PROJECT INFORMATION

Assessing status of coastal aquaculture practices and improvement through technology intervention for promoting livelihood of fish farmers in the west coast of India.

PROJECT OVERVIEW

Funding Agency	Institute
Total Outlay	
Duration	6 Years
Single / Multi-Institutional	Single
Principal Investigator	Shri Trivesh S. Mayekar
Co-Investigators	Dr. Sreekanth G.B., Dr. Gopal Mahajan

RATIONALE

The west coast of India supports an extensive and largely under-utilised brackishwater and estuarine resource base — *khazan* lands, salt-pan fields, estuarine creeks, tidal canals and inland freshwater ponds — yet its aquaculture productivity remains well below potential. Coastal aquaculture in the region continues to be dominated either by traditional, low-input, single-crop systems or by shrimp monoculture, which is capital-intensive and vulnerable to disease and market shocks. Finfish farming, despite strong local demand and assured price realisation, remains marginal. For the small and marginal coastal fish farmer, the two decisive constraints are the cost of formulated feed and the reliability of seed supply. In carnivorous finfish culture, particularly of Asian seabass (Lates calcarifer), pelleted feed forms the single largest component of operational cost, and its escalating price effectively excludes resource-poor farmers from a species that is otherwise ideally suited to the region's salinity regime and market. At the same time, Goa and the adjoining west-coast districts hold a rich and largely unexploited assemblage of small indigenous fishes (SIFs) and low-saline tolerant species that can be produced on-farm at low cost and used as live forage. A live-feed based, forage-fish supported polyculture of Asian seabass therefore offers a route to lower the cost of production, improve the benefit–cost ratio, reduce nutrient loading from uneaten pelleted feed, and simultaneously create an on-farm use for indigenous species. Realising that route, however, requires a documented baseline of what is actually practised along the coast, standardisation of the forage-fish component (species, stocking ratio, density and salinity regime), a dependable protocol for producing

forage-fish seed, and a validated techno-economic package that can be demonstrated to farmers. The project was formulated to address precisely this chain — assessment, technology development, techno-economic evaluation and transfer — with livelihood improvement of coastal fish farmers as the end objective.

RESEARCH GAPS

- No consolidated, field-verified baseline exists on the coastal aquaculture systems actually practised along the west coast, the candidate species in use, their productivity levels, or the constraints perceived by farmers; planning of interventions has therefore been largely inferential.
- Carnivorous finfish culture in the region is almost entirely dependent on commercial pelleted feed. Live-feed / forage-fish based polyculture has not been standardised — optimum forage-to-predator stocking ratio, stocking density, forage species combination and salinity regime remain undefined.
- The biology and captive propagation of the potential forage species themselves are poorly documented. Length–weight and growth baselines for the common SIFs of Goa's freshwater bodies, and broodstock development, freshwater tolerance and breeding protocols for *Ambassis ambassis* and *Chanda nama*, were not available.
- Techno-economic evidence — benefit–cost ratio, capital efficiency, optimum stocking density and feed-cost saving — for seabass polyculture in freshwater and low-saline pond systems of the west coast was absent, leaving no basis on which a farmer or a financing agency could appraise the enterprise.
- Seed supply is erratic. The comparative performance of wild-collected versus hatchery-produced seabass seed was not established, the seasonal stocking window was not defined, and no nursery / hapa rearing protocol existed for raising small seed to a stockable fingerling size — a gap directly responsible for high early-phase mortality.
- Indigenous ornamental species of the Western Ghats–west coast belt, with clear export and entrepreneurship potential, lacked captive breeding and seed production protocols.
- Awareness and adoption of contemporary culture systems — biofloc, recirculatory aquaculture, cage culture and integrated farming — among coastal farmers of the region is low, and no farmer-usable database or extension package linking practice, species and economics was available.
- Risk factors specific to small-scale coastal systems — predator entry from adjoining wetlands, inadequate aeration, differential growth in carnivore culture and water-quality fluctuation — have not been factored into system design or management advisories.

OBJECTIVES

Objective 1.
To assess the present status of coastal aquaculture practices, production systems and candidate species along the west coast of India, and to identify the technical, economic and institutional constraints faced by coastal fish farmers.

Objective 2.
To develop, refine and evaluate cost-effective, feed-efficient and environmentally sustainable finfish culture technologies — in particular forage-fish based polyculture of Asian seabass and diversification with other candidate species — through experiments at the institute farm and on farmers' fields, including their techno-economic assessment.

Objective 3.
To transfer the standardised technologies to the farming community through demonstrations, training and awareness programmes, and to develop databases and extension literature on coastal aquaculture resources and practices for promoting the livelihood of coastal fish farmers.

ACTIVITIES

Structured / participatory survey of coastal fish farmers, *khazan* and estuarine farm holders across Goa and adjoining west-coast districts (primary + secondary data) Inventorisation of candidate finfish and shellfish species for coastal aquaculture; site-wise soil and water quality characterisation Compilation and submission of status reports to the Institute and State line departments Development of an experimental and demonstration aquaculture farm (15,400 m^2): four new nursery ponds of 400 m^2 each, renovation of three grow-out ponds, one new grow-out pond; ten ponds operational Grow-out polyculture trials of Asian seabass (*Lates calcarifer*) with small indigenous fishes (SIFs) and tilapia as live forage, at graded stocking densities (T1–T3, 270-day crop) Parallel reference trial of Asian seabass reared solely on formulated pelleted feed Salinity-graded feeding trials with *Ambassis ambassis* as forage fish (0, 5 and 10 ppt against a 15 ppt control) Length–weight relationship and growth-pattern studies of SIFs (*Systomus sarana*, *Rasbora dandia*, *Puntius vittatus*, *P. mahecola*) from Goa's freshwater systems Captive broodstock development, freshwater-tolerance and maturation studies of *A. ambassis*; pond breeding of freshwater glassfish Chanda nama Species diversification trials — improved tilapia strains, pangasius and pearlspot; nursery and hapa rearing of seed to stockable fingerling size Comparative evaluation of wild versus hatchery-produced seabass seed and standardisation of the stocking calendar (seabass June–July; IMC fingerlings two months in advance); periodic grading Periodic monitoring of soil and water quality; statistical analysis, interpretation and publication of results On-farm validation trials and culture demonstrations at farmers' fields along the coast Training, awareness and exposure programmes on biofloc, RAS, cage culture, integrated farming and ornamental fisheries; farmers' field visits Development of a project database (practices, growth–survival, water quality, SIF biology) and of extension literature Popularisation through extension folders, popular articles, success stories and print media

EXPERIMENTAL DETAILS

Treatment:	NA
Fertilizer Doses	NA
Variety	Asian Sea bass
Replications:	NA

Observations:	NA
GPS Coordinates:	15.4964° N, 73.9167° E

EXPECTED OUTPUT

A standardised three-phase Asian seabass polyculture package — nursery in hapa (300–400 larvae/hapa, 5–6 feedings/day, weekly grading), pre-grow-out in 300–400 m^2 ponds (10–15 g stocking) and grow-out in 1500–2000 m^2 ponds (80–100 g stocking, 500–600 fish/2000 m^2), supported by 3–4 dedicated forage-fish breeding ponds. Techno-economic evidence of cost advantage — production cost of Rs 180/kg in forage-fed freshwater polyculture against Rs 300–350/kg in RAS, cage and brackishwater pond systems, raising profit to Rs 270/kg; validated on farmers' fields with 85–90% survival, 992–1200 kg production and net profit of Rs 1.40–1.95 lakh per unit. Forage and indigenous seed production protocols — about 60,000 SIF seed produced through natural and induced pond breeding, captive breeding of Haludaria pradhani (1000 seed) and first documentation of early ontogeny of the threatened *Pethia setnai*. Two farmer-ready technologies and a west-coast farm database — the floating integrated duck-cum-fish cage and bamboo aquarium, plus LCA and economics data from 25 shrimp farms and 10 cage farms across Goa, Karnataka, Maharashtra and Kerala; a database with 48,000 hits, 6 extension publications and 6 research papers.

EXPECTED OUTCOME

Cost of seabass production nearly halved by replacing pelleted feed with on-farm live forage, making high-value finfish culture viable for small and marginal coastal farmers. Demonstrated diversification away from disease- and market-vulnerable shrimp monoculture, with seabass, tilapia, pangasius and pearlspot taken up in Goa and the neighbouring coastal states. Assured farm-level seed and forage security through SIF, IMC and tilapia breeding ponds, reducing early-phase mortality and dependence on external seed sources; 70 kg of brood fish also supplied to the Goa Department of Fisheries. Additional livelihood streams for coastal women's SHGs through ornamental fish enterprises, with Rs 8.83 lakh revenue generated and entrepreneurship established at three locations. Conservation gains linked to livelihoods — captive breeding and ranching of threatened endemic species, Ramsar-site and river fish documentation, and recognition through the ICAR-CCARI Institute Team Award.

FIELD INFORMATION

When the field was developed:	2022-26
What are crops being cultivated season-wise:	Fishes
Soil type:	NA
Soil pH, EC, OC:	NA
Soil depth:	NA
Soil NPK and Micronutrient status:	NA

Common pests and diseases:	Rhinoceros beetle, Pepper foot rot, Red palm weevil, Budrot in coconut