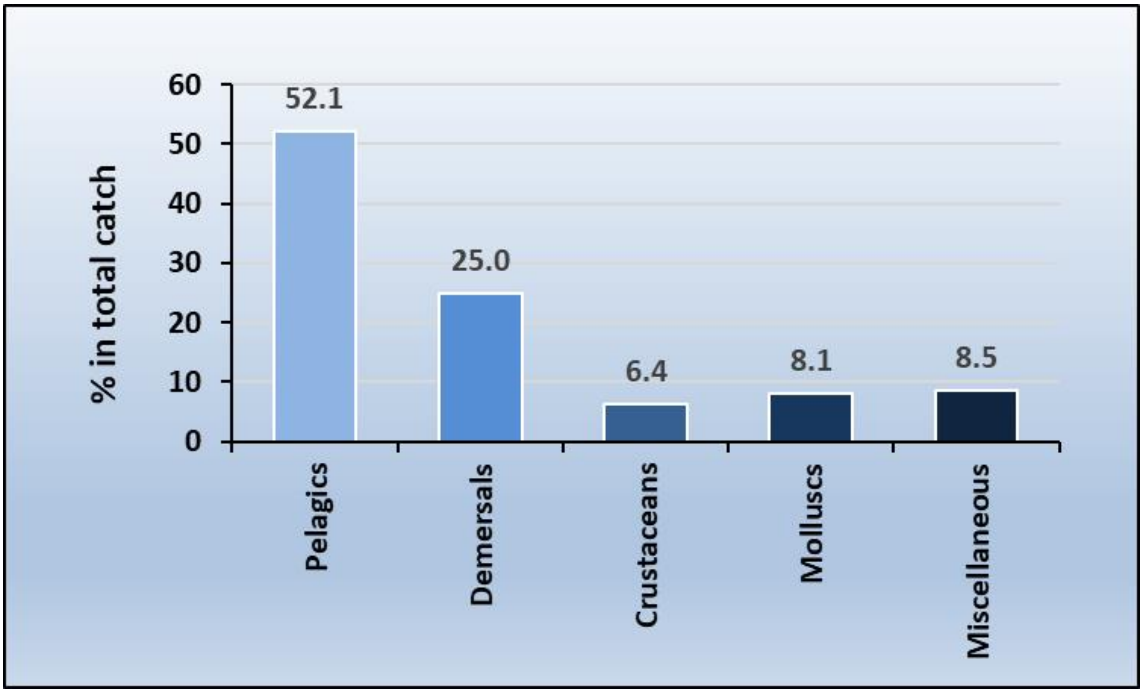
Madras Regional Station of Central Marine Fisheries Research Institute, Chennai
Major Achievements

A. Marine Capture Fisheries

- Data on marine fish landings at major and minor fish landing centres by different gears were collected through field surveys and compiled for estimation of monthly and annual fish landings in the districts of Ongole, Nellore (A.P), Thiruvallur, Chennai, Cuddalore, Villupuram (T.N.) and in Puducherry.
- Database on species composition, catch rates, length composition, feeding biology and reproductive biology of major demersal, pelagic (including large pelagics), crustacean and molluscan resources landed in Chennai, Cuddalore and Puducherry was strengthened for estimation of Biological Reference Points (BRPs) and assessment of stock status and for development of management plans for sustainable fisheries.
- The estimated total marine fish landing in Tamil Nadu in 2021 was 5.62 lakh tonnes, increasing marginally by 0.6% from the landings in 2020. During 2022, the total fish landings were estimated to be ~7.22 lakh tonnes and ~0.5 lakh tonnes in 2022 Tamil Nadu and Puducherry respectively.



- Online training on identification of finfish and shellfish resources of Tamil Nadu was conducted for FRAD survey staff and field staff associated with fishery resource monitoring in Tamil Nadu during April-May 2021.
- Data analysis for preparing spawning season calendar for commercially important finfish and shellfish resources of Tamil Nadu was initiated. The spawning season of prawns off Coromandel Coast has been identified as July-September with peak in August. The

Minimum Legal Size (MLS) of commercially important species was worked out for three ecosystems – Coromandel Coast, Palk Bay and Gulf of Mannar.

- Biology-based stock assessment of threadfin breams *Nemipterus japonicus*, *N. randalli* and *N. bipunctatus* indicated healthy stock along the north Tamil Nadu coast. The croaker *Nibea maculata* is optimally exploited while the tiger toothed croaker *Otolithes ruber* is overexploited. Implementing MLS is advised to counter the incidence of juveniles in the trawl landings.
- Stock status studies on *Metapenaeus dobsoni* and *M. monoceros* indicated that the possible marginal increase of yield from the present level is very low and the economic yield is also not profitable. Moreover, the spawning stock biomass is very low even at the present fishing level (17% of Bvss) in the case of *M. monoceros*. Considering the heavy exploitation of juveniles of these species from the nursery grounds, further increase of fishing effort is not advisable.
- Age and growth and stock assessment of *Himantura imbricata* was carried out and manuscript is under preparation
- Re-emergence of spade nose shark in the fishery was noticed in 2021. It was observed in the trawl landings at Chennai consistently throughout most part of the year. It constituted ~22% of the total shark landings by mechanized trawls at the centre during 2021.
- The ornate eagle ray *Aetomylaeus vespertilio* was recorded for the first time from Gulf of Mannar region in Tamil Nadu. The size of the specimen measuring 384 cm DW is the largest recorded for the species.
- Data compilation and analysis was done to prepare Non-Detriment Finding documents for mako sharks (*Isurus*spp.), devil rays (*Mobula*spp.), bowmouth guitarfish *Rhinaancylostoma*), wedgefishes (*Rhynchobaus*spp.) and guitarfishes *Glaucostegus* spp
- Fishery and biological observations on large pelagic fishes were continued based on fish landings at Chennai. Two species of queenfish *Scomberoides commersonniamus* and *S. lysan* were studied; 62% and 55% of the sampled *S. Commersonianus* and *S. lysan* respectively were immature. Rainbow runner *Elagatis bipinnulata* fishery was observed during the months of July to September
- Two species, *Scomberomorus commerson and S. guttatus* constituted the fishery by gillnet, hooks & lines and trawl net. The former was the dominant species and constituted 90% of the seerfish landings. The mean lengths were 39.4 cm and 34.6 cm respectively.
- The abundance of barracudas was good during January to July. Four species of *Sphyraena putnamae, S. obtusata*, *S. forsteri* and *S. jello* constituted the fishery with mean length of 54.5 cm, 21.4 cm, 20.5 cm and 21.8 cm respectively.

B. Mariculture

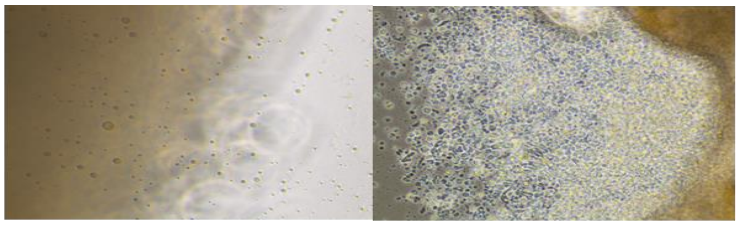
- Biological productivity indices and Reef efficiency indices for artificial reef sites along Tamil Nadu coast indicate a 10 to 15 fold and 20-25 fold increase in benthic and pelagic fish fauna at reef sites, compared to non-reef sites. Macro benthos in the reef associated sediments increase 25-50% in just six months and stabilises to 45-75 % (after 3-5 years).

- Online training programmes on "*Artificial reefs for Coastal Fisheries Management*" under ICAR-Department of Fisheries Convergence PMMSY in February and March 2021 and on "*Identification of finfish and shellfish resources of Tamil Nadu*" was conducted for FRAD survey staff and field staff associated with fishery resource monitoring in Tamil Nadu.
- Two to three-days hands-on Training on Mariculture Practices in Coastal Waters of Tamil Nadu for 56 TSP Beneficiaries in October 2022 and for 53 SCSP Beneficiaries in December 2022.
- Two to three-days Trainers Training program (ToT) on "The Fundamentals of Artificial Reefs for Improving Marine Fisheries in India" during 18-20 Jan. 2023 and 30,31 Jan. and 01 Feb. 2023 with course manuals in English and Hindi and Tamil (in preparation) for the benefit of the officials and trainees, with funding from NFDB under PMMSY. The participants (72) from all coastal states, UTs and Lakshadweep attended the programme.
- Sand lobster broodstock were scanned for the quality and percentage age category of berries.
- Subsample of all the size ranges of orange spotted grouper *Epinephelus coioides* were sampled for brain, liver, kidney, spleen, and muscle for extracting RNA using Trizol and converting them to cDNA using superscript reverse transcriptase and these cDNA used for real time PCR analyses for selected growth genes to examine the differential growth pattern of growth genes targeting growth hormones, growth receptor and insulin-like growth factor
- Coastal cages stocked with sea bass, pearl spot, mangrove snapper and giant trevally in Kadalur Chinnakuppam during the period was harvested in November 2021, yielding 360 kg of sea bass,10 kg of pearlspot,20 kg of mangrove snapper and 20 kg of trevally that fetched a revenue of ~Rs 3,00,000/-
- One thousand seeds each of silver pompano *Trachinotus blotchii* and Indian pompano *T. mookalee* procured from the Hatchery at RS of CMFRI Vizhinjam and The Azhikode Hatchery supported by the RS of CMFRI Vizhinjamwere reared in hapas separately in KadalurChinnakuppam with pellet feeds three times a day. The culture progressed till June 2021 but later at higher water temperatures in the lake, the seeds developed vibriosis like symptoms and collapsed.
- Sea weed seed material collected from Mandapam was brought to Kadalur Chinnakuppam and seeded on to coir ropes and tied along the sea bass cage nets and grown. In 30 days the sea weeds grew successfully and more than 30 fold increase was observed and the specimens were healthy.
- Coastal cages stocked with sea bass, in Kadalur Chinnakuppam during the period was harvested during November 2022 and 1000Kg of sea bass and nearly 50 kg of Mangrove Jack snapper, was sold realizing approximately Rs 5,00,000.00. The operator directly markets the produce in the fish market and thus realizes maximum rates during the season Rs 450-500 per Kg. The seeds were sourced from the nursery raised fingerlings from the SCSP women's group in Kottaikkadu.

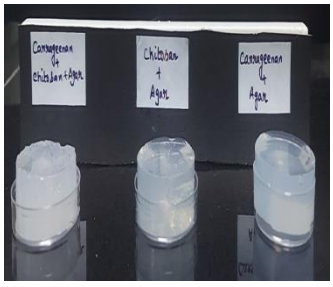

- The farmer has initiated a new unit of GI cage 5x5 M and6x6 OD by his own under the PMMSY -NFDB scheme with 40 % subsidy through the State Fisheries Department.
- Biological productivity indices - Area of Influence, Primary Effective Boundary and Secondary Effective Boundary for fish catch from reef perimeter (PEB & SEB), Biological Influence Range (BIR) and biomass and density of fish fauna were derived for selected artificial reef sites deployed along Tamil Nadu coast. Fish fauna was found to be 10-15 foldhigher in bottom waters and 20-25-fold higher in surface waters as compared to adjacent non-reef area.
- Equations for estimating reef efficiency indices - Efficient Life of Artificial Reef (years), Sinking Rate of artificial reef modules (mm/year) ARSR, Performance efficiency of Artificial reef (ARPE) - for artificial reef modules designed by ICAR-CMFRI were developed.
- Comparison of sediment texture in five villages across three categories of sites (i) plain area with no reef (ii) site with reef deployed 6 months ago and (iii) sites where reefs were deployed 7-10 years ago revealed that fractions of medium and fine sand of <2 mm tend to increase gradually over time in the proximity of the artificial reefs. Macro benthos in the reef associated sediments increase 25-50%in just six months and stabilises to 45-75 % (after 3-5 years).
- Impact assessment studies in deployed reef sites in the coastal waters of TN indicated that for a reef with surface area of 0.15-0.17 ha, the pelagic impact zone is 32 ha while the benthic impact zone is 5 ha, for an efficient Artificial reef that has entered its second year of maturity. Area of Influence (surface and midwater) is 200-300 m from the epicentre of the reef and 1-100 at the bottom, Maximum catches in gill nets were from 40-60 m extending from periphery of the reef.
- Primary Effective Boundary for fish catch from the reef periphery (PEB) was 200-400 m for the pelagic realm and 40-200 m for the benthic realm. Secondary Effective boundary for fish availability from the reef periphery (SEB) was 400-600 m for the pelagic realm and 200-300 m for the benthic realm. Biological Influence range (BIR) was 40-60 m. A 25 % reduction in scouting time is observed in the hook and line and OBGN fishing from that of the fishing in a non-reef area. The Benefit-Cost ratio was 1.6-1.8.

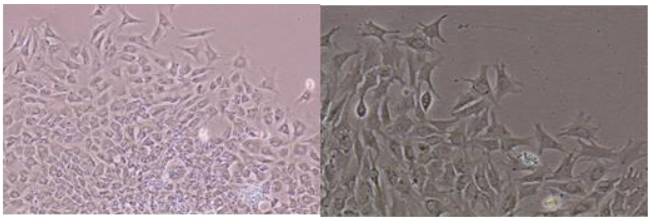
C. Marine Biotechnology

- The transcriptome profiling and identification of novel genes associated with hypersensitivity (allergens) was performed in *Perna viridis* collected from the wild. About 24,109 (60.32%) transcripts could be annotated. Identification of candidate allergenic sequences in the transcriptome revealed 318 unigenes as candidate allergens exhibiting similarity to 116 unique allergens.
- The transcriptome profiling of the metamorphosing flat fish, Indian Halibut, *Psettodes erumei* was carried out to study for better understanding of their cellular, biological and functional modifications for their efficient and successful production. 20 million reads per sample with 150 bp length in paired-end mode of transcriptome data is being generated through Illumina Novaseq 6000. The initial total number of contigs in skin and stomach were found to be around 64570 and 37342.
- With an aim to achieve green and clean meat production, cell-based food development was initiated. Long-term *in vitro* cultures of mantle epithelial cells of the black lip pearl oyster, *Pinctada margaritifera* could be established using sterilized seawater as a basic medium for culture. Cell Cultures are being maintained in a viable state for more than 7 years. Initial TEM analysis revealed 0.25mm thickness of lustrous nacre, falling under good category gradation. The repeatability to form lustrous nacre is almost 66%. The repeatability to form lustrous nacre is almost 66%.
- Primary cell cultures were initiated from the muscle explants of healthy live Carangids and Nemipterus fishes. TEM analysis revealed 0.30 mm thickness of lustrous nacre, falling under good category gradation. The repeatability of the experiment to form lustrous nacre is 68%. Long term cryopreservation (365 days) of *in-vitro* cultured mantle epithelial cells gave post thaw viability of 98.5% with Glycerol when compared to 87% with unfrozen control.



Liberation of cells from explants





Transformation of fibroblasts to Myofibroblasts & Myocytes

D. Fishery Environment Management and Marine Biodiversity

- Micro-level environmental management plans for selected critical habitats for ecosystem health and sustainable production. Water samples were collected once a month from Ennore estuary, Ennore sea and Madras Fisheries Harbour (MFH) and analysed for different water quality and nutrient parameters. As per the water quality indexing of US EPA, 2004, overall grade showed "Fair" condition at all these stations.

E. Socio-Economic Assessment, marine fish marketing and livelihoods

- Economic analysis of the dynamics of the ornamental fish and fish feed industry based in Southern India was carried out based on a primary field survey. The findings of the survey suggested that there are close to 1,850 ornamental fish producing units operating in Kolathur and adjacent regions of Athur and Devanpumedu, which supply approximately 94.9 million ornamental fishes to the Kolathur based wholesale market per annum.
- The profitability of different craft-gear combinations was worked out for Ramanathapuram, Puducherry and Cuddalore. During the year 2020 in Ramanathapuram district, there was 50 per cent reduction in fishing days and increase in fish landing & retail centre price due to COVID-19 pandemic and other factors.
- Month-wise analysis of economics of marine fishing methods in Ramanathapuram district for the year 2021 revealed that the capital productivity of mechanized single day trawling for shrimp and fish resources varied from 0.56 to 0.73 and 0.53 to 0.73
- The estimate of the value of marine fish landings during 2022 at landing centre **(LC)**level was Rs 58247 crores, (8.57 % increase over 2021) and at retail centre **(RC)** was Rs. 79866 crores (4.21 % increase over 2021). The unit price per kg of fish at LC was Rs.166.90 (5.69 % decrease over 2021) and at RC was Rs.228.84 (5.55 % decrease over 2021). The marketing efficiency was 72.93 % (4.18 % increase over 2021). The increase in the value is attributed to increase in landings during 2022.
- The index number of the value of landing centre worked out to 239.02, showing a 139.02 per cent increase in landing Centre prices in 2023 compared to 2011.

F. Marine fish distribution and consumption demand in India

- Landing Centre valuation (LC valuation) of marine fish landings in Tamilnadu was Rs. 7908/-crore (14.76%) and Retail Centre valuation (RC valuation) was Rs. 15179/- (19.81%).
- State wise landing price behaviour of major species in Tamilnadu was Rs. 98.77/ kg for Oil sardine, Rs. 84.75/kg for Hilsa shad, Rs. 123.15/kg for Ribbonfish, Rs. 287.04/kg for Penaeid shrimp, Rs.136.08/kg for Non-penaeid shrimp, Rs. 187.41/kg for Squids and Rs. 176.34/kg for Indian mackerel.
- The per capita annual fish consumption of Tamilnadu, Chennai (Urban coastal district) was 9.47kg.
- The price behavior of marine fish varieties was analyzed collecting the weekly data on wholesale and retail prices from selected markets- Chindadiripet, Wimconagar, Tondaipet, and Kasimedu in Chennai. The fishermen's share of consumer's rupee across the varieties ranged from 70 to 76%.

Externally funded, consultancy and contract research projects

***National Innovations in Climate Resilient Agriculture (NICRA) – SCSP component*:**

- Climate Smart Villages: (Livelihood vulnerability assessment) Survey of the vulnerable fisher population in the districts of Thiruvallur, Chennai, Kancheepuram (now Chingleput) and Cuddalore was carried out towards framing necessary support. Empowerment of stakeholders through training programs, demonstrations, farming inputs and supply of equipment/materials were carried out under the SCSP program implemented at Chennai.
- 55 women beneficiaries in Kottaikadu village, Chingleput district were identified for skill development in bivalve processing and marketing and field accessories were distributed to them at a stakeholder meeting on 09/03/2021.
- Questionnaires were developed for carrying out value chain surveys to assess the impacts of climate change across the chains for select species/groups. Pilot surveys have been initiated at Chennai.
- Data mining for risk assessment and to assess the impact of extreme events across coastal communities have been initiated.
- 35 women beneficiaries in Kottaikadu village, Chingleput district, Tamil Nadu and 41 women beneficiaries in Thonirevu village, Thiruvallur district, Tamil Nadu were supported with field accessories for fish cutting and marketing under the NICRA-SCSP component.



Sustainable fishing and farming livelihood support programme for the SC –Adi Dravidar fisher community at Kottaikkadu Panchayat, Cheyyur Taluk, Kancheepuram, TN Schedule Caste Sub Plan (SCSP)

- In Kottaikadu village in Chingleput district of Tamil Nadu, three teams comprising 12 members each operated two cages each stocked with sea bass for 263 DOC. The final production achieved by the teams was 544, 340 and 474 kg each.
- Emergency harvests due to heavy floods cut short the farming duration by 30 days; the crop suffered a loss of 30% and the estimated loss in revenue was nearly 50%. Gross revenue realised was Rs 4,22,904/-.
- Hatchery produced (Visakhapatnam Regional Centre of ICAR-CMFRI) orange spotted grouper (*Epinephelus coioides*) fingerlings of 45 to 75 mm length sizes were stocked in April 2022 in three hapas (hapa inside the cage) at 300nos/hapa under the SCSP cage culture activity at Kottaikadu. The growth and survival were assessed in July 2022 and fishes were released from the hapa to the cages for further growth. The groupers from two cages were harvested on 17 October 2022. Totally 43.65 kgs and 7.85 kgs harvested from the cage maintained by Vivekanandar and Annai Theresal group respectively, with 100% survival (fishes after released from hapa to cage) and final survival at 45% and 18.3 %. The third cage was harvested on 21 October 2022. Totally 75.46 kgs harvested from the cage maintained by Nallur Naththathanar group, with 100% survival (fishes after released from hapa to cage) and final survival at 74%.




- The harvested fishes were chill frozen and transported to Chennai and sold to buyers directly and hence the selling prices of Rs 500 and 600 could be realized. A gross value of Rs 50,000/- was realized by the team. A request has been placed with the Department of Fisheries by the community seeking support in the form of iinsulated three-wheeler trucks on loan.

Sustainable fishing and farming livelihood support programme for the TSP-IRULAR fisher community at Senjiammannagar, Kottaikuppam Panchayat, Ponneri Taluk, Thiruvallur district, TN (TSP)

- Demonstration cum livelihood support programme on cage farming in coastal waters taken up with the community of Irulars (ST) at Senjiammannagar, Ponneri Taluk in Thiruvallur district TN
- Full scale cage farms of four GI units of 4x4 m and four earlier units are to be operated by 50 beneficiaries identified (total of eight cages).The farming will commence with the stocking of seabass seeds
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Site selection for installation Two artificial reefs in inshore waters of Thiruvallur district in north Tamil Nadu. (Client –Department of Fisheries, Govt of Tamil Nadu, under CSR mode for the Kamarajar Port Chennai)

- Deployment of artificial reefs in two sites (Goonankuppam and Light House Nadukuppam) in the district of Thiruvallur, in Tamil Nadu, were carried out. The stakeholders' consultations were completed, and the deployment was carried out on 1st October 2022.

Figure (Top) Pradhan Mantri's Kisan Samman Sammelan on 31 May 2022
(Bottom) Harvest mela of cage cultured fishes at Kotaikadu village