Technology Fact Sheet for Adaptation

Floating Mariculture Systems for Sea Weed Farming [i]

Floating Mariculture Systems for Sea Weed Farming

Sector: Coastal

- **Technology characteristics**

1. **Introduction to establishment of floating mariculture systems for sea weed farming**

A reduction in coastal land due to inundation from sea level rise is expected and it will affect the land based agriculture. In addition to the above sea level rise may cause salt water intrusion in to fresh water and reduce the availability of fresh water for aquaculture. As an adaptation to the above, marine and coastal lagoons and bays with the required salinity should be used for aquaculture.

Seaweed farming is a profitable coastal activity which will help to improve the socio-economic standard of coastal communities. It can be introduced as an alternative livelihood activity for coastal communities involve in coral mining & ornamental fish collection, which are currently causing harmful impacts to sensitive coastal ecosystems. This is a farming system which does not need the addition of fertilizers or nutrients as they are freely available in nature. This industry can attract foreign exchange to the country, which will improve the county's economy.

Globally there are over 9,000 species of seaweed divided into three major types;green-6000 species, brown -2000 species and Red 1200. Like land plants, all seaweeds depend on light for growth, so they only occupy the intertidal area or relatively shallow photic (light penetrating) zone. Green seaweeds tend to be found towards the top of the shore, browns from the top to deeper waters, and, since they are adapted to photosynthesise at lower lights levels, red seaweeds tend to dominate the deeper, darker waters and also beneath kelp canopies and in shady rockpools. Seaweed is harvested throughout the world as a food source as well as an export commodity for the production of agar & carageenan products.

Seaweeds have been traditionally cultured for decades and probably for centuries in several Asian nationssuch as China, Korea & Japan. Until 1980s seaweed production in other nations in the Asia has been from wild stocks, although limited culture took place in nations such as Philippines & Indonesia.Species harvested include varieties of *Euchema (Kappaphycus), Gracillaria & Porphyra,* among others. Exports of seaweeds from Philippines increased from - 675 MT in 1967 to 28,000MT MT in 1985. Between 1984 & 1991 production of seaweed increased in Indonesia from 9,100 MT to 19,000MT to which *Eucheuma* contributed 78%. *Eucheuma* was & remains a major component of seaweed export from these countries.

As early as 1970s, it was recognised that demand for seaweed & seaweed products was much higher than the supply & cultivation was viewed as the best means to increase production. Growth in demand encouraged research & development of culture methods & to address problems in the industry such as poor quality & fluctuating prices.

The profitable nature of seaweed farming also became evident & accelerated its expansion.

Sea weeds are important as a source of agar and alginates such as Carrageenan (A chemical categorised as gums)for a range of products including ice cream, yoghurt, pet food, Beauty treatments (as an ingredient in facial & body lotions, in moisturizers, in seaweed baths, as a health supplement, in tooth paste, etc. It is also used in preparation of drugs, in agriculture and horticulture as an organic fertiliser and a soil dressing.

Cutrrently sea weeds are cultured in Sri Lanka as a small scale project and at University the University of Ruhuna Sea weed (*Euchema & Gracilaria*)farming was successfully carried out successfully in floating cages.

2.1.2 Technology Characteristics/Highlights

Light floating cages (2.0x1.0x1.0m^2) should constructed with a PVC tube frames and plastic mesh could be used for sea weed culture (Plate 1). Propagules of sea weed should be tiedto lines fixed to the inside frame of the frame. After that they should be anchored in the shore coastal waters with a water depth of at least 3 meters. Sea weeds would grow to fill the whole cage. Plate 1 Culture should be carried out when the calm conditions prevail in the coastal belt. Coastal bays and the eeastern coast of Sri Lanka are suitable for sea weed farming

Plate 1: Cage used for culturing sea weed Pk\left) with propagules tied to lines in side the cage

Plate 2: Deploying the cages using a canoe (Left) and the floating cage filled with sea weeds grown out of the cage (middle & right)

2.1 Institutional/ organisational requirements

- National Aquaculture Development Authority should take an initiative to introduce sea weed culture to coastal bays and the eastern coast of Sri Lanka.
- Universities and research institutes should carry out research to
    - develop culture methods
    - reduce the cost for production of cages with a material which can stand the energy of sea waves.

3 Operations and maintenance

3.1 Endorsement by experts

Ministry of Fisheries and Aquatic Resurces Development has identified them as priority area

3.2 Adequacy for current climate

- Sea weeds are being farmed
- Tuna & Grouper are available around Sri Lanka

3.3 Size of the beneficiary group

- All person involve in Aquaculture
- Industries using sea-weed products
- All consumers of fish
- Government due to attraction of foreign exchange

4 Costs

4.1Cost to implement adaptation options

Activity	cost	
	Unit cost (US $)	Total cost (US $)
Field surveys to decide the suitable sites (duration 6 months)		8,000
Training workshops 10 Nos		40,000

Material for construction of cages/ha	75/m²	750,000
Supply of propagules		5,000
Allowances for persons (5) involved in construction of cages,trasplanting, maintenance & harvesting 3 years		60,000
Transport & other miscellaneous costs		25,000
Contingencies		42,000
Total cost for three years considering the life time of cages to be three years		930,000/ha/3years
Total cost for 1 year	31/m²	310,000/ha

4.1 Additional costs to implement adaptation option, compared to "business as usual"

- Every three years cages will have to be replaced
- During the 2nd and third years propagules could be obtained from the harvest gained every year but it is advisable to obtain new propagules every three years to maintain the quality of sea weeds produced.

5 Development impacts , indirect benefits

5.1 Economic benefits

- Employment :
  - Provide self employment opportunities to coastal communities during the periods when calm sea is prevailing
- Investment :
  - Since this industry will reduce the cost on the imports of dried sea weeds & Carrageenan to Sri Lanaka and there is a potential to establish an export market, which will contribute to the GDP of the country

5.2 Social benefits :

- Income :
  1. It given an additional income to coastal communities three months after the culture cycle is commenced
  2. During the culture trials fisherman in the area reported about the presence of larg aggregates of fish around the tank and they have been harvesting them
  3. Inside the cages certain species of ornamental fish (*Abudufdef* sp) were observed and they were not harmful to the sea weeds but the cages provided them shelter from the predators. This shows that ornamental fish collectors could use this as a device to rear marine ornamental fish which are not feeding on sea weeds and it will provide them with an additional income.

- **Education**
    1. They can obtain a training on how to culture sea weeds, dry them & prepare them for export market
    2. Those who can invest on equipment necessary for extraction of Agar and carrageenan can obtain a training on the extraction techniques and on the industries where these extracted material is used (Confectionary industry, cosmetic industry, etc.)
- **Health:**
    1. Carageenan is used in ice-cream and other products in place of milk and it is good for persons who have problems with cholesterol
    2. Increased income to coastal communities will help to maintain their nutritional standards at a higher level

5.3 Environmental benefits

- Sea weed culture does nor need any inputs such as fertilizer that can pollute the environment
- Sea weeds use the CO_2 in water and will help the reduction of GHG release
- During the experimental trials, fisherman indicated that the fish harvests near the cages increased.
- There were certain species of ornamental fish (*Abudufdef* sp) which were growing inside the mesh cages and they were not harming the sea weeds. Therefore enhancement of biodiversity also was evident

6 Local context

6.1 Opportunities & Barriers

- **Opportunities**
    - Where ever calm sea is prevailing and the water depth is around 3 m this culture method could be adopted
    - This is applicable mainly to eastern coast of Sri Lanka and the bays and sheltered areas in the western & southern coastal belt are also suitable.
    - 2 to 3 month culture cycle is sufficient to get a good harvest.
    - Currently cream biscuit manufacturing companies are importing dry sea weed and carrageenan from far east countries & if local supplies are available money spent on imports could be reduced and if there are excess productions export market also could be developed

- Carrageenan could be used for cosmetics, confectionaries, tooth paste, etc. and agar could be used in place of gelatine

- **Barriers:**
  - Rough sea prevailing during the monsoon periods are not suitable for this culture programme and therefore inter monsoonal calm sea period could be used for this programme
  - Open farms cannot be used in the vicinity of reefs because certain reef fish such as Parrot fish are feeding voraciously on sea weeds
  - Cages have to be brought to the shore during rough sea conditions to prevent damage to them
  - High initial cost for construction of cages
  - Poaching

6.2 Status:

- Sea weed culture is currently practiced by certain biscuit manufacturing companies (Munchi Biscuit Company) and National Aquatic Resources Development Authority
- Faculty of Fisheries and Marine sciences & Technology of University of Ruhuna also had a trial on cultured *Euchema* & *Gracillaria* in cages at Weligama and it resulted in a high growth within 2 to 3 months.

Time frame

	Year 1 divided to 4 quarters				Tear 2 divided to 4 quarters			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Survey for selection of sites	X							
Awareness/training		X						
Preparation of transplant material			X	X				
Transplanting/monitoring					X	X	X	
Evaluation of success							X	X

6.3 Acceptability to local stake holders:

7 References

- Linham, Mathews M. & Robert J. Nicholls((2010). Technologies for Climate Change Adaptation –Coasta Erosion & Flooding- (Xaanil Zhu ed.). UNEP Riso Centre, University of Southhampton. ISBN978-87550-3855-4
- FAO Mannual for Sea weed farming

[i] **This fact sheet has been extracted from TNA Report – Technology Needs Assessment Reports For Climate Change Adaptation – Sir Lanka. You can access the complete report from the TNA project website http://tech-action.org/**