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The need for a systems approach to the development of the coastal agroecosystems in the Gulf of Mannar area

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Introduction

The Gulf of Mannar is bordered by Ramanathapuram, Thoothukudi, Thirunelveli and Kanyakumari districts. Most of this coast is dry, and experiences only limited rainfall during the northeast monsoon. The mainstay of the population is comprised by marine fisherfolks, marginal farmers and landless labourers. Marine fish production has already reached its peak, and there is little scope for the expansion of capture fisheries. No large - scale agricultural farming is possible because of the limited irrigation potential. Agricultural operations essentially comprise seasonal millet and paddy cultivation and sheep rearing. The coastal terrain is saline and / or alkaline, and infested with xerophytic small trees belonging mainly to *Acacia* and *Prosopis juliflora.*

Against this background, a systems approach is suggested here to tap the existing natural resources (both marine and land) with the help of modern farming technologies to ameliorate the livelihood of the coastal communities of this region.

Integrated coastal mari-culture and seafarming

A large number of coastal shrimp farms and hatcheries came into existence along the Gulf of Mannar coast since 1990. Most of these farms were of smaller size ranging from 2 to 5 ha area. The larger farms invariably and operated a hatchery also. Significant among the larger complexes of farms hatcheries were SPIC, Minota Aqua, Victory, MIL and Gem group. All these larger farms and some of the smaller farms have closed their operations because of the combined effects of legal interventions, social opposition, whitespot disease problem and formation of acid sulphates in the farm ponds.

Service agancies belonging to the Central and State sectors could not do much to reverse the process and restore the farms to sustainable levels. As a result, the enormous capital invested in this sector is remaining idle. The substantial employment potential created by the sector could not accrue to the coastal poor. It has been realized that the only viable alternative to coastal shrimp monoculture is to introduce and popularize polyculture by integrating pearl oyster, seaweeds and seacucumber with shrimp in farm ponds with a bottom lining of silpaulin and sealing the inner surface of the pond dykes with biocrete (a mixture of cement, sand and powdered coconut husk pith).

While silpaulin and biocrete prevent acidification of pyrites in coastal soils, pearl oyster, seaweeds and seacucumber utilize effectively the wastes released by the shrimp stock in the ponds. The regime of feeding the shrimp stock and water quality management generally followed in shrimp monoculture should continue to be followed in this polyculture, with suitable modifications, appropriate to the integrated components.

In order to demonstrate this new package of practice to the defund and / or problem farms, the 5 ha research farm of the Mandapam Regional Centre of the Central Marine Fisheries Research Institute (MRC of CMFRI) at Mandapam Camp was developed into a model polyculture farm. This farm, which is now running very successfully, may take up onfarm trials throughout the Gulf of Mannar coast to popularize the polyculture technology on a mission-mode approach. The Department of Fisheries (Government of Tamilnadu) and the Marine Products Export Development Authority (MPEDA) should come forward to join the efforts of the CMFRI to take up this programme without any further delay. The industry is both ignorant and oblivious to the polyculture package developed by the CMFRI at Mandapam Camp. Invitations were sent to all the shrimp farm owners throughout the country for their participation in the National Symposium on 'Eco-friendly Mariculture Technology Packages - An Update' being held at the MRC at Mandapam Camp on the 25th and 26thApril, 2000, but the response has been so poor.

In a detailed study conducted by the CMFRI, Kochi, in September - October, 1998, it has been found that 45,537 of the 76,596 artisanal non-motorized boats, 34,925 of the 50,922 artisanal motorized boats and 28,144 of the 49,070 mechanized boats are surplus, and hence, are economically unproductive. A new system has been designed by this author for the conversion of the surplus boats into floating, mobile, motorized seafarms in phases. It is made by rigging four artisanal boats of the same size into two pairs and connecting the two pairs by a series of alternative wooden planks and metallic rods. The planks serve as bridges for the movement of men and materials, while the rods are meant for hanging ropes (rens) seeded with the selected candidate species (e.g.) pearl oyster, mussel and seaweed. The outer boats of each pair can be properly roofed for storing materials and for the crew to stay. Each unit is powered with two outboard engines of suitable horsepower depending on the size of the unit. Since the hanging rens serve as fish aggregating devices, fishing should be undertaken daily using low energy gears like traps, jigs and hooks & lines. A carrier boat has to be deployed for bringing supplies to the seafarm and taking the catches ashore. The MRC of CMFRI may construct this model seafarming-cum-fish aggregating-cum-seafishing platform and run it as one of its frontline activities and simultaneously undertake training of fisherfolks on this new venture.

Overfishing has resulted in the decline of many of the demersal fish stocks in the Indian seas, especially during the last one to one-and-a-half decade. Uncontrolled bottom trawling has caused considerable damage to the precious benthic habitats. In order to build new benthic habitats, which could facilitate colonisation by a large number of marine organisms, both flora and fauna, ranging from the algae to apex carnivores, a scheme of artificial reefs has been introduced by the Government of India since the Seventh Five Year Plan onwards. However, only 32 reefs in the extreme southwestern coast (Thiruvananthapuram and Kanyakumari districts) 2 reefs in the Gulf of Mannar (Thoothukudi district) and 2 reefs in the Chennai coast (Chengalpet district) have been installed so far, Gujarat, Maharashtra, Andhra Pradesh and Orissa states have initiated some steps in this regard, but no significant development has taken place so far.

The CMFRI has developed standard designs of artificial reef, and has helped the Government of Kerala over the last one decade in the creation, installation and operation of these reefs successfully as community reefs. Based on this experience, the MRC of CMFRI, Mandapam Camp, may create a standard artificial reef complex at an appropriate depth in the immediate vicinity of its research

facilities and undertake regular fishing jointly with the fisherfolks of the neighbouring villages in order to popularize this practice among them. The necessary funding may be obtained from the Ministry of Agriculture through the Department of Fisheries of the Government of Tamil Nadu. The floating, mobile seafarm described above can operate from above this artificial reef or independently of it any ground where optimum conditions prevail.

There are in all 13 regional research centers and 28 Field Centres under the CMFRI located along the Indian Coastline. The integrated coastal onshore polyculture and seafarming together with a system of artificial reef complexes proposed in this article to be developed by the MRC of CMFRI, for the Gulf of Mannar coastal agroecosystem can be replicated in the country's entire coastal ecosystem through the above institutional network and the various state fisheries departments in phases through the successive five year plans. Following the success of India's Fish Farmers' Development Agencies (FFDAs) in the freshwater aquaculture sector, it is important to create Sea Farmers' Development Agencies (SFDAs) for every coastal district in the country to bring about rapid development changes in the seafarming sector in the country, along the lines proposed in this article.

Intergrated inland farming system

In spite of a highly arid climate and low rainfall, the coastal districts of Gulf of Mannar offer ample opportunities for integrated inland farming of various agricultural, livestock and fish crops. In developing such systems, the local natural resources of plant, animal and fish species need to be taken into consideration. Irrigation is very crucial in the development of farming systems, and therefore, the initial focus should be on locations where proper irrigation could be source. Where there is fairly good groundwater potential, one of the best low-cost options would seem to be the farming of small ruminants (sheep and goat) by the small households and on a large-scale. The required fodder grass, fodder trees and fodder grains can be developed in farms, the extent of which will depend on the irrigation potential of the aquifer. These farms may be declared as community farms, where individual households will be given independent plots to raise the required fodder for their small household flocks to supplement natural grazing during day time. The irrigational infrastructure development is the responsibility of the Government, while the households are responsible for the proper maintenance of their fodder plots. Goat and Sheep Farmer Development Agencies (GSFDAs) under the Chairmanship of the District Collector can be thought of as an Institution for the promotion of this venture, which has immense potential for rural employment and income generation.

Many such low-cost options could be identified depending on local situations, opportunities and resources. In locations where the groundwater is brackish and alkaline, and cannot be used for agriculture or domestic purposes, salt and alkali tolerant fodder grass like paragrass ***(Brachiaria mutica)*** and fodder trees like ***Acacia nilotica*** could be grown with proper gypsum application, rather profusely, to sustain goat and sheet farms. In fact, if there exists good supply of such water from the subsurface aquifer, shrimp culture could be integrated very profitably in this system by storing the water in farm ponds before irrigating the fodder plots. The sprawling institutional campus of over 100 acres in the MRC of CMFRI, Mandapam Camp seems ideal enough to take up this model development with inputs from the District Collector and the Departments of Rural Development, Animal Husbandry, Fisheries, Agriculture and forest of the Central and State Governments.

Govenment institutions in India are generally tuned to specific tracts as per their defined mandates. Where necessary, these

institutions need to be re-oriented to take up community tasks, which function essentially on a systems approach. Development agencies can be the best institutional model at the District level where all specialist institutions (both development and research categories) can contribute to the emergence of farming systems in the coastal agroecosystems in thecountry.