Framework for Mariculture Water Lease Policy in India

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INTRODUCTION

Globally, coastal aquaculture is one of the fastest growing food sector industries. The production from coastal ecosystem through farming, which was less than 0.5 million tonnes in 1950, increased to 10 million tonnes in 1990 and to 36 million tonnes by 2007 (FAO, 2009). Currently nearly 106 nations are involved in farming marine organisms. During the last six and half decades, the potential of aquaculture for food production and the alleviation of poverty of the people living in coastal areas, many of whom are among the poorest in the world, were widely recognized and legal policies were drafted in many countries and implemented to support the farmers.

In India, traditionally, brackish water fishes and shrimps are farmed in coastal tide-fed ponds by simple extensive system of farming like the *Pokkali* farms of Kerala, the *Ghazani* and *Khar* of Karnataka and fish farms (*Bheries*) of West Bengal. Though these simple farming practices are still in vogue, modern methods of aquaculture have been adopted in almost all maritime states. Semi-intensive farming of shrimps, farming of green mussels and oysters, fattening of lobsters and crabs, finfish farming, seaweed farming, semi-culture of clams have increased the production through aquaculture in coastal ecosystems. The total production (excluding seaweeds) has increased from 3868 tonnes in 1980 to 197,339 tonnes in 2008. This phenomenal increase in production indicates the magnitude of utilization of water resources for costal aquaculture and mariculture.

In spite of these fast paced developments a policy support to govern the mariculture development in a sustainable manner has not been made in the country. As land based aquaculture is generally undertaken on private land and there is generally no substantial use of common property resources, an aquaculture lease is not required. Due to pressure from environmentalists, rules and regulations to make shrimp farming sustainable have been put in place by

the Coastal Aquaculture Authority of India (CAAI) and specific rules have been framed by some maritime states.

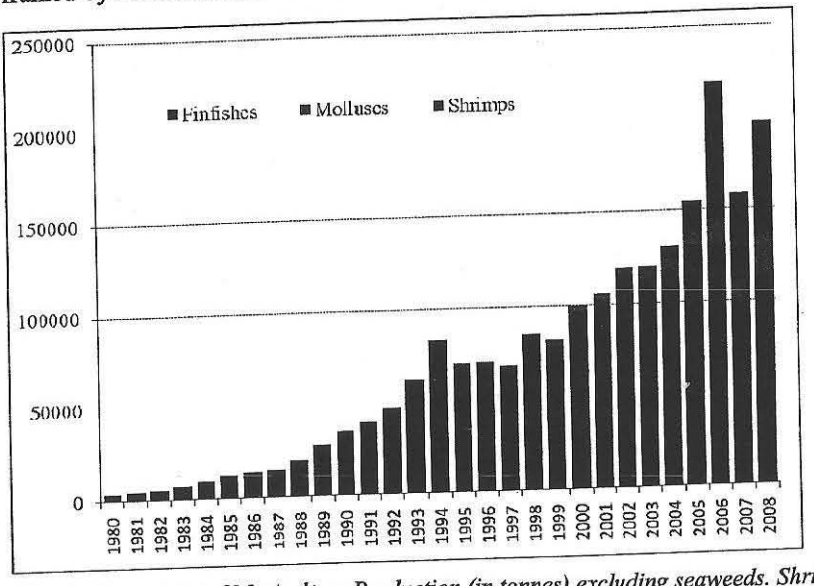

Fig. 1: Time series of Mariculture Production (in tonnes) excluding seaweeds. Shrimps includes mainly tiger shrimps; molluscs include mussels, edible oysters and clams. Data modified from FAO and CMFRI

TYPES OF FARMING SYSTEMS IN COASTAL ECOSYSTEMS

The mariculture activities are diverse, developed and perfected to suit the ecological and biological requirements of the farmed species. The systems range from simple sowing of seeds as in clams to engineered floating off-shore structures for fast moving carnivorous fishes like tunas. The main groups of marine resources which are farmed in India are the crustaceans, finfishes, molluscs, and seaweeds. Molluscs such as clams, oysters, mussels and pearl oysters are mostly sedentary animals hence they are farmed either by on-bottom methods by sowing or from suspended floating structures like the rafts after stocking in small to medium sized cages or semi open containers (trays). Racks or trestles are also widely used in shallow areas to farm molluscs (Table.1).

Table 1. Mariculture farming systems prevalent in India

	Resource	*Location*	*Type of farming*	*Farming status*	*Status regarding lease*
1	Shrimps *Penaeus monodon* *P.indicus, P.semisulcatus,* *Metapenaeus dobsoni,* *M.monoceros*	Intertidal/ subtidal	Land based (ponds)	Commercial	Lease policies exists in some maritime states guided by rules framed by AAI
2	Oysters *Crassostrea madrasensis*	Intertidal/Sub tidal Open waters	Off-bottom (Rack and ren)	Commercial in Kerala	None
3	Mussels *Perna viridis*	Intertidal/Sub tidal Open waters	On bottom, off-bottom (racks, lines, rafts)	Commercial in Kerala	None
4	Pearl oysters *Pinctada fucata* *P.margaritefera*	Bay/lagoons/ Oceanic Open waters	Off bottom (rafts, cages)	Experimental (Commercialization-Transition phase)	None
5	Clams (*Paphia malabaraica* *Villorita cyprinoides*)	Intertidal/Sub tidal Open waters	On-bottom	Semi-commercial in Kerala, Karnataka	None
6	Crabs *Scylla serrata*	Intertidal/ subtidal	Cages/ land based	Commercial fattening	None
7	Lobsters *Panulirus homarus, Thenus orientalis*	Near shore	Land based (Ponds/cages)	Commercial fattening/ Experimental	None
8	Finfishes	Open sea	Sea cages	Experimental	None
		Coastal	Land based ponds, fixed cages	Commercial, experimental	Lease policies exist in some maritime states

Crustaceans like shrimps and crabs are farmed mainly from land-based systems like ponds or impoundments. Finfishes are farmed mostly in land based ponds, and very recently on an experimental level in floating structures like cages which are moored in the near shore areas or in open oceanic waters. Seaweeds are cultured mainly using simple bamboo frames in the Gulf of Mannar and Palk Bay.

LEASING POLICIES FOR COASTAL AQUACULTURE IN INDIA

As per Article 21 of the Indian Constitution the states are empowered to regulate and manage marine fisheries in their territorial waters extending 12 nautical miles off the coastline towards the sea and all maritime states have enacted the Marine Regulations Acts since 1980. The area from 12 nautical miles to 200km in the EEZ comes under the jurisdiction of the Union Government. The provisions made in the 73rd and 74th amendments to the Constitution of India empower the panchayats to perform functions mentioned in the eleventh schedule of the Constitution in 29 subjects including fisheries. However, due to lack of legal clarity this has not been implemented in any panchayat.

The coastal aquaculture leasing policies in India have been drafted mainly for shrimp farming, particularly in Tamilnadu. Tamilnadu also has a draft mariculture policy which states in clause 11.2.7 that mariculture activities are not permitted in estuaries, backwaters, lagoons etc. Such a clause indicates lack of proper understanding of the fledging mariculture industry and needs to be corrected in consultation with research organization and scientists. The Government of Gujarat has enacted a land lease policy for aquaculture according to which an individual is admissible for allotment of 5 ha area, co-operative society for 50 has area while private company is eligible for 100 ha area. Allotment is made by the Revenue Departments authority after approval by various pre-defined aquaculture authorities.

It is now essential that leases (short-term or long term) giving the aquaculturist exclusive rights to occupy the site and to the cultured organisms should be developed. Such leases should be guided by a set of rules and principles relevant to public trust responsibilities (see Table 2) and should specify the size of farm, duration of farming and other terms of lease. Rents thus collected should be used for development of coastal areas.

Table 2. Principles to be considered to frame policy for mariculture lease in open water bodies

	Principle	*Policy Guided by*
1	Common property use conflicts	Use of open water bodies for navigation, fishing should not be hindered by mariculture. Similarly, mariculture activities in open water bodies should not cause disturbances to other users. Further, mariculture when permitted by the state should be afforded complete protection of structure and stock kept in the open water bodies.
2	Carrying capacity	Open water bodies have limits to biological productions and such limits should be defined by the state in consultation with research institutions
3	Environmental protection	The polluter pays principle enacted by the CAAI should be applicable to open water bodies so as to minimize environmental impacts. Pre and post EIA (environmental impact assessment) should also be mandatory.
4	Conservation	Aquatic ecosystems are very sensitive to changes caused by human activities, and hence, all activities should take into consideration conservation of aquatic biodiversity.
5	Zonation	Since mariculture in open water bodies is diverse and region specific, states have to draw-up zonation plans in GIS formats with the help of research institutions. Creation of mariculture parks should be encouraged.

REGISTRATION OF OPEN WATER BODY FARMS

During the last decade several estuaries and backwaters in Kerala with high saline conditions have been used for bivalve farming. The farms which are not registered are small- scale and owned by Self Help Groups or individuals. Moreover, there are no environmental assessments made either prior to farming and after farming. Studies conducted by the Central Marine Fisheries Research Institute (CMFRI), Kochi have indicated that farming bivalve at the same site for more than three years can negatively impact the sediment structure and benthic faunal communities. Since these aquaculture activities are conducted in open waters where there are other common users, the need to legally recognize mariculture has become inevitable. In most nations where mariculture has advanced as a commercial activity, government leasing determines the appropriate areas for mariculture activity, allocating the rights to use the

resource and evaluation of environmental impacts. This also includes attention to the ecosystem of the target areas, the interests of the border community that has traditionally had access to the resource and considers regional and social impacts. The rights of riparian owners in estuaries and backwaters (riparian owner means a shorefront property owner) should be given due recognition by allotting 100 m water area to such interested owners.

ZONATION OF SITES

Table 3. Criteria for classifying edible bivalve harvesting areas as per European Union Directives (Laing and Spencer, 2006)

Class	*Microbial standard*[1]	*Post-harvest treatment*
A	Live bivalve molluscs from these areas must not exceed 230 MPN *E. coli* per 100 g of flesh and intra-valvular liquid[2]	None
B	Live bivalve molluscs from these areas must not exceed the limits of a five tube, three dilution Most Probable Number (MPN) test of 4,600 *E. coli* per 100 g of flesh and intra-valvular liquid[3]	Purification, relaying in class A area or cooking by an approved method
C	Live bivalve molluscs from these areas must not exceed the limits of a five tube, three dilution Most Probable Number (MPN) test of 46,000 *E. coli* per 100 g of flesh and intra-valvular liquid[3]	Relaying for a long period or cooking by an approved method
Prohi bited	>46,000 *E. coli* per 100 g of flesh and intra-valvular liquid[4]	Harvesting not permitted

1. The reference method is given as ISO 16649-3.
2. By cross-reference from Regulation (EC) No 854/2004, via Regulation (EC) No 853/2004, to the Draft Commission Regulation on Microbiological Criteria for Foodstuffs (SANCO 4198/2001, revision 16).
3. From Regulation (EC) No 854/2004.
4. This level is not specifically given in the Regulation but does not comply with classes A, B or C. The competent authority has the power to prohibit any production and harvesting of bivalve molluscs in areas considered unsuitable for health reasons

In the draft mariculture policy of Tamilnadu different zones are demarked. The Core Zone, is an ecologically and strategically sensitive zone in the EEZ where no human or production activity is allowed (Anonymous, 2008). Area around defense establishments and other buildings or facilities of strategic importance

also come under this zone and 'Single use Zone" covers Ports, fishery harbours etc. Finally there are the zones where mariculture activity is permitted. This zone is further classified based on distance from shore. This is an impractical exercise as it is very difficult to earmark zones in the sea.

Prior to commencement of farming, the suitability of the proposed site should be approved and certified by a competent research organization taking into consideration the biological suitability of the location preferably classifying the site as A, B or C as per the classification mainly based on the level of pollution (Table 3).

MODALITIES FOR IMPLEMENTING A LEASE

Once the site is approved, the lease conditions can be drafted based on the farm size, the stocking density and other conditions which will promote sustainable bivalve farming. The forms for registration/leasing can be drafted and these forms can be made available through the local governing bodies. The farmers can submit their requests to the state fisheries departments and after evaluation based on the approval by the competent authority, the farms can be registered. The application by the farmer should contain a description of the location of the proposed lease by corner coordinates or boundaries with coordinates for one starting point, a map of the lease area and its adjoining waters and shorelands, with the names of the known riparian owners as they are listed in the panchayat or State property tax records. A list of the species to be cultivated and a description of the proposed source(s) of organisms to be grown at the site should also be included.

A description of current commercial, navigational and or recreational activities such as eco-tourism occurring in the proposed lease tract and the immediate vicinity of the proposed lease site should be indicated. The description should include type, duration and quantum of activity.

The applicant should provide information regarding the financial resources available to operate and maintain all aspects of the proposed mariculture activities. Each applicant shall submit accurate and complete cost estimates of the planned mariculture activities. The applicant shall submit a resume or other documentation as evidence of technical expertise and capability to implement the proposed project.

Once a decision on the lease is made by the local governing body, registration of the farms should be mandatory. Besides being helpful to determine the level to which carrying capacity has been reached for the region, it would also be helpful to indicate the origin of the farmed production. Currently, traceability of seafood is a necessary part of export of food products to foreign markets.

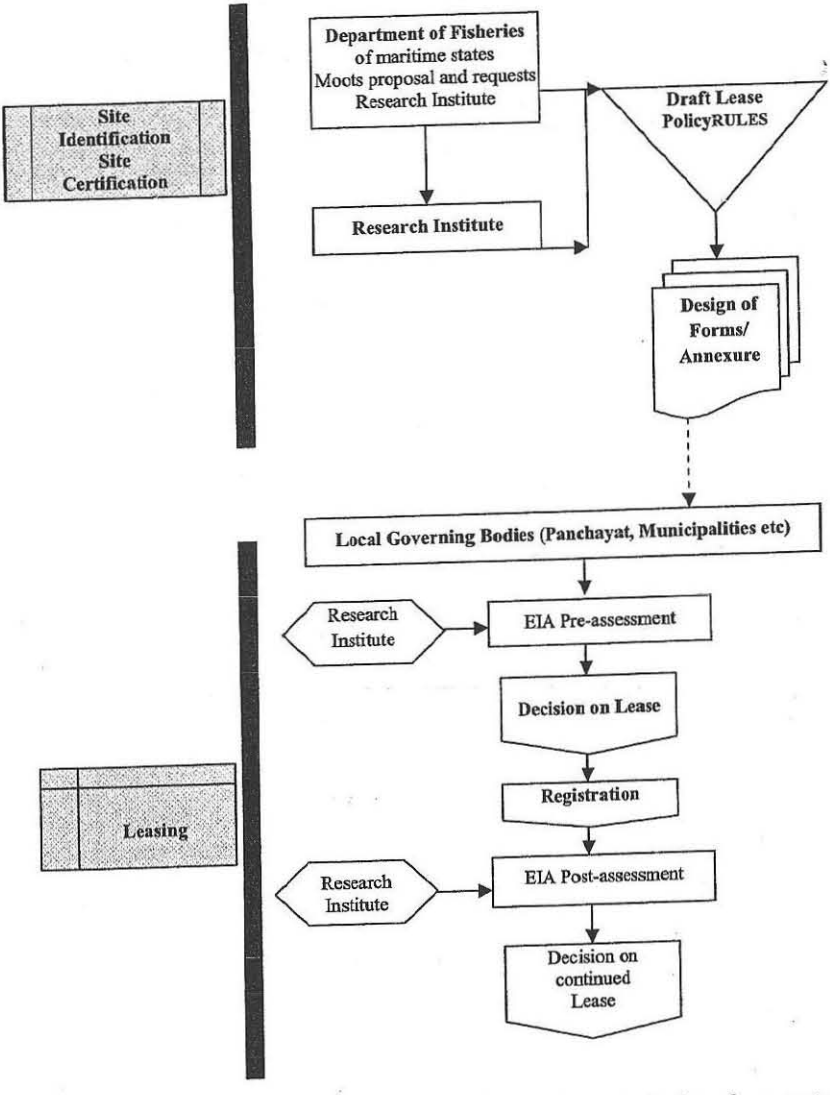

Fig. 2: Flow diagram of steps and activities for developing a mariculture lease system in India

After the farms are registered and prior to stocking, the sediment and benthic faunal assemblage study (Pre stocking EIA) should be done. Similarly, after the farming also similar study should be done and corrective measures taken if negative impacts are identified. Since bivalves are filter-feeders, there is a need

to restrict the number of farms in each estuary. Overstocking can lead to stunted growth which can lead to low productivity. This can also lead to disease outbreaks and ecological disturbances due to increased sedimentation and bio-deposition. Hence it is necessary to estimate the carrying capacity by taking into consideration the water flow, plankton biomass, particulate organic matter and other physic-chemical parameters of the water body. Major steps that should be followed for elucidating a leasing system for open water body farming are given in Fig.2.

POLICY FRAMEWORK

The policy for open water body mariculture in India should be drawn up with the following basic tenets:

1. Encourages responsible open body mariculture in the Indian coastal ecosystems
2. Promotes a decision making process that is transparent, efficient, coordinated and credible with the entire process taking 3-4 weeks
3. Employs a precautionary approach to avoid and minimize environmental impacts and promotes integration into the ecosystem
4. Is consistent with existing Indian laws and Agency responsibilities
5. Is consistent, to the maximum extent possible, with the coastal water environmental and aquaculture policies of adjacent nations; and is also consistent with India's obligation under International agreements
6. Is adaptive, and promotes opportunities for innovation, data collection and continual learning.

CREATION OF MARICULTURE PARKS

Certain mariculture practices like the pearl culture and cage farming can be done only in bays and open sea areas which are protected and not affected by cyclones and oceanic disturbances. One of the major impediments in development of mariculture in open access water bodies is the lack of protection of the farm structures. The prospective entrepreneurs should be assured that their farm is protected. The state Governments in consultation with competent research institutes can demarcate selected areas congenial for mariculture as "Mariculture Parks". Those who are interested to invest in mariculture can apply for lease in these mariculture parks and after the approval by the competent authority they will have ownership over the allotted area for the specific time period.

MONITORING AND ADMINISTERING AGENCIES

The monitoring process envisaged in this policy frame work should necessarily vest with a research institute. For open water body mariculture of finfish, crustaceans, molluscs and other invertebrates, the responsibility should be given to the Central Marine Fisheries Research Institute, Kochi which is the premier research institute in the country mandated by R& D in marine fisheries and management. For land-based mariculture of finfishes and crustaceans in ponds and impoundments, the responsibility should rest with the Central Institute of Brackish water Aquaculture, Chennai.

The administering mechanism for the mariculture policy should primarily be vested with the respective state fisheries departments (SFD). The chain of command should begin with the SFDs and end with the local governing bodies. In essence there should be considerable synergy between monitoring and administering agencies as shown in Fig 2.to effectively and sustainably develop mariculture in the country.

SELECTED READING

[1] Anonymous 2008. Tamilnadu mariculture leasing policy, 2008.Goverment of Tamilnadu document.

[2] Cicin-Sain, B. et al. 2007. Development of a policy frame work for marine aquaculture in the 3-200 m US ocean zone. Sea Grant Technology Program, NOAA, USA p 1-4

[3] FAO, 2009. Aquaculture Production 1950-2007. www.fao.org/fishery/statistics/software/fishstat/en

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[5] SARFAC, 2004. Aquaculture leasing and licensing policy in South Australia. Gazette, 4th March, 2004. 12p