

In addition to pond and wetland conservation, ICAR-CCARI has been actively engaged in river ranching initiatives aimed at restoring fish populations in degraded river systems. This involves releasing captive-bred individuals into rivers, enhancing natural fish stocks, and ensuring the survival of native species in the wild. This approach is coupled with the establishment of live gene banks, ensuring that genetic diversity is preserved and that future generations of fish species can thrive despite environmental challenges.



Release of fish fingerlings into Valvanti river, Keri, Sattari

On 14th March 2024, ICAR-CCARI organized a field day and fish stocking event in Valvanti River, Keri, Sattari, Goa, to mark the International Day of Action for Rivers. The initiative aimed to highlight the importance of conserving Small Indigenous Fishes (SIFs) and their habitats for the sustainability of riverine ecosystems. The event saw the release of about 1,000 hatchery-produced seeds of seven indigenous fish species into the river, attended by 40 participants, including local residents, students, fishermen, and officials. The event emphasized the critical role of rivers in supporting diverse aquatic habitats and the threats posed

by urbanization, pollution, and overfishing. Discussions underscored the need for preserving indigenous fish stocks to ensure food and nutritional security for rural populations. Activities included an aqua-quiz competition for students, distribution of fish posters and extension folders, and presentations on the ecological significance of SIFs. The event also facilitated community engagement and awareness on river and fish conservation, with an emphasis on reducing dependence on wild catches for the ornamental fish trade.

‘Need citizen-centric approach to conserve indigenous fish species’

► From P 1

ICAR is collecting various species of small fishes for captive breeding in ponds and hatchery. “Larval rearing is also done to release seed for propagation in water bodies,” Mayekar said.

Shamila Monteiro, fisheries director, said the fisheries sector has ample opportunities and stressed the importance of conserving rivers to sustain fish diversity.

The International Day of Action for Rivers is celebrated annually to emphasise the importance of the river as a life-support system.

Nanda Majik, chairperson, biodiversity management committee, spoke abo-



The International Day of Action for Rivers is celebrated annually to emphasise the importance of the river as a life-support system

ut the importance of conservation of indigenous fish species, while Gopinath Gawas, a local school headmaster, provided details of initiatives to clean the Valvanti in the past few years.

“We need a citizen-centric approach in conserving

the indigenous fish germ plasm in the wetland and rivers. Cleaning and ensuring environmental flows are really the need of the hour to improve the habitat and ecology,” Sreekanth G B, senior scientist (fisheries resource management), said.

1,000 indigenous fishes introduced into river Valvanti to enhance popn, help eco balance

Paul Fernandes

Panaji: Around 1,000 individuals of seven indigenous fishes which were bred in the Indian Council of Agricultural Research (ICAR) hatchery at Old Goa were released to boost fish stocks in River Valvanti at Keri, Sattari.

These small indigenous fishes (SIF) are highly valued for their taste and nutrition, but face a serious threat, especially along the Western Ghats region due to pollution, drying of rivers, overfishing and other factors.

On International Day of Action for Rivers on Thursday, ICAR, CCARI had organised a ranching of SIFs into



Small fishes form a critical link in the life and livelihood of rural populations.

the river to sensitise stakeholders about the importance and need for its conservation and their habitats.

Forty participants, including fishermen, students, villagers, fisheries department officials, Keri sar-

panch Dilsha Gawas and panch members watched as officials released fish seeds for conservation.

“These small fishes are not found in the commercial market, but they have good nutritive value and form a critical

link in the life and livelihood of rural populations,” Trivish S Mayekar, ICAR scientist (fish genetics/breeding) said.

Mahecola barb (Puntius mahecola), green stripe barb (Bhava vittata), Melon barb (Haludartia prodham) and filament barb (Dawkinsia filamentosa) were some of the fishes ranching into the river.

Rivers are an integral part of ecosystems, as they maintain diverse aquatic habitats and support a myriad of species ranging from fish to amphibians. “They provide crucial breeding and feeding grounds for their survival,” the stakeholders were told.

► ‘Conserve rivers’, P 2

Development of Live Gene Banks

Live gene banks were established as repositories of genetic diversity for key fish species, which are vital for research, breeding, and potential reintroduction efforts in degraded or lost habitats.



भा.कृ.अनु.प. - केन्द्रीय तटीय कृषि अनुसंधान संस्थान, गोवा
ICAR - Central Coastal Agricultural Research Institute, Goa



Live Fish Gene Bank

Species stocked : 40

- *Pethia setnai*
- *Haludaria pradhani*
- *Aplocheilus kirchmayeri*
- *Dawkinsia filamentosa*
- *Garra mullaya*
- *Mystus malabaricus*
- *Pethia ticto*
- *Ompok goae*
- *Puntius mahecola*
- *Puntius vittatus*
- *Rasbora dandia*
- *Devario malabaricus*



Fish Live Gene Bank at ICAR-CCARI, Goa

Notable Achievements

Temple Pond Live Gene Banks

With community participation and support from local religious institutions, live gene banks through ranching in the temple pond at Mangeshi Temple, Ponda, were developed. These sanctuaries have been used to ensure the preservation of critical SIF species, including those that are threatened or declining in the wild. The successful conservation of *Puntius vittatus* and *Haludaria pradhani* in temple ponds has been established as a model that can be replicated across other states with similar water bodies. Further, as part of the National Fish Farmers Day 2025 celebrations, ICAR–CCARI organised a Fish Ranching Programme on 10 July 2025 at Shri Shantadurga Temple pond, Kavalem, Ponda, to promote SIF conservation and rejuvenation of temple ponds. Over 500 fingerlings representing 12 SIF species—including Mola carplet, Malabar danio, Olive barb, and Filament barb—were released into the temple pond.

Breeding and Larval Rearing in Natural Ponds

The breeding and larval rearing of key species in controlled natural ponds have proven to be a highly effective strategy for conservation. The establishment of breeding ponds for species like *Rasbora dandia* and *Puntius mahecola* ensures a steady supply of larvae for conservation activities.

Future Expansion of Gene Banks

Moving forward, the institute's goal is to create a chain of live gene banks across Goa, with a focus on freshwater systems like rivers, creeks, and canals. This activity aims to conserve a broader range of aquatic species, contributing to the overall biodiversity and ecological health of the region.

Conservation and Breeding of Small Indigenous Freshwater Fishes (SIFs) of Goa

ICAR-CCARI successfully achieved the captive breeding of several key SIF species, including *Haludaria pradhani*, *Pethia setnai*, *Rasbora dandia*, *Systemus sarana*, and *Puntius vittatus*. These species were reared in natural pond ecosystems to establish a sustainable stock for conservation efforts. Additionally, efforts to enhance seed production through broodstock development were implemented, which are now being maintained in live gene banks at ICAR-CCARI.

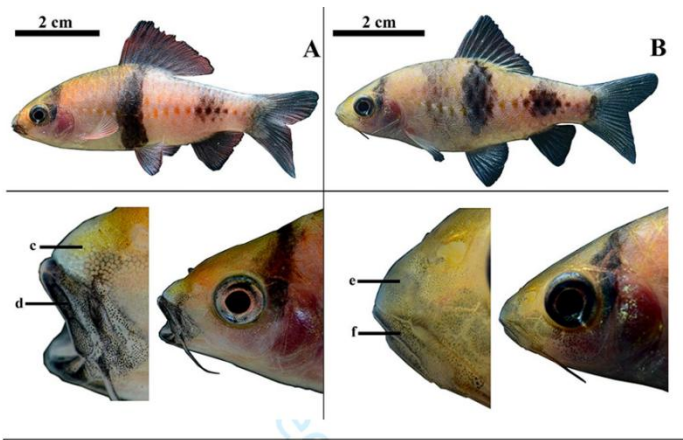
Breeding and Conservation of *Haludaria pradhani*

Haludaria pradhani, or the Melon Barb, is an endangered ornamental species endemic to the Southern Western Ghats, including select freshwater habitats in Goa. It thrives in shallow, fast-flowing hill streams with sandy or rocky substrates, often alongside other indigenous cyprinids. Owing to its striking orange and black coloration, the species holds high ornamental value and serves as an important flagship species for freshwater biodiversity conservation. Captive breeding protocols have been standardised to support both conservation and commercial-scale production. Breeding was carried out in open-water egg scatterer setups, with mature broodstock conditioned on a diet of live and formulated feeds. Spawning occurs in the early morning, with eggs dispersed over the tank substrate. Collected eggs were transferred to hatching tanks to avoid predation. Hatching

takes place within 24–36 hours. Early-stage larvae were fed infusoria or micro-worms, transitioning to *Artemia* nauplii and finely powdered formulated feeds as they grew. This approach not only ensures ex situ conservation but also provides a sustainable alternative source for the aquarium trade, reducing pressure on wild populations.

Breeding and Conservation of *Pethia setnai*

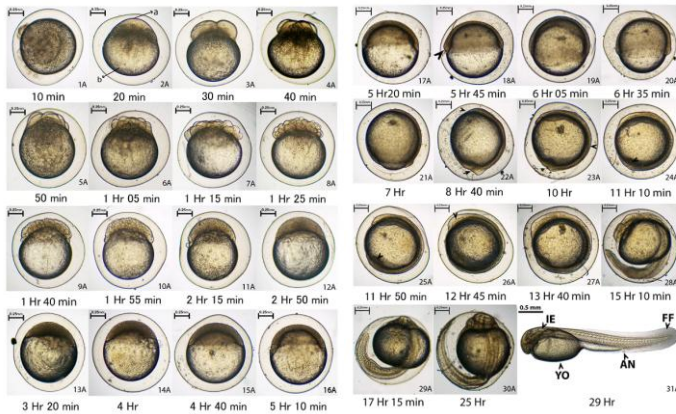
Pethia setnai, commonly called the Indigo Barb, is an endemic ornamental fish restricted to certain river systems of the Western Ghats in Goa. It prefers clear, flowing streams with pebbly or sandy substrates and is valued for its metallic blue sheen and distinct black markings. The species is a representative of the unique freshwater fauna of the region and holds potential for both ornamental and conservation-focused aquaculture. Breeding was conducted in planted aquarium setups or cement tanks with a fine gravel or sand substrate. Broodstock were conditioned with live feed and high-quality formulated diets before being introduced for spawning. Egg scattering occurs naturally, with eggs adhering to the substrate and plant material. After spawning, eggs were carefully collected or brooders are removed to prevent predation. Fry emerged within 24–36 hours and were initially reared on infusoria before being shifted to *Artemia* nauplii and other micro-feeds. Captive breeding of *P. setnai* supports its ex-situ conservation and provides opportunities for livelihood diversification through the ornamental fish trade. These efforts, combined with in situ habitat protection, form an integrated approach to preserving the species' genetic diversity and ecological role in its native rivers.



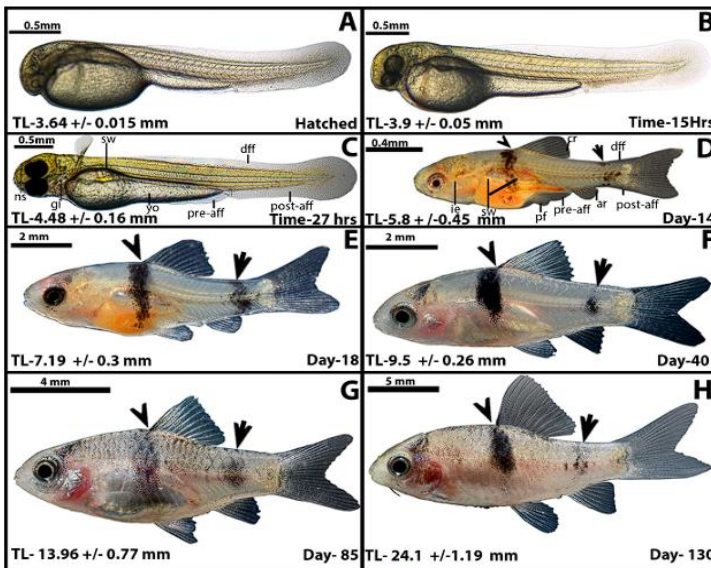
Sexual dimorphic characteristics in Haludaria pradhani: A) Male (c: nuptial tubercles, d: black coloured mouth), B) Female (e: nuptial tubercles absent, f: mouth not blackened)



A) Mating behaviour in Haludaria pradhani, B) Fertilized egg attached to pebbles, C) Yolksac larvae attached to aquatic plant



Stages of development in the Melon barb



Life history traits of *Haludaria pradhani*. (A) Yolk sac larvae, (B) 15 Hours old Yolk sac larvae, (C) 27 Hours old Yolk sac larvae, (D) Pre-flexion larvae, Juvenile, (G) Juvenile, (J) Sub adult.

Assessment of Freshwater Fish Diversity in Goa's Riverine Ecosystems

A study was conducted over a two-year period (2020–2022) to document the species composition and distribution patterns of freshwater ichthyofauna in Goa's riverine ecosystems, involving systematic surveys in major river basins including the Mandovi, Zuari, Terekhol, and Chapora. Sampling was carried out using cast nets, gill nets, drag nets, and, where permitted, electrofishing. Environmental parameters such as water temperature, pH, dissolved oxygen, and conductivity were recorded in situ, and species were identified using standard taxonomic keys.

A total of 84 fish species were documented, belonging to 59 genera, 26 families, and 12 orders. The family Cyprinidae was the most dominant group with 28 species, followed by Nemacheilidae and Oxudercidae with six species each. Among the river systems surveyed, the Mandovi River exhibited the highest diversity, with a Shannon diversity index (H') ranging from 2.38 to 2.41 and species counts between 36 and 38. Eight species recorded during the survey are listed as Threatened under the IUCN Red List, including *Haludaria pradhani* (Endangered), *Pethia setnai* (Vulnerable), *Hypselobarbus curmuca* (Endangered), and *Carinotetraodon imitator* (Vulnerable). Invasive alien species such as *Oreochromis mossambicus* and *Clarias gariepinus* were also recorded, indicating potential ecological threats to native fish assemblages.

Freshwater fishes of Goa



Fish Biodiversity Documentation from Protected Forest Areas of Goa

Under a project funded by the Forest Department, titled *“Fish Biodiversity Survey, Inventory and Documentation from Streams and Rivers in Notified Government Forest and Protected Areas of Goa for Conservation and Management”*, surveys are being conducted across six key sanctuaries of Goa—Bhagwan Mahavir Wildlife Sanctuary, Mhadei Wildlife Sanctuary, Netravali Wildlife Sanctuary, Cotigao Wildlife Sanctuary, Bondla Wildlife Sanctuary, and Dr. Salim Ali Bird Sanctuary. Documentation work was initiated on streamwise inventory, documenting indigenous and endemic fish species, their distribution patterns, relative abundance, and habitat preferences. This project aims at assessing the conservation status of lesser-known native species, many of which are restricted to forested aquatic ecosystems. The study also aimed for anthropogenic pressures and habitat degradation as key threats and culminated in science-based recommendations for the long-term conservation and sustainable management of Goa’s freshwater fish biodiversity within these ecologically sensitive zones. Particular focus has been placed on the conservation status of rare and threatened taxa, habitat characterization, and identifying anthropogenic pressures. The project directly contributes to SDG 15 (Life on Land) and SDG 6 (Clean Water and Sanitation) by enhancing conservation planning for freshwater ecosystems within Goa’s critical forest zones.





Exploration of ichthyofaunal diversity of protected areas of Goa



Devario malabaricus



Dawkinsia filamentosus



Garra sp



Hypseobarbus jerdoni



Rasbora sp



Salmostoma sp



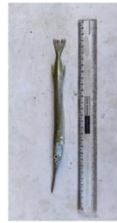
Pseudotropheus maculatus



Pethia setnai



Rasbora Dandia



Xenentodon cancila



Tor malabaricus



Haltadaria Pradhani



Loach



Glossogobius sp

Indigenous fish species recorded

Conservation and Management of Ramsar Site: Nanda Lake Fish Biodiversity

Nanda Lake, a Ramsar site of international importance, represents a unique wetland ecosystem within Goa's landscape. The exploration of Nanda Lake focused on understanding its biodiversity and ecosystem services. The lake is an important habitat for migratory birds, aquatic species, and various flora and fauna.

This initiative underscores ICAR-CCARI's commitment to conserving critical wetland ecosystems and safeguarding biodiversity at Nanda Lake. This work contributes to the conservation of globally significant wetlands, aligning local conservation efforts with international biodiversity targets.



Exploration of ichthyofaunal diversity of Nanda lake

Accomplishments

Biodiversity Assessment: Documented species diversity, particularly focusing on aquatic species, to better understand the ecological value of the lake.

Conservation Action Plans: Proposed strategies for the sustainable management of the lake, including the protection of native species and restoration of wetland health.

Community Involvement: Engaged local communities to participate in the conservation of Nanda Lake, emphasizing the lake's importance for both biodiversity and sustainable livelihoods.

Initial Survey Findings: A total of 17 fish species were documented, including *Pethia setnai* and *Haludaria pradhani*, both classified as threatened by the IUCN Red List. The decline in fish diversity, particularly concerning the presence of these threatened species, was observed, emphasizing habitat degradation.

Conservation Urgency: The presence of threatened species and observed declines highlight the urgent need for robust conservation measures. ICAR-CCARI has identified the necessity for improved habitat management and conservation strategies.

Future Plans: ICAR-CCARI aims to collect brood stock of threatened species and develop captive breeding programmes to address declining fish populations. Collaborative efforts with stakeholders, governmental bodies, and local communities are essential for the sustainable management and preservation of this vital Ramsar site.



Scientific name : *Pethia setnai*
Common name: Indigo barb



Scientific name : *Haludaria pradhani*
Common name: Melon barb



Scientific name : *Hypselobarbus jerdoni*
Common name: Jerdon's carp



Scientific name : *Garra mullya*
Common name: Sucker fish



Scientific name : *Awaous grampomus*
Common name: The Scribbled goby



Scientific name : *Channa marulius*
Common name: Giant murrel

Common indigenous fish species of Nanda lake

Major decline in fish diversity in Quepem's marshy Nanda Lake, warn scientists

Team Herald

MARGAO: Recent findings from a field survey conducted by the ICAR-Central Coastal Agricultural Research Institute (ICAR-CCARI) have sounded alarm bells over the diminishing diversity of fish species in Nanda Lake, Goa's sole Ramsar site. The study stresses the pressing need for conservation efforts to protect the lake's delicate ecosystem.

ICAR-CCARI has been extensively documenting fish diversity across Goa's various ecosystems, collaborating with the Goa State Biodiversity Board (GSBB) and Goa State Wetland Authority (GWSA). This partnership led to the designation of Nanda Lake as a Ramsar site, a significant milestone for conservation in the State.

Initiating the documentation



of fish faunal diversity at Nanda Lake, the study, led by Trivish Suresh Mayekar, a Scientist at ICAR-CCARI, revealed critical insights into the biodiversity of this Ramsar site.

Nanda Lake, located in Quepem taluka, spans 64.5 hectares amidst intermittent freshwater marshes adjacent to a Zuari River tributary. As the State's only Ramsar site, Nanda Lake plays a pivotal role in the regional ecosystem. Connected to the river channel via a sluice gate, these marshes support

HABITATS DESTROYED

- Nanda Lake, located in Quepem taluka, spans 64.5 hectares amidst intermittent freshwater marshes adjacent to a Zuari river tributary.
- The field survey identified 17 fish species within the Ramsar site.
- Two fish species, *Pethia setnai* and *Haludaria pradhani*, classified as 'threatened' on the IUCN Red List, were found only at one of the five sampling sites.
- ICAR-CCARI plans to address declining fish stocks by collecting brood stock and producing them in a captive environment.

diverse migratory water birds, along with a rich array of plants, animals, and fish species," noted ICAR-CCARI officials.

The field survey identified 17 fish species within the Ramsar site. However, concerning observations were made regarding the decline in fish species diversity, with local fishermen and residents reporting the decline.

Of particular concern are two species, *Pethia setnai* and *Ha-*

ludaria pradhani, classified as threatened on the IUCN Red List, found only at one of the five sampling sites. This indicates habitat destruction and underscores the urgent need for conservation measures.

ICAR-CCARI emphasised that the presence of threatened fish species highlights the vulnerability of Nanda Lake's aquatic habitats.

Habitat destruction has led to

a significant decrease in fish faunal diversity. Robust conservation policies and management practices are imperative for Nanda Lake and its surrounding areas. Collaborative efforts involving state holders, governmental bodies, and local communities are essential for sustainable management, stressed ICAR-CCARI officials.

In response, ICAR-CCARI plans to address declining fish stocks by collecting brood stock and producing them in a captive environment.

Effective management strategies are crucial for the long-term preservation of Nanda Lake's biodiversity," emphasised ICAR-CCARI officials.

The research team included Dr. Sreekanth GB, Melbin Lal, JB Borges (research scholars of ICAR-CCARI), Shiruti S (Project assistant GWSA), and Samiksha C (programme officer, GSBB), alongside Mayekar.

Promotion of Mola–IMC Polyculture

ICAR-Central Coastal Agricultural Research Institute (ICAR-CCARI), Goa, has successfully implemented a demonstration of polyculture involving *Amblypharyngodon mola* (mola carplet) and Carps such as catla (*Catla catla*), rohu (*Labeo rohita*), Silver carp and Common carp in its research ponds. Small Indigenous Fishes (SIFs) are important components of freshwater biodiversity and local nutrition systems. Among them, *Amblypharyngodon mola* (mola carplet) is of special significance due to its high micronutrient content and ecological adaptability.

Mola is a micronutrient-rich fish containing high levels of calcium (up to 1,400 mg/100 g), iron (19 mg/100 g), and vitamin A (2,226–2,503 µg RAE/100 g), along with vitamin B12, vitamin D3, iodine, and essential fatty acids. While IMCs mainly contribute protein, the inclusion of mola significantly improves the nutritional value of pond-based fish production systems. Under coastal agro-climatic conditions of Goa, ICAR-CCARI trials demonstrated that mola integrates well into carp polyculture without competing for feed, as it occupies the surface and marginal niches and feeds largely on natural plankton. The integration of mola resulted in a 12–15% increase in overall fish productivity compared to conventional carp polyculture, along with regular harvest of nutrient-rich small fish for household consumption. Beyond productivity gains, mola–IMC polyculture also serves as a conservation-oriented approach by promoting the sustainable utilization and propagation of a native species whose wild populations

are under threat due to habitat loss, invasive species and overexploitation. ICAR–CCARI is promoting this model through field demonstrations, training programmes and awareness campaigns as a biodiversity-friendly and nutrition-sensitive aquaculture intervention suitable for freshwater and coastal pond systems.



Mola carplet, *Amblypharyngodon mola*



Catla, *Catla catla*



Rohu, *Labeo rohita*

Utilization of Farm-Propagated SIFs as Live Feed for Asian Seabass

Asian seabass (*Lates calcarifer*), an important candidate species for coastal and brackishwater aquaculture, requires high-protein live or fresh feed during its early nursery and juvenile stages for optimal survival and growth. In many small-scale and coastal farming systems, feed cost and availability remain major constraints. Considering this, ICAR–Central Coastal Agricultural Research Institute (ICAR–CCARI), Goa, conducted experimental trials to evaluate the potential of Small Indigenous Fishes (SIFs) as a low-cost, locally available and nutritionally rich feed source for seabass seed rearing.

A dedicated SIF breeding pond was developed at ICAR–CCARI, where limited numbers of wild-caught broodfish of selected indigenous species are initially stocked and maintained under protected conditions. These fishes are allowed to breed naturally under semi-controlled pond environments, resulting in regular production of SIF seed. This approach minimizes continuous extraction of SIFs from natural water bodies and significantly reduces pressure on wild populations, while ensuring a sustainable and controlled supply of live prey organisms.

Farm-propagated SIF juveniles such as *Amblypharyngodon mola*, *Puntius vittatus*, *Rasbora dandia*, and other native small fishes were periodically harvested from the breeding pond and introduced into seabass nursery

and rearing ponds as live feed. This system closely mimics natural predator–prey interactions observed in wild habitats, allowing seabass juveniles to exhibit natural hunting behaviour, enhancing feeding efficiency, and reducing rearing stress.

The experimental trials demonstrated that seabass seed readily accepted live SIFs as prey, showing good growth performance, improved survival, and lower cannibalism due to the continuous availability of appropriately sized live fish. The use of live, farm-propagated prey also helped maintain better pond water quality by minimizing leftover organic waste compared to conventional trash fish feeding.

This experimental model integrates biodiversity conservation with aquaculture by promoting the controlled utilization of indigenous fishes without exerting additional stress on wild populations. It represents a biologically realistic, conservation-sensitive and economically viable feeding strategy for seabass seed rearing under coastal aquaculture conditions.

Indigenous Fish Conservation in Agro-Eco-Tourism Unit, Goa

In a pioneering conservation initiative, ICAR–Central Coastal Agricultural Research Institute (ICAR–CCARI) has successfully integrated indigenous fish species conservation within an agro-eco-tourism framework. As part of the Butterfly Garden & Conservatory Project developed by the Nectar & Nest Trust in Benaulim, Madgaon, indigenous fishes such as *Rasbora dandia*, *Pethia setnai*, *Haludaria pradhani*, and *Puntius amphibius* were introduced into a specially constructed, fish-shaped pond designed to replicate natural ecosystems. The Butterfly Garden, spanning 3,000 m² in the shape of a butterfly, was originally developed as a sanctuary for butterfly rehabilitation under increasing anthropogenic pressures.

By merging biodiversity conservation with agro-ecotourism, the project provides a unique platform for public engagement and education. Visitors, especially students and young learners, gain exposure to the importance of conserving Goa's native aquatic species and maintaining healthy freshwater ecosystems. ICAR–CCARI's role extended beyond stocking fish to providing scientific advisories on pond and aquatic plant management, ensuring sustainable upkeep of the habitat. This innovative integration of conservation, recreation, reinforcing the institute's commitment to preserving Goa's endemic fish fauna while fostering community awareness and sustainable tourism opportunities.

Promotion of Indigenous Ornamental Fish Culture through Innovative Bamboo Aquarium

In line with the institute's broader biodiversity conservation efforts, innovative methods were developed to sustainably manage indigenous ornamental fish species from Goa, highlighting their potential for both conservation and livelihood enhancement. A notable outcome of this work was the design and development of a bamboo aquarium, an eco-friendly, climate-resilient alternative to conventional aquaria, incorporating native ornamental fishes such as *Haludaria pradhani*, *Pethia setnai* and *Puntius vittatus*. This unique aquarium, crafted from locally available bamboo, not only reduces reliance on plastic and glass



Bamboo aquarium

but also serves as a living display of Goa's freshwater heritage. By bringing live native fishes into public spaces in a sustainable way, the initiative bridges the gap between conservation science and everyday life, fostering a personal connection between people and aquatic biodiversity. Complementing the product development, ICAR-CCARI conducted hands-on training programmes for local farmers, fish breeders, and entrepreneurs, demonstrating techniques

for ornamental fish breeding, aquarium maintenance, and species care. These efforts have not only promoted species conservation but have also opened avenues for rural income generation, thereby integrating biodiversity preservation with socio-economic development in the region.



Demonstrating the bamboo aquarium to the Hon'ble Chief Minister of Goa.

Community Engagement and Education

A significant component of the institute's conservation strategy is rooted in community involvement. The success of biodiversity conservation hinges on the active participation of local communities, especially in areas that are directly affected by conservation efforts. Key initiatives in this area include:

- **World Fisheries Day Campaign:** A campaign on World Fisheries Day focusing on the conservation of SIFs was conducted. The event held at Mangeshi temple brought together tourists, students, and locals to participate in releasing fish into temple ponds, fostering awareness of fish conservation practices.



Celebration of World Fisheries Day

- **National Fish Farmers Day Celebration:** An Awareness and Exposure Programme on Ornamental Fish Keeping was conducted on 9th July 2025 at Sharada Mandir School, Kadamba, Old Goa as part of the National Fish Farmers Day 2025 celebrations. The programme aimed to introduce school students to ornamental fisheries, aquatic biodiversity, and responsible fishkeeping. Over 150 participants including students, staff and ornamental fish farmers were present for the event. Lectures covering aquarium fish diversity, care, and basic aquarium management including tank fabrication and accessories were delivered, followed by a live demonstration and hands-on training on aquarium setup. Additionally, ornamental fish farmers from Mapusa and Parra set up a mini-expo displaying various ornamental fishes, aquatic plants, and accessories, offering students practical exposure.



Celebration of National Fish Farmers Day at Sharada Mandir School, Kadamba

- **Educational Materials:** The institute has published several posters, extension folders, and technical bulletins that inform and educate the public on fish conservation, ornamental fish culture, and sustainable aquaculture practices.

FRESHWATER FISHES OF GOA PART-I



Scientific name: *Puntius sarana*
Common name: Balgry barb



Scientific name: *Puntius punctatus*
Common name: Dotted snout barb



Scientific name: *Puntius ticto*
Common name: Meen barb



Scientific name: *Puntius sikkimensis*
Common name: Pflanzl barb



Scientific name: *Puntius amphibius*
Common name: Karkhadkar barb



Scientific name: *Systomus sarana*
Common name: Ullu barb



Scientific name: *Barbus ethan*
Common name: Gmanga barb



Scientific name: *Mystus malabaricus*
Common name: Carinosa barb



Scientific name: *Barbus barbus*
Common name: Blackbar barb



Scientific name: *Barbus shufeldti*
Common name: Molitor barb



Scientific name: *Aplocheilichthys trichoptera*
Common name: The black parrot of Goa



Scientific name: *Aplocheilichthys trichoptera*
Common name: Singud parrot



Scientific name: *Channa asiatica*
Common name: Rohu fish



Scientific name: *Channa argus*
Common name: Blue mahaseer



Scientific name: *Channa punctata*
Common name: Golden mahaseer



Scientific name: *Channa striata*
Common name: Singud mahaseer



Scientific name: *Anabas testudineus*
Common name: Snakehead goby



Scientific name: *Pseudogobius oligopus*
Common name: Rignash stream goby



Scientific name: *Oligoneurus goni*
Common name: Tank goby



Scientific name: *Mystus malabaricus*
Common name: Jackal's Mystus



Scientific name: *Mystus malabaricus*
Common name: Snake Mystus



Scientific name: *Batasiocheilichthys*
Common name: Snake headfish



Scientific name: *Pseudogobius olivaceus*
Common name: Orange chromide



Scientific name: *Batasiocheilichthys*
Common name: Green chromide



Scientific name: *Caranx malabaricus*
Common name: Shark Mahabar pufferfish



Scientific name: *Squalius biwaensis*
Common name: Freshwater goby fish



Scientific name: *Oryzias latipes*
Common name: Rucker fish



Scientific name: *Leptobotia*
Common name: Spiny loach



Scientific name: *Mochizukiichthys*
Common name: Zulu fish



Scientific name: *Mochizukiichthys*
Common name: Zigzag fish



Scientific name: *Puntius*
Common name: Dog's glass fish



Scientific name: *Channa*
Common name: Shargha glass pufferfish



Prepared by: Trivash Mayekar, Brahmkarthi GB, Anwar AS, Rajeev Raghavan, Madan Lal, Borges S B
Published by: Director, ICAR - Central Coastal Aquacultural Research Institute, E-6, Old Goa-403405, Goa, India (ICAR)



Breeding and Conservation of Indigenous Ornamental Fishes of Goa

Pethia setnai (Chhappgar & Sane 1992)

Introduction

Pethia setnai, commonly known as the Indigo Barb, is an Indigenous ornamental fish species found in the Western Ghats region of India. These fish belong to the family Cyprinidae and by virtue of the vibrant color pattern and small size, these fishes are popular among aquarists. The males have a reddish-pink hue body with a red-colored margin along the dorsal and anal fins, whereas the females are pale yellow in color.

Sexual dimorphism



Male

Female

Distribution and Habitat

The Indigo barb, *Pethia setnai* is an endemic species is so far recorded from the west flowing rivers in Western Ghats where it is known from the low land rivers in Goa, Karnataka and Maharashtra states. The species is known to inhabit the riffle habitats within the slow flowing stream segments with pebbles, sand and mud substrate, where it cooccur with other cyprinids including *Dawkinsia filamentosa* and *H. pradhani*.



Natural habitat of *P. setnai*



Haludaria pradhani (Tilak 1973)

Introduction

The 'Melon barb', *Haludaria pradhani* is another endemic species having ornamental value in the global aquatic pet trade. Males of Melon barb exhibit more vivid coloration and develop snout tubercles, whereas females display duller colors and lack these snout tubercles at maturity. Conserving these species is crucial for maintaining biodiversity and safeguarding the genetic diversity of native fish populations in India.

Sexual dimorphism



Male

Female

Distribution and Habitat

The Melon barb, *Haludaria pradhani* is an endangered species endemic to South India of the Western Ghats mountains ranges. This fish inhabits various biotopes from mountain streams to major rivers, irrigation canals, and ponds and lakes. They found co-occur with species such as *P. setnai*, *Dawkinsia filamentosa*, and *Rasbora dandii* in the natural habitats.



Natural habitat and manual collection of *H. pradhani*

Breeding and Larval Rearing

Breeding can be done in well planted aquariums with pebbles as bottom substrate. These open-water egg scatterers can be bred in well-planted aquaria with a substratum provided with pebbles. The species can easily be induced to spawn by hormone administration. The eggs are adhesive, demersal and pale yellow in color with a fecundity ranging from 100 to 150 per individual. Hatched larvae can be fed with artemia nauplii later onwards with prepared protein diet.



P. setnai spawning in aquaria



Adhesive eggs



Larva



Larva

Breeding and Larval Rearing

Melon is an open-water egg scatterer. Being another open-water egg scatterer, the melon barb can breed in glass aquarium tanks with plants and pebbles as substrate. During courtship and spawning the body color intensifies for male individuals. After spawning the parents do not show any parental care towards their offspring. The egg starts hatching within 24 to 48 hours after fertilisation. Initial feeding is to be carried out via Infusoria grade food until they are large enough to receive micro-worms.



Breeding setup for *H. pradhani*



Community tank



Larva



Larva

Conclusion

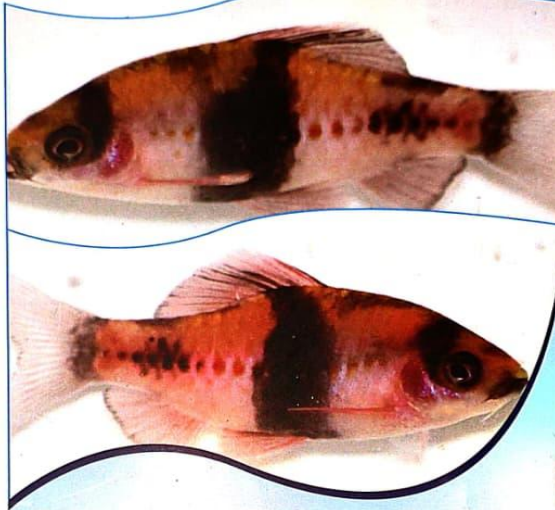
The Western Ghats region is a biodiversity hotspot and a treasure trove of indigenous ornamental fishes. Through this exposition, it becomes evident that these fishes are not merely ornamental but vital components of the region's aquatic ecosystems, playing crucial roles in maintaining ecological balance. In conclusion, the conservation and sustainable management of indigenous ornamental fishes in the Western Ghats are imperative. Efforts must be made to preserve their habitats, regulate trade practices, and promote community-based conservation initiatives that involve local communities. By safeguarding these unique aquatic species, we not only protect the biodiversity of the Western Ghats but also uphold the cultural and ecological heritage intertwined with these magnificent creatures. Thus, concerted action is necessary to ensure indigenous ornamental fishes' continued existence and thriving in this ecologically significant region.



Prepared by: Trivish Mayekar, Anvar Ali, Sreerajith GB, Melton Lx, Gokuldas PP, Borges B.S
Published by: Director, CCARI - Central Coastal Agricultural Research Institute, E-6, Old Goa 403002, Goa, India 2024



Extension Folder No.103/2021



**Promoting indigenous
ornamental fish of Goa:
Breeding and Seed
production of *Haludaria
pradhani* for conservation
and management**



भा.कृ.अनु.प.-केंद्रीय तटीय कृषि अनुसंधान संस्थान
(भारतीय कृषि अनुसंधान परिषद)
ओल्ड गोंया ४०३ ४०२, गोंया, भारत



ICAR - Central Coastal Agricultural Research Institute

(Indian Council of Agricultural Research)
Old Goa - 403 402, Goa, India.

**Under Scheduled Caste Sub Plan
Govt. of India**

Significant Achievements

- » **Established a comprehensive SIF conservation model** integrating in-situ measures (temple pond sanctuaries, river ranching, wetland stewardship) with ex-situ interventions (live gene banks, broodstock development, captive breeding).
- » **Operationalized temple pond live gene banks** across key cultural sites, creating replicable models for community-led conservation.
- » **Implemented river ranching programmes** in priority habitats to replenish native fish populations and maintain genetic diversity.
- » **Standardized captive breeding protocols** for priority indigenous species, ensuring a sustainable seed supply for conservation and ornamental trade.
- » **Documented Goa's freshwater fish diversity**, including threatened, endemic, and invasive species, providing a critical evidence base for conservation planning.
- » **Initiated ichthyofaunal documentation in protected areas**, strengthening habitat-specific conservation strategies.
- » **Documented freshwater fish biodiversity of a Ramsar site of Goa**, covering threatened, endemic, and invasive species, providing a critical evidence base for habitat specific conservation strategies.
- » **Integrated conservation with agro-eco-tourism** through initiatives like the Butterfly Garden & Conservatory, promoting biodiversity awareness among the public.
- » **Developed an eco-friendly aquarium model** - bamboo quarium, as an innovative conservation-linked livelihood model, gaining recognition at the state leadership level.
- » **Strengthened community outreach and education** via awareness campaigns, school engagement, and extension materials to foster long-term stewardship.

Recommendations and way forward

To ensure the long-term conservation and sustainable management of indigenous freshwater fishes in Goa, it is crucial to build upon the successful models already demonstrated through live gene banks in temple ponds such as Mangeshi and Shantadurga. These sanctuaries should be scaled up and replicated across other temples and community-managed water bodies, with an expanded focus to include a wider range of threatened, endemic, and economically valuable species. Captive breeding protocols for priority taxa such as *Haludaria pradhani*, *Pethia setnai*, *Rasbora dandia*, and *Puntius vittatus* must be further refined and supported through the establishment of decentralised broodstock centres. This will ensure a consistent supply of high-quality seed, reduce reliance on wild capture, and strengthen both conservation outcomes and the ornamental fish trade. In parallel, targeted habitat restoration measures—such as riparian buffer creation, removal of invasive species, and regulation of water abstraction—must be prioritised for ecologically sensitive sites including Nanda Lake, Ramsar wetlands, and protected forest streams. Integrating these conservation measures with community-based livelihood models, such as native ornamental fish culture, bamboo aquarium production, and eco-tourism ventures like the Butterfly Garden project, will not only enhance biodiversity but also provide sustainable income opportunities for local populations.

Continuous biodiversity assessment and monitoring should remain a cornerstone of the strategy, with a centralised and regularly updated freshwater fish biodiversity database established for Goa. This should be

supported by long-term research on population dynamics, genetic diversity, habitat quality, and emerging threats such as climate change, hydrological alterations, and pollution. Community engagement must remain integral to conservation action, with active participation from schools, temple committees, fishers, and local self-help groups. Awareness and capacity-building programmes—through training workshops, extension materials, field demonstrations, and public exhibitions—should be intensified to foster stewardship and ensure protection of aquatic habitats. Finally, these conservation measures must be backed by robust policy and institutional support, including state-level freshwater fish conservation plans, inter-departmental coordination, and integration with climate adaptation strategies. Aligning all efforts with national priorities such as the National Biodiversity Action Plan and global commitments like the United Nations Sustainable Development Goals will help secure the ecological integrity of Goa's freshwater ecosystems while safeguarding the socio-economic benefits they provide. Looking ahead, Goa Indigenous Fish Conservation Mission (GIFCM) may be launched which can be served as the umbrella framework for coordinated action between the Department of Fisheries, Forest Department, ICAR-CCARI, and key partners including GSBB, WRD, Education Department and Temple Trusts.





ICAR-Central Coastal Agricultural Research Institute

Ella, Old Goa, Goa - 403 402

Ph: 0832 2993097

Email: director.ccari@icar.gov.in

Website: <http://www.ccari.res.in>

© ICAR-Central Coastal Agricultural Research Institute, 2025