Role of CMFRI in Seaweed Mariculture in India: Prospects and Potentials

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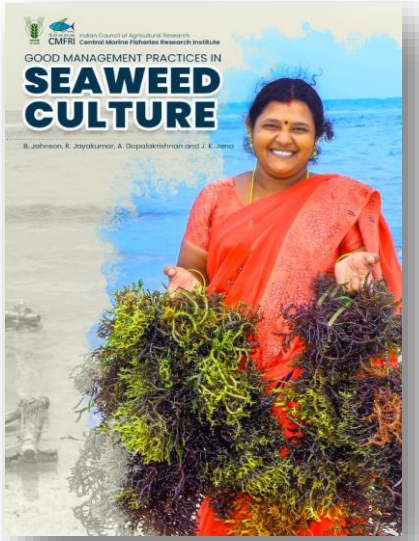
Seaweed Research – CMFRI's role – Initial Phase

- CMFRI started seaweed farming research during 1966 at Mandapam
- *Gracilaria edulis*, *Gelidiella acerosa*, *Ulva lactuca*
- Further strengthening in 1972 – *Gracilaria edulis*
- Series of training programmes on seaweed farming and extraction of phycocolloids
- Cottage industry for manufacture of agar, algin during 1980s leading to many small scale industries in Madurai
- Floating Bamboo raft [12 ft x 12 ft] culture – maximum photoenergy absorption
- Taxonomy & Distribution of seaweed species & their culture along the Indian Coast (CMFRI Bulletins 20 [1970] & 41 [1987])
- CMFRI and NAAS jointly brought out a policy document – Seaweed Culture and Utilisation, No 22 (2003)

Present Status

- Annual seaweed harvest estimation (wild caught) from Indian Coast since 1970s with detailed information for ten species – In 2021 – total wild harvest – 33,345 tonnes.
- Estimated total harvestable biomass from Indian Coast – 0.26 million tonnes/year (2000)
- Supporting *Kappaphycus* culture since 2003
  - Current number of seaweed rafts – 21,587 nos, out of these, more than 5000 nos being supported by CMFRI through SCSP, TSP and NICRA programmes.
- More than 68 hands-on training for >1200 trainees (fishers/women/state officials) since 2014-'15
- Recorded NO establishment of *Kappaphycus* in the wild (GoM) by CMFRI
- Economic assessment of seaweed culture has been carried out
  - Production cost (including capital) ~ Rs 2000/raft/year
  - One family [3 members] can hold a minimum of 30 rafts of 12 ft x 12 ft
  - Net income per year is Rs 1.1 Lakhs per family per 30 rafts/year

  (formed the basis for PMMSY Schemes)
- Standardised culture practices (400 rafts of 12 ft x 12 ft in one ha)
- Brought out Good Management Practices (GMP) & Standards - for Bureau of Indian Standards (BIS)
- CMFRI's own target for demonstration – additional 5000 rafts by 2025

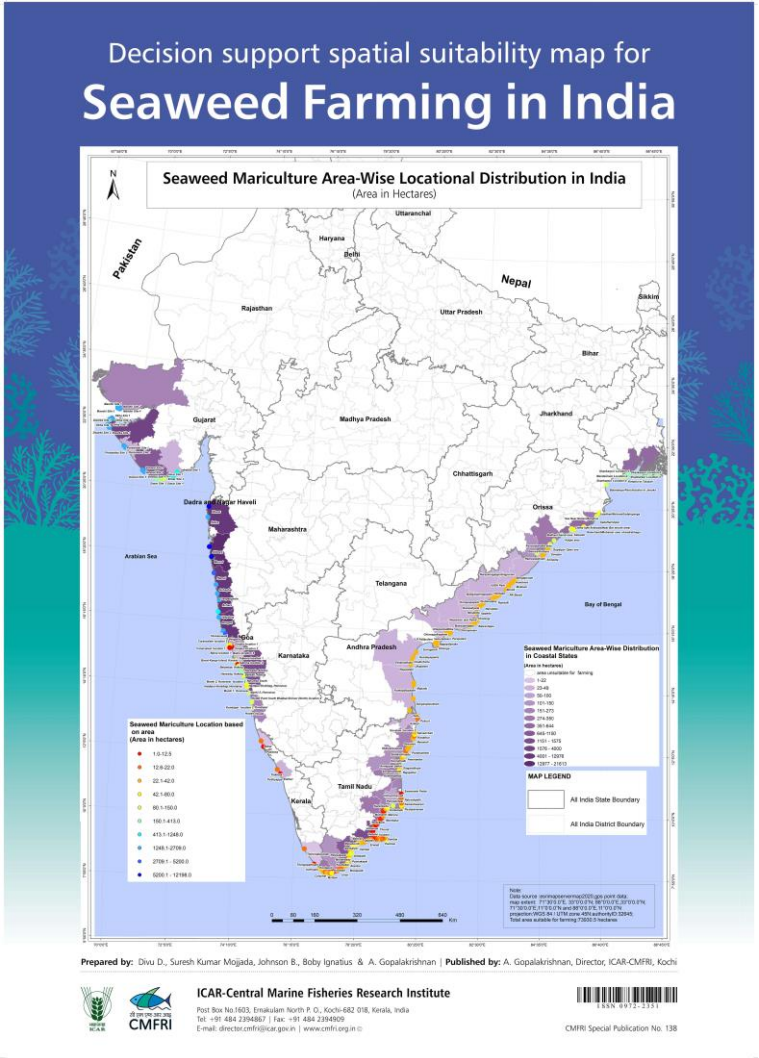


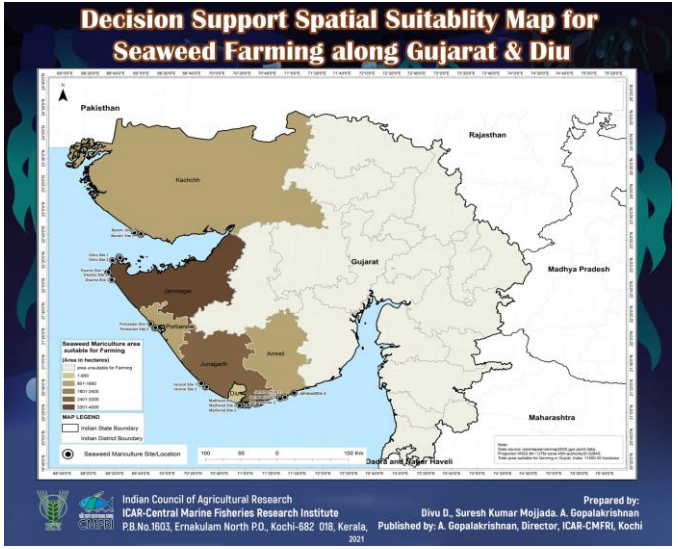
Integrated Multi-trophic Aquaculture (IMTA)

- **Seaweeds - excellent bioremediating agents**
- **Excellent uptake of dissolved minerals - nitrates, ammonia & phosphate + more production**
- **Standardised and developed package of practices for IMTA - 16 seaweed bamboo rafts (12 ft x 12 ft) + 1 cage (6 m dia. sea cage)**
- **1 Kg planting material grows to 4.1 Kg (Non-IMTA) vs 6.4 Kg (IMTA) in 45 days**
- **Yield - 250 Kg/raft vs 390 kg/raft (IMTA) | 56% additional yield & 18% additional income to the farmer.**
- **Significantly Improved water quality in cage culture sites when integrated with seaweeds and reduced chances of eutrophication**

Mapping of potential seaweed culture sites

- Geo-referencing using GIS-MCE modelling using data based on survey, sea-truth data & Satellite imagery
- **Identified 317 potential seaweed farming sites of 23,950 ha using GIS based models.**
- **Seaweed Production potential = 9.58 million tonnes (wet weight)** [400 rafts (12ft X 12ft) in 1 ha X 1 tonnes/raft/year X 23950 ha]
- Shared the information with Govt. of India-DoF and all coastal states
- Detailed geo-referenced state-wise maps being prepared
- Completed for Gujarat State
- Requests for feasibility and pilot studies received from 8 states - Puducherry, Andhra Pradesh, Lakshadweep, Kerala, Odisha, Maharashtra, Goa and Gujarat State Govts.
- NITI Aayog – to develop Lakshadweep as a seaweed hub - jointly with CMFRI





Research Communications

Preliminary estimates of potential areas for seaweed farming along the Indian coast

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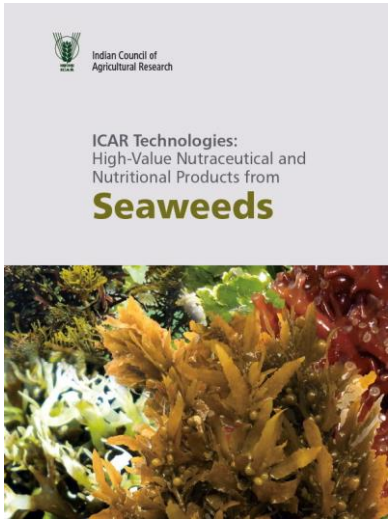
Abstract

India has enormous potential for seaweed mariculture; however, mass scale commercial farming of seaweeds is yet to take off successfully in the country. R&D efforts over the years have resulted in techno-scientific improvements in farming technologies such as floating rafts, net-tubes, long-lines, and cage based IMTA systems for seaweed culture. However, a few challenges remain, particular in identifying potential sites, its demarcation and developing suitable and sustainable spatial plans for seaweed farming on a country-wide

Nutraceuticals

- **For human well-being & to treat lifestyle diseases** ***(Diabetes, Hypothyroidism, Arthritis, Obesity, Hypertension, Osteoporosis, NAFLD etc.)***
- **Developed 11 nutraceutical products exclusively from seaweeds of which 9 are commercialised – completed preclinical trials in Govt of India recognised laboratories**
- **350 mg ingredient per capsule (~ 7 g of dry seaweed is required/capsule)**
- **For 120 Million capsules/year, ~ 400 t (dry weight) seaweeds are required.**
- **~1.4% of Indian Nutraceutical market**
- **Queries received from USA for collaboration**
- **16 Indian Patents granted & more than 40 filed & in different stages of processing**

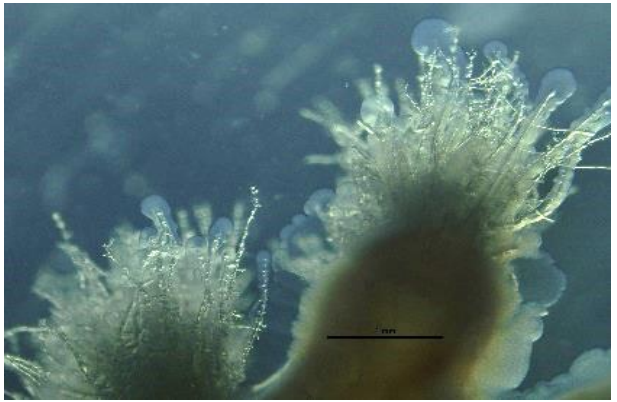


Other developments

- ✓ **Micropropagation – success with five species – to be commercialised**
- ✓ ***Aquagri* approached CMFRI joined hands to form a *Section 8* company for large scale production of seeds**
- ✓ **ICAR-NIANP – CMFRI to identify candidate Indian seaweed species to be used for fodder replacement for mitigation of methane emission**
- ✓ **Strain improvement experiments of *Gracilaria edulis* from four locations at Mandapam**
- ✓ **Whole genome sequencing of *G. edulis* initiated (~0.1GBp)**

- ❖ **CMFRI's request to Dept of Fisheries to import improved strains of *Kappaphycus / Eucheuma* for better farming results (for farming in ecologically non sensitive areas)**
- ❖ **Request from Tamil Nadu Wildlife Dept to identify good native species for farming in the Gulf of Mannar – *G. edulis, G. debilis***
- ❖ **Targets for training – another 10,000 fishers by 2025**

Branching of *Kappaphycus*



Plantlets of *Kappaphycus*

Gaps

- Seaweeds - Lack of domestic acceptance as food
- **Need for Leasing policy of coastal areas in coastal states**
- Technical knowhow on offshore culture of seaweed is yet to be developed in India.
- **Poorly organised markets for seaweeds and its products**
- Requirement for diversification of seaweed based products' value chain and development of processing/products/fodder replacement industries
- **Need for insurance to cover risks associated with farming activities**
- Inadequate availability of seed/plantlets and need for development of improved strains.
- **Need for commercial micropropagation hubs in different parts of the nation for round the year seed availability**
- Need for better collaboration – ICAR-CMFRI/CIFT & CSIR-CSMCRI.

Way Forward

1. Research

- Pilot farming trials in potential areas identified suitable for seaweed culture
- Eco-friendly materials for replacement of bamboo and wooden rafts
- Exploring scope for exotic strains/ screening for suitable indigenous species which are fast growing and abiotic stress tolerant
- Genetic improvement of native species for faster growth and better yield of phycocolloids
- **Offshore farming** & Scientific interventions to minimise grazing, fouling and disease incidences in a collaborative mode
- Development of culture practices & Large scale cultivation of native species suitable for **fodder replacement**/ bio-stimulant

Way Forward

2. Developmental Activities

- Development of seed banks/ micropropagation for continuous round the year production of seeds
- Exploring the scope for introducing **fish farmer producer companies** in seaweed farming
- To develop a rural enterprise comprising of farming, marketing and post-production activities associated with seaweeds - "**seaweed hubs**" in coastal states
- Enhancing the **availability of credit, insurance** and other logistical support for farmers
- Development of **FSSAI standards for seaweed products/recipes** (including dried products) **for human consumption**
- Exploring **better market opportunities including international markets** – organic farming - fodder
- Govt approval to treat **seaweed farming on par with agriculture** to ensure greater policy support
- Nation-wide seaweed consumption campaigns – National seaweed product festivals, ***"National Seaweed Day"***

Thank You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