No: NEDAC/ 2021-CommAqua
19 January 2021

Hon'ble Member of NEDAC
Hon'ble Invitee to NEDAC

Subject: INTERNATIONAL WEBINAR ON ENTREPRENEURSHIP DEVELOPMENT IN SEAWEED BUSINESS BY COOPERATIVES

Dear Sir / Dear Madam,

I am happy to inform that an international webinar is being jointly organized by NEDAC, the Department of Fisheries, Government of India and the Laxmanrao Inamdar National Academy for Cooperative Research and Development (LINAC) of NCDC on 28 January 2021 from 10.30 AM to 1.30 PM IST on Zoom platform, also to be live-restreamed through Facebook Live and YouTube.

As you know, NEDAC General Assembly, in its meeting held in October 2020 had approved the broad contours of Work Plan 2021 & 2022. This webinar is being organized as part of the NEDAC's comprehensive Work Plan. On behalf of the organizers, I am pleased to invite you to take part in the webinar. Kindly give wide publicity among stakeholders and interested colleagues to take part in the webinar.

A copy of the concept paper, developed by the LINAC Fisheries Resource Team, and the technical program of this unique webinar, which hosts a fine mix of cooperatives, academia/researchers, industry, and policymakers are also enclosed.

The participants' profile would be from field level covering the following:

i. Entrepreneurs / Women / Youth / Disadvantaged groups from NEDAC member countries;
ii. Leaders / Personnel from fisheries Cooperative Organizations/ Federations / Associations
iii. Leaders / Personnel from government organizations / agencies: Ministries/ Departments / Institutions
iv. Leaders / Personnel from any private sector institution;
v. Leaders / Personnel from any Coop or Government-supported institution;
vi. Leaders / Personnel supported by any cooperative sector institution;
vii. Leaders / faculty / staff from academic or training institutions or Universities;
viii. Leaders / Personnel deputed by any international organization.

With warmest regards,

Yours sincerely,

Prof Krishna R Salin
Honorary Director
NEDAC, Bangkok Office
Joint Coordinator of Webinar

राष्ट्रीय सहकारी विकास निगम
NCDC
*Assisting Cooperatives. Always!*

Department of Fisheries
Ministry of Fisheries, Animal Husbandry & Dairying
Government of India

NEDAC

# You are invited to the International Webinar Entrepreneurship Development

On

# SEAWEED BUSINESS BY COOPERATIVES

## 28 January, 2021 Thursday at 10: 30 AM Indian Standard Time

Jointly Organized by
Department of Fisheries, Min of AHD&F, Govt. of India
LINAC-NCDC, Department of Agriculture, Coop & FW, Min of Agri & FW, Govt. of India
NEDAC, Bangkok (www.nedac.info)

## PROGRAM

Free registration required in advance at www.nedac.info
Zoom link will be sent to the registered participants
Live-streamed (no registration needed) on
NCDC YouTube: https://www.youtube.com/c/sahakarCooptubeNCDCIndia.
NCDC Facebook: https://web.facebook.com/ncdcindia

| Indian Std Time | Program |
|---|---|
| 10:30- 10:35 AM | Welcome by Webinar Coordinator, **Lt. Col. Bikramjit Singh**, Chief Director, LINAC-NCDC, **India**<br>Introductory remarks by Webinar Coordinator, **Prof Krishna R Salin**, Hon. Director, NEDAC Bangkok, **Thailand** |
| 10:35- 10:38 AM | Address by **Mr Sundeep Kumar Nayak**, MD NCDC and Chairman, NEDAC, **India** |
| 10:38-10:48 AM | Address by Chief Guest: **Dr. Rajeev Ranjan**, Federal Secretary, Department of Fisheries, **India** |
| 10:48 - 10:53 AM | Ministry of Food Proc Industry support for seaweed based food: **Mr Manoj Joshi**, Federal Addl Secy, MoFPI **India** |
| 10.53 - 11.08 AM | Seaweeds, a key component of Integrated Multi-Trophic Aquaculture (IMTA) providing important ecosystem services, which should be valued: **Dr. Thierry Chopin**, Prof of Marine Biology, Univ of New Brunswick, **Canada** |
| 11.08 - 11.13 AM | Seaweed based *Sagarika* for farmers: **Dr. US Awasthi**, MD IFFCO, **India** |
| 11.13 - 11.20 AM | Seaweeds in the cosmetics industry in India: **Dr. Blossom Kochhar**, Chair, Blossom Kochhar Group, **India** |
| 11.20 - 11.27 AM | Seaweeds business experience: **Mr Abhiram Seth**, Aqua Agri, **India** |
| 11.27 - 11.37 AM | Seaweed business experience: **Ms Kavita Nehemiah**, Snap Natural & Alginate, **India** |
| 11.37 - 11.57 AM | Seaweed research linked business in Vietnam: **Dr. Nguyen Van Nguyen**, Dy Dir, Res Inst for Marine Fish, **Vietnam** |
| 11:57- 12:12 PM | Innovations in red seaweed cultivation: **Dr. Anicia Q Hurtado**, University of the Philippines Visayas, **Philippines** |
| 12.12 - 12.27 PM | Seaweed farming for industrial applications: **Dr. Yugraj Yadava**, Director, Bay of Bengal Programme IGO, **India** |
| 12.27 - 12.32 PM | Perspectives from States: **Dr. Atul Patne**, Commissioner Fisheries, Gov of Maharashtra, **India** |
| 12.32 - 12.40 PM | Seaweed business opportunities in the pharmaceuticals industry: TBC |
| 12.40 - 12.50 PM | Seaweed based functional foods - business models from ICAR-CIFT: **Dr. Suseela Mathew**, Pr Scientist, **India** |
| 12.50 - 01.00 PM | Seaweed scenario in India: **Dr. Raj Naresh Gopal**, NCDC and **Mr Nilesh Patil**, NCDC **India** |
| 01.00 - 01.15 PM | Q & A session moderated by **Prof Krishna R Salin**, Hon. Director NEDAC Bangkok, **Thailand** |
| 01.15 - 01.25 PM | Summing up by **Prof Krishna R Salin**, Hon. Director NEDAC Bangkok, **Thailand** |
| 01.25 - 01.30 PM | Closing - Vote of thanks by **Ms Inderjeet Kaur**, NCDC, **India** |

QR Code NCDC YouTube

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QR Code NEDAC Twitter

**Revised draft on 10.01.2021**

**CONCEPT PAPER**

# INTERNATIONAL WEBINAR ON ENTREPRENEURSHIP DEVELOPMENT BY COOPERATIVES IN SEAWEED BUSINESS

Prior registration at https://webinar.ncdc.in on ZOOM platform

**Jointly organized by**

**DOF-GOI, LINAC-NCDC, NEDAC-BANGKOK**

## INTRODUCTION

India has a coastal line of around 7,500 km which can be potential seaweed farming zones. The required manpower for the seaweed farming and processing can be met considerably from the fishermen communities which are vulnerable to climate changes thereby can enhance their livelihoods. Seaweed farming and its associated preliminary processing can be taken in village or community levels as a strategy of adaptability and resilience in the context of climate change. India has 14500 km of navigable waterways. Utilizing these natural advantages for Seaweed cultivation could have several advantages for India.

Seaweed does not require any fresh water, arable land and nutritional inputs. As water scarcity is emerging as an important challenge in the country, this is particular relevance of the country. World Bank predicts that achieving a global production of 500 million tons of Seaweed by 2050 would absorb 10 million tons of nitrogen, which is 30% of the nitrogen estimated to enter in the ocean. Seaweed can also absorb 15 million tons of phosphorous, which is 33% of the total phosphorous reached to the ocean by runoff.

The Seaweeds are macroscopic / macrophytic algae, a primitive type of plants lacking true roots, stems and leaves. Seaweeds grow in the marine and shallow coastal and brackish waters, and lack root system and conducting tissues like land plants. Four groups of seaweeds are recognized according to their pigments that absorb light of particular wave lengths and give them their colours of green algae (900 species), blue algae, brown algae(1500 species) and red algae(4000 species),. The greatest variety of red seaweeds is found in subtropical and tropical waters, while brown seaweeds are more common in cooler and temperate waters.

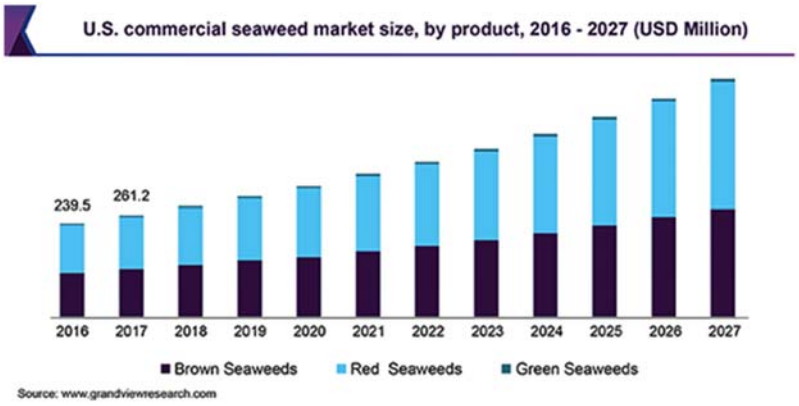
Seaweeds (macro algae) are wonder plants of the sea, the new renewable source of food, energy, chemicals and medicines with manifold nutritional, industrial, biomedical, agriculture and personal care applications. Seaweeds are also termed as the 'Medical Food of the 21$^{st}$ Century' due to usage as laxatives, for making pharmaceutical capsules, in treatment of goiter, cancer, bone-replacement therapy and in cardiovascular surgeries.

The major industrial applications of seaweeds in India are as a source of agar, agarose and carrageenan used in laboratories, pharmaceuticals, cosmetics, cardboard, paper, paint and processed foods. There are 46 seaweed-based industries, 21 for Agar and 25 for Alginate production, but they are not functioning up to their rated capacity, due to short-supply of raw materials.

## GLOBAL SCENARIO OF SEAWEED PRODUCTION

Seaweed resources available around the world include more than 1000 species, from which only hundred species are being commercially used. Apart from the natural sea weed beds, they are extensively farmed and traded mainly in several South East Asian Countries. In 2012 only 33 countries and territories worldwide cultivated seaweed, but in 2015, 50 countries reported the practice of seaweed aquaculture (FAO, 2016). Seaweed production had grown in output volume from 13.5 million tonnes in 1995 to just over 30 million tonnes in 2016. World seaweed production showed *Kappaphycusalvarezii*, and *Eucheumadenticulatum* together contribute 41% of total seaweed production while, *Saccharina japonica* contributes 29%, *Gracilaria spp*. 14%, *Porphyra spp*., 7% and *Undariapinnatifida* 9% of the total production.

The global commercial seaweeds market size was calculated to be at USD 5.9 billion in 2019 and is anticipated to witness a CAGR of 9.1% over the forecast period. Technological developments in cultivating cultured seaweed coupled with rising investments in application segments, including animal feed and agriculture, are likely to propel market growth in the coming years.




Increasing awareness pertaining to the health benefits of the product coupled with increasing demand for foods and snacks derived from commercial seaweed is estimated to boost the human consumption application segment. The swelling demand for marine plant extracts, used as a thickening and gelling agents in the cosmetic and food industries, is also likely to boost growth, primarily in North America and Europe.

The industry in the U.S. was valued at USD 311.4 million in 2019. It was the fastest-growing region in North America owing to the strong presence of application industries. The industry in the U.S. is anticipated to expand further due to increasing awareness regarding the application of the product in the pharmaceutical industry.

China and Indonesia are the largest seaweed producers with over more than 80% of the world production in 2016. China produces mostly *Saccharina japonica* and *Undariapinnatifida* and to the lesser extent Gracilaria and Pyropia (FAO 2016). On the other hand, Indonesia produces mainly the carrageenophytesKappaphycus and Eucheuma (FAO 2016). Philippines and

Republic of Korea produce over 1 MT while the Democratic Republic of Korea, Japan, Malaysia and Zanzibar produced over 1 Lakh tones each.

Trade in aquatic plants increased from USD 60 million in 1976 to more than USD 1 billion in 2016. Indonesia, Chile and the Republic of Korea the Leading exporters. China, Japan and the United States of America are the Leading importers in the Sea weed trade (FAO, 2018).

The key players in the global commercial seaweed market include CP Kelco, Seasol International, Chase Organics GB Ltd., Indigrow Ltd., Acadian Seaplants Ltd., Yan Cheng Hairui Food Food Co., Ltd., Algea, Pacific Harvest, Mara Seaweed, Aquatic Chemicals, and others. Global concern has been rising regarding the impact of climate change on seaweeoabunciance, distribution and quality. it is therefore relevant and timely to develop alternative production strategies.

## WHY SEAWEED CULTIVATION IN INDIA

- ✓ Remedy for non-availability of required quantity seaweeds for various uses.
- ✓ Provide occupation for the coastal people.
- ✓ Provide continues supply of raw material for seaweed based industry.
- ✓ Provide seaweeds of uniform quality for use in industry.
- ✓ Conserve natural populations of concerned seaweeds.
- ✓ Seaweed farming is a eco-friendly activity.
- ✓ Tool to treat coastal pollution in sea and to reduce CO2 emission.

India has the potential and long coast line to become one among the player in seaweed market that's projected to hit $26 billion globally by 2025. In India, seaweed becomes strategic commodity in fisheries revitalization plan other than shrimp and tuna in the recent years though natural sea weed collection has been the livelihood for the coastal fisherwomen for several decades especially in Gujarat and Tamil Nadu where the natural sea weed resources are found. *G. acerosa* and *G. edulis* are being commercially harvested for agar production and Sargassum, and Turbinaria are harvested for alginate production since the early 1950s in India (Krishnamurthy, 1971). These algae are harvested from 20 islands and the mainland coast of Gulf of Mannar and Palk Bay, Southeast coast of India.


Some 844 species of seaweeds have been reported from Indian seas, their standing stock is estimated to be about 58,715 tonnes (wet weight). Among them, 221 species are commercially important and abundant along the Tamil Nadu and Gujarat coasts and around Lakshadweep and

Andaman & Nicobar Islands. Rich seaweed beds occur around Mumbai, Ratnagiri, Goa, Karwar, Varkala, Vizhinjam and Pulicat in Tamil Nadu & Andhra Pradesh and Chilka in Orissa.

## NUTRITIONAL COMPOSITION OF SEAWEED

Most people unknowingly utilize seaweed products daily in the form of processed food items like processed dairy, meat and fruit products and domestic commodities like paint, toothpaste, solid air refreshers, cosmetics etc. Seaweeds are excellent source of vitamins A, $B_1$, $B_{12}$, C, D & E, riboflavin, niacin, pantothenic acid, folic acid as well as minerals such as Ca, P, Na, K. Their amino acid content is well balanced and contains all or most of the essential amino acids needed for life and health. They have more than 54 trace elements required for human body's physiological functions in quantities greatly exceeding vegetables and other land plants. These essential elements are chelated, colloidal, optimally balanced form hence they are bio-available.

## WHY SEAWEED CULTIVATION

- ✓ Seaweed farming creates promising business opportunities in developing countries by promoting rural communities, small family farms and women through cooperative model, while at the same time combating the environmental problems we face, such as overfishing and climate change. Ensuring that this green business stays afloat will have positive ripple effects for years to come.

- ✓ Seaweed farming does not require buying land, fertilizer, pesticides, seeds, fresh water, or a multitude of expensive tools and equipment. The only necessities for this business are sunlight, sea water, carbon dioxide, seaweed (which multiplies on its own and is 50 times more productive than corn), and sometimes a boat.

- ✓ Seaweed farming is one of the few ways of life in developing countries that allows a certain level of flexibility. As a result, women can work in this business and gain an independent income without neglecting their traditional household work. In particular, Tanzania has seen women emerge as leaders in the seaweed world, and they have even moved onto producing seaweed flour in addition to farming.

- ✓ Over the years, global fishing practices have become less and less sustainable, resulting in the decline of the global fish stock. Overfishing has become such a problem in our oceans that it is leading to the loss of species and entire ecosystems, which in turn will deprive the world of a rich food source that we depend on for economic, social and dietary reasons. In the coastal areas of this world where fishing is a main industry, the growing field of seaweed farming can offer a lucrative alternative. The fewer people who are out fishing, the less risk for overfishing.

- ✓ Considered to be the trees of the sea, seaweed can help to negate the effects of climate change in our oceans, which has caused rising temperatures and increased levels of carbon dioxide in our waters. Seaweed does this by absorbing carbon dioxide in the water, and it can even absorb five times more $CO_2$ than plants found on land.

- ✓ In addition, unlike industries such as shrimp production, seaweed growing has little negative effect on coasts and leaves shoreline ecosystems intact. In fact, seaweed can actually leave the coast cleaner than it was before, because it captures toxic chemicals, such as nitrogen from sewage and agricultural runoff.

**ENTREPRENEURSHIP POTENTIAL FOR SEA WEED BUSINESS IN INDIA**

- ✓ Seaweeds grow abundantly along the Tamil Nadu and Gujarat coasts and around Lakshadweep and Andaman and Nicobar islands. There are also rich seaweed beds around Mumbai, Ratnagiri, Goa, Karwar, Varkala, Vizhinjam, Pulicat and Chilka.
- ✓ Out of approximately 700 species of marine algae found in both inter-tidal and deep water regions of the Indian coast, nearly 60 species are commercially important.
- ✓ The surveys carried out by CSMCRI, CMFRI and other research organizations have revealed vast seaweed resources along the coastal belts of South India. On the West Coast, especially in the state of Gujarat, abundant seaweed resources are present on the intertidal and sub tidal regions.
- ✓ The seaweed industry in India is mainly a cottage industry and is based only on the natural stock of agar-yielding red seaweeds, such as Gelidiella acerosa and Gracilaria edulis, and algin yielding brown seaweeds species such as Sargassum and Tubineria.
- ✓ India produces 110-132 tons of dry agar annually utilizing about 880-1100 tons of dry agarophytes. Annual algin production is 360 to 540 tons from 3,600 to 5,400 tons dry alginophytes.

Seaweed farming has evolved into a successful commercial endeavour in a number of tropical countries endowed with clear, unpolluted intertidal environments and protected beach locations. In contrast to other forms of aquaculture, seaweed farming has minimum capital and technological requirements and provide important economic opportunities to marginal coastal communities with limited livelihood options. India with a lengthy coastline and a major coastal fisher population is more suitable for sea weed farming.

In India, 434 species of red seaweeds, 194 species of brown seaweeds and 216 species of green seaweeds are found in both inter-tidal and deep water regions. (CMFRI, 1987). Out of these, nearly 60 species are commercially important. Agar yielding red seaweeds such as *Gelidiellaacerosa*and *Gracilaia*

*sp*. are collected throughout the year while algin yielding brown algae such as Sargassum and Turbinaia are collected seasonally from August to January.

The seaweed production potential in India is estimated at 1,005,000 ton distributed in six states of India (Modayil, 2004) comprising 250,000 ton in Gujarat; 250,000 ton in Tamil Nadu; 100,000 ton in Kerala; 100,000 ton in Andhra Pradesh, 5,000 ton in Maharashtra and 300,000 ton in Andaman and Nicobar islands. However, a significant progress in organised seaweed farming was not made till the beginning of the 21 century due to various reasons.

Besides, seaweed industry has a potential export market mainly due to its diverse uses. It has been estimated that India can produce one million tonnes of dry sea weed providing employment to nearly 2 lakh fishers with an annual income of Rs 1.00 lakh per individual. The annual turnover of Kappaphycus alone is estimated as Rs 2.00 billion. Cooperative backed by institutional and financial support led to the expansion of seaweed (Cooperatives/ Self Help Groups (SHG) model (mostly women). It is a potential employment generating and income earning activity to the coastal fisher women.

## BUSINESS OPPORTUNITY FOR COOPERATIVES IN SEAWEED

### Applications of seaweed in various sectors/industries

- ❖ Food
- ❖ Cosmetics
- ❖ Medicine
- ❖ Fertilizers
- ❖ Animal Feed
- ❖ Textiles

- ✓ As a staple food in Japan and China. Seaweed is super-food packed full of protein, omega-3s, vitamins, minerals, fiber, calcium, iron and bioactive substances, and are called medical food of the 21$^{st}$ century.
- ✓ Provides valuable source of raw material for industries like health food, medicines, pharmaceuticals, textiles, fertilizers and animal feed.
- ✓ Used for production of Agar, Alginates and Carrageenan. Chemicals from brown seaweeds such as alginic acid, mannitol, laminarin, fucoidin and iodine are extracted on a commercial basis.
- ✓ Seaweeds are exported either in **raw form** (fresh or dried seaweeds) or **processed form.**
- ✓ A soluble fiber from red seaweed, **carrageenan** is used as a food stabilizer in organic foods, and it is a natural healthy food additive, replacing sugar or salt. It can even be used to produce vegan and kosher dietary supplements, such as fish oil, which we take for plenty of health benefits like supporting a healthy heart and brain.

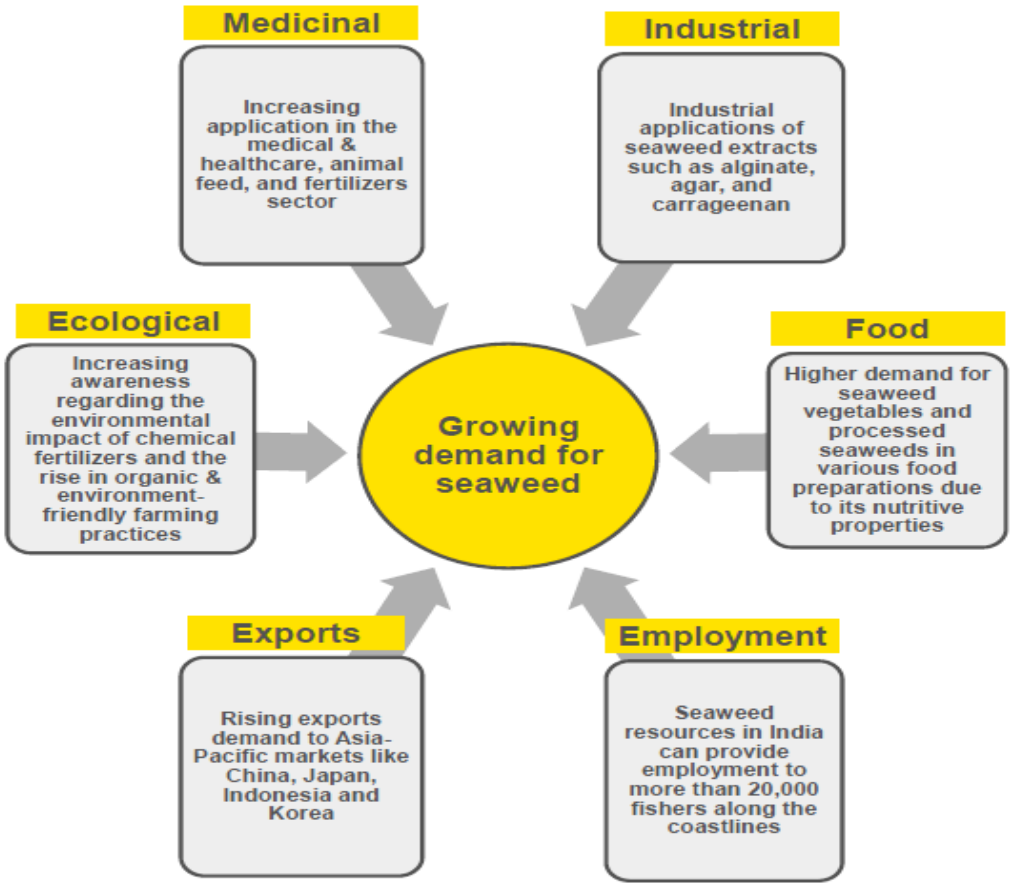
- ✓ **Agar** (Agar can be a vegetarian substitute for gelatin, a thickener for soups, in fruit preserves, ice cream and other desserts, as a clarifying agent in brewing and for sizing paper and fabrics), **Algin** (Algin is used to make medicines), **Sodium Alginate** (used in many industries including food, animal food, fertilizers, textile printing and pharmaceuticals) can be produced from seaweed.
- ✓ Seaweed also can produce **Biostimulants** and benefits of Biostimulants are as follows.
- They can help farmers reduce the use of chemical fertilizers by 25-30 per cent.
- When paired with organic farming, they can improve the yield by 15-20 per cent.
- In the advent of a crop undergoing stress, through a delayed monsoon, for instance, the chances of survival or revival using biostimulants are much higher.
- ✓ Production of **hydrocolloid** – The main uses are thickening and gelling agent. As thickening agent, they find uses in soups, gravies, salad dressing, sauces and toppings while as gelling agents, they are extensively used in products like jam, jelly, marmalade, restructured foods, and low sugar/calories gels.

## SEAWEED PRODUCTION AND AREAS IN INDIA


| Station No. | Area | Annual yield in tonnes (Fresh wt.) |
|---|---|---|
| I | Tamil Nadu | 22,044 |
| II | Gujarat | 20,000 |
| III | Maharashtra | 20,000 |
| IV | Lakshadweep | 8,000 |
| V | Goa | 2,000 |
| VI | Kerala | 1,000 |
| VII | Unexplored areas | 27,000 |
| | **Total** | **100,044** |

*Source: Food and Agriculture Organization of the United Nations*

## NEED FOR EXPANSION OF SEAWEED FARMING

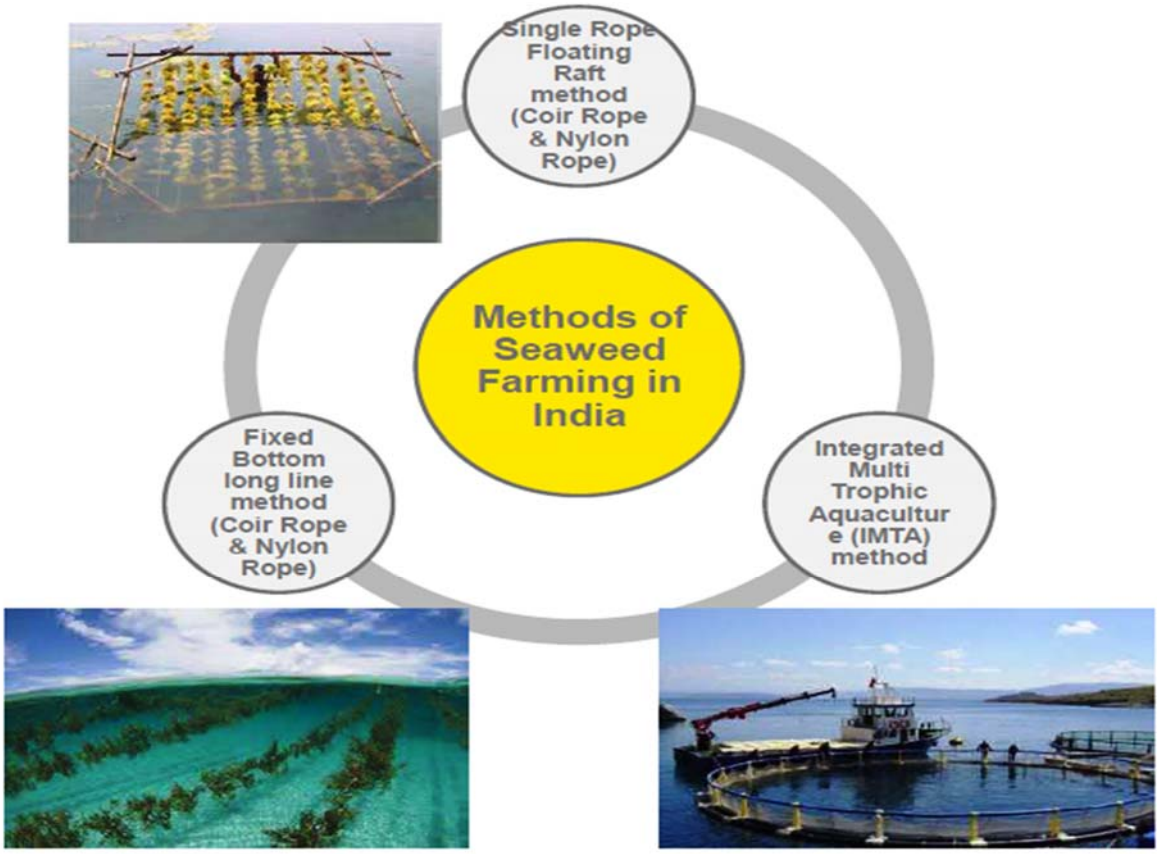



- ✓ Seaweed farming Provides alternative occupation with revenue generation for the coastal people.
- ✓ Culture of seaweed helps to prevent natural collection and conservation /sustenance of natural resources.
- ✓ Seaweed farming involves minimum technological and capital requirements.
- ✓ Grow out periods are short, normally lasting less than two months.
- ✓ Given these unique characteristics, seaweed farming has generated substantial socio-economic benefits to marginalized coastal communities.
- ✓ Supplies raw material for seaweed-based industry and has the potential to generate further socio-economic benefits to coastal communities in tropical regions.

## GROWTH DRIVERS

Application of seaweeds in human food, animal feed, pharmaceuticals, agriculture, cosmetics, production of bio-fuel, and wastewater management has been important for the growth of the commercial seaweeds market.

## METHODS OF SEAWEED FARMING IN INDIA




## PROCESS OF CULTIVATION

**Single Rope Floating Raft (SRFR) method developed by CSMCRI**

| |
|---|
| Single Rope Floating Raft (SRFR) method developed by CSMCRI is suitable for culturing seaweeds in wide area and greater depth. |
| ↓ |
| A long polypropylene rope of 10 mm diameter is attached to 2 wooden stakes with 2 synthetic fiber anchor cables and kept afloat with synthetic floats. The length of the cable is twice the depth of the sea (3 to 4 m). |
| ↓ |
| Each raft is kept afloat by means of 25-30 floats. |
| ↓ |
| The cultivation rope (1 m long x 6 m diameter polypropylene) is hung with the floating rope. A stone is attached to the lower end of the cultivation rope to keep it in a vertical position. |
| ↓ |
| Generally 10 fragments of Gracilaria edulis are inserted on each rope. The distance between two rafts is kept at 2 m. |
| ↓ |
| Floating raft technology has been recommended to be used in certain areas in the Gulf of Kutch for deep-water seaweed cultivation |

## ACTIVITIES OF SEAWEED CULTURE


RAFT PREPARATION


TYING GRAFT SEAWEEDS


MOVING THE RAFT TO SEA


SECURING THE RAFTS


CULTURE IN PROGRESS


SAMPLING FOR GROWTH


HARVESTED RAFT


WET SEAWEED


SUN DRYING OF SEAWEED

**CULTURE ECONOMICS OF SEAWEED FARMING (RAFT CULTURE - Kappaphycus spp)**

The Kudumbam (family) model of cultivation (KMC) is a farming system initially introduced by PepsiCo and then widely adopted for Kappaphycus culture in Tamil Nadu. Cultivation is organized by members of a SHG who normally belong to the same family but may include other members from the same community. Collectively, the group prepares the rafts, seeds the lines, provides maintenance and harvests on the due date. Basic infrastructure is facilitated by the company, the harvest is purchased on a buyback basis and payments are effected by the company through the bank accounts of the SHG.

### Total cost for seaweed culture for 5 members

| S.No. | Description | Amount |
|---|---|---|
| 1 | No. of Cooperative member / SHG-SIZE | 5 |
| 2 | Cost of one Raft (Rs.) | 1500 |
| 3 | No. of Raft per member | 45 |
| 4 | Total No of raft for 5 members (5x45) | 225 |
| 5 | Total cost for 225 rafts (225xRs1500) | 337500 |
| 6 | **Total cost (Rs.)** | **337500** |

**Cultivation operation for 5 member group**

| S.No | Description | Amount |
|---|---|---|
| 1 | Total no. of rafts | 225 |
| 2 | Harvesting period (Days) | 45 |
| 3 | No. of rafts handling per day | 5 |
| 4 | Total seaweed after harvest from 5 rafts (Kg) @ 260kg/raft | 1300 |
| 5 | Total seed required for re-plantation of 5 rafts @ 60 kg/raft (in kg) | 300 |
| 6 | Net produce from 5 raft deducting seed / day ( in kg) | 1000 |
| 7 | Dry weed obtained from 1000 kg of fresh weed (10:1 Dry ratio) ( in kg) | 100 |
| 8 | Dry weed produce in a month (100 X 25 days operation) (in kg) | 2500 |

**Monthly income of a 5-member group**

| S.No | Description | Rs |
|---|---|---|
| 1 | Cost of one kg dry weed (Rs) | 38 |
| 2 | Gross monthly income / group (2500 kg XRs. 27.5/-) | 95000 |
| 3 | Loan repayment-monthly EMI/GROUP ( Rs 1900x5 members) inRs | 9500.00 |
| 4 | Net monthly income / group (Rs 95000-Rs 9500) | 85500 |
| 5 | **Net monthly income / member (Rs.85,500/5)** | **17100** |

- Earlier, the fisherwomen gets Rs.5000/-month as income thorugh natural seaweed collection. After seaweed cultivation each fisherwomen are getting on average Rs.17,100/month.

## STATUTORY REQUIREMENTS FOR CULTIVATION AND COMMERCIAL UTILIZATION

Biological Diversity Act, 2002 regulates the access to biological resources which includes seaweed for purpose of research/ commercial utilization and thus, users' needs to seek prior approval of National Biodiversity Authority (NBA)/State Biodiversity Board (SBB) as per section 3 /section 7 of the Biodiversity (BD) Act, as the case may be. Cultivation of seaweeds do not fall within the ambit of Biological Diversity Act, 2002.

## CHALLENGES IN SEAWEED CULTIVATION IN INDIA

- ✓ In India, seaweeds are mainly used for extracting phycocolloids and the high cost of pond-produced seaweeds may not be profitable unless the harvested seaweeds are processed for multiple products e.g. biofuel, bio-stimulants, food, cosmetics and pharmaceuticals Seaweed growers are receiving minimal prices for their harvested seaweeds due to their sale to cottage-level industries for indigenous phycocolloid extraction.

- ✓ Seasonal dependency of Indian seaweed culture represents a crucial challenge needing to be overcome. Monsoon (Southwest and Northeast monsoon) periods in India are associated with occasional occurrence of cyclones and typhoons and create high seawater turbulence and high tidal fluctuations.

- ✓ A major portion of the Indian coastline is exposed to the open sea and has high tidal amplitudes. Hence, R & D efforts needs to develop culture systems which can withstand high water dynamics in open water areas.

- ✓ Seaweed farming in India revolves around only *Kappaphycus sp. And there is s*carcity of quality seed material for *Kappaphycus* cultivation in coastal areas and scarcity of quality seed materials of native species such as *Gracilariadura*, *Gracilariadebilis*especially after monsoon rains.

- ✓ Limited extension services: Training and workshops and extension material for Seaweed Cultivation is not readily available making it hard to train personnel in this field. Intensive education to empower rural households to increase duck production is limited.

- ✓ Marketing constraint: Lack of awareness and information makes the Seaweed Cultivators/ farmers depend on middlemen for the marketing of raw material.

- ✓ Financial constraint: Institutional Financial support is hard to avail in Seaweed Cultivation.

- ✓ Other challenges in seaweed farming affecting crop productivity and quality are crop health issues such as high temperature impacts, diseases, epibionts and grazing pressures which rely on R&D efforts to reduce or eliminate.

## KEY MANUFACTURER/EXPORTERS/WHOLESALE SUPPLIERS IN INDIA

| | |
|---|---|
| ✓ Sri Lingeshwar Andavar (SHG). | ✓ Aushadh Agri Science (P) Ltd. |
| ✓ Aquagri Processing (P) Ltd. | ✓ Sikko Industries Ltd. |
| ✓ Pssgt Export (P) Ltd. | ✓ Migrow Agro Products (P) Ltd. |

| | |
|---|---|
| ✓ Parshv Chem. Industries.<br>✓ Mars Petcare Company (p) Ltd.<br>✓ Suboneyo Chemicals Pharmaceuticals (P) Ltd.<br>✓ Redox Industries Limited Darshan Bio Tech (P) Ltd. | ✓ Blue Clouds International Ltd.<br>✓ United Agro Chemicals (P) Ltd.<br>✓ Pruthvidhara Crop Care (P) Ltd.<br>✓ Gujarat Livelihood Promotion Company (GLPC) |

## POTENTIAL COLLABORATION OPPORTUNITIES

Potential collaboration can be among value chain players, credit linkage organization (NCDC), technical organization, cooperatives of fishing communities (primary / federations /self help groups) and Government bodies.

## MAJOR INITIATIVE BY GOVERNMENT OF INDIA : Pradhan Matri Matsya Sampada Yojana

Foreseeing the immense potential of seaweed of seaweed cultivation and byproduct Industry in India, the Pradhan Matri Matsya Sampada Yojana (PMMSY) has put forth a number of components under its various schemes for the development of Seaweed farming in the country with a total investment of **Rs 640 Crores** which is expected to deliver direct and indirect employment to about 10 lakh for next five years (2020-21 to 2024-25), mainly as subsidy support people in the initial stage.

Under PMMSY, seaweed farming will be promoted in a mission mode and supported through financial, marketing and logistical support to ensure income and welfare gains to small fisher population especially women and fisherwomen headed households. Seaweed seed banks, nurseries, tissue culture units, processing and marketing units, etc. would be supported. The mission Seaweed Culture integrates the following major components.

### i. Genetic improvement programmes and Nucleus Breeding Centers

Under the central sector scheme sub-components of 'Genetic improvement programmes and Nucleus Breeding Centers (NBCs) of the PMMSY, genetic improvement programmes for seaweeds will also be supported with 100% central funding.

### ii. Fish data collection, fishers' survey and strengthening of fisheries database

PMMSY envisages strengthening of fisheries database which includes survey and regular census of inland and marine fishermen, resource/fish stock assessment (including seaweeds), with 100% central assistance.

### iii. Development of seaweed cultivation

Under the centrally sponsored Beneficiary oriented sub-component of (PMMSY):'Development of marine fisheries including Mari-culture and seaweed cultivation', the following activities will be supported.

a) Establishment of Seaweed culture rafts including inputs (per raft).

b) Establishment of Seaweed culture with Monoline/tube net Method including inputs (one unit is approximately equal to 15 ropes of 25 m length)

For establishment of Seaweed culture (including inputs), for raft method, financial assistance of Rs.15000 per raft with central share/subsidy of 40% i.e.Rs.6,000 for General category and 60% i.e.Rs.9,000 for ST/ST/Women beneficiary would be provided and for monocline/tube net method, financial assistance of Rs.8000 per raft with central share/subsidy of 40% i.e.Rs.3200 for General category and 60% i.e.Rs.4800 for ST/ST/Women beneficiary would be provided under this scheme.

### iv. Establishment of Brood Banks/ seed banks for seaweeds)

Under the centrally sponsored non-beneficiary oriented sub-component of (PMMSY): 'Enhancement of fish production and productivity', Establishment of Brood Banks/ seed banks for seaweeds may be supported.

## INCENTIVES by NATIONAL FISHERIES DEVELPMENT BOARD (NFDB)

Analyzing the importance of seaweed prospects, a Parliamentary Consultative Committee of the Ministry of Agriculture & Farmers Welfare on **"Marine Fisheries-Mari culture in India"** was conducted on July 2nd 2018 at Rameshwaram which was convened by the Government of India in coordination with the Tamil Nadu State Fisheries Department.

Consequent to this meet, an exclusive project proposal on "Large scale cultivation of sea weeds in coastal areas of Ramanathapuram District in Tamil Nadu" requesting at a total project cost of 200 lakhs and Rs.25.50 lakhs towards training of 1500 fisher women was sent to National Fisheries Development Board (NFDB). So far, NFDB has released Rs.36.00 lakh as first instalment out of 60% share and the state Government has sanctioned Rs.18.00 lakh out of 30% share. Till yet, 750 fisherwomen were provided hands on training on seaweed culture (Kappaphycus 550 and Gracilaria 200) with the coordination of Central Salt Marine Chemical Research Institute (CSMCRI). The trained beneficiaries were formed into 170 clusters and cultures are in progress. Currently 6800 rafts (2400 rafts for *Gracillaria edulis* and 4400 rafts for *Kappaphycus sp)* have been provided to the fisherwomen.

Production of 18 tonnes of *Gracillaria edullis* and 268 tonnes of *Kappaphycus sp* have been achieved.

## OBJECTIVES OF THE INTERNATIONAL WEBINAR

The overarching goal of the proposed workshop on 'ENTREPRENEURSHIP DEVELOPMENT THROUGH SEAWEED BUSINESS BY COOPERATIVES' is to bring various stakeholders on one stage and to work towards forging alliances among stake holders for promotion of entrepreneurship in seaweed business through cooperatives. At the same time, the webinar will identify bottlenecks at various levels and will aim at evolving options. The key beneficiaries of this webinar are: Seaweed farmers, budding entrepreneurs, youth, women and vulnerable communities. The webinar also aims at augmenting awareness about Seaweed farming as a business and to come up with an actionable, time bound plan which will contribute towards attaining '*Atmanirbhar Bharat'*. Specifically, webinar aims at developing models of commercial Seaweed Farming through cooperatives.

The proposed outline of the 150 minutes long workshop on remote video mode can be as follows:

A. Inaugural : 10 minutes

B. Business Sessions : 90 minutes

i. Seaweed Farming: Indian scenario
ii. Seaweed Business: International perspectives
iii. Seaweed Business: Private sector players
iv. Role of Collectives (Cooperatives, Self Help Groups and others)

C. Experience sharing : 20 minutes

D. Way forward : 30 minutes

## EXPECTED PARTICIPATION

Cooperative Societies/Federation entrepreneurs, Seaweed cultivators, Private sector businesses, Government, youth, fisherwomen, vulnerable communities, scientists, technocrats, policy makers, processors, sellers, subject matter experts, academicians, supply chain players, development finance institutions, quality control institutions and the media & other stakeholders.

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