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REGULATORY FRAME WORK FOR MARICULTURE DEVELOPMENT AND MANAGEMENT

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Introduction

Mariculture is becoming a promising area of aquaculture all over the world and is one of the most important and rapidly growing components of Asian aquaculture contributing substantially to the increased demand for high value seafood items in the global market. India has a long tradition of aquaculture from time immemorial and is a leader in the world after China, contributing to about 5.2% of the total production in 2003 (FAO, 2005). 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 t. in 1950, increased to 10 million t. in 1990 and to 36 million t. by 2007 (FAO, 2009). A sub continent, with seas all around on three sides, India has a long coastline of about 8129 km. The country's continental shelf is estimated as 0.5 million square km, within its Exclusive Economic Zone (EEZ) that extends to 2.2 million square km. The southern edge of the Indian peninsula extends in to the Indian Ocean, with the Bay of Bengal in its eastern part and the Arabian Sea in the west.

During the last six and half decades, the potential of aquaculture for food production were widely recognized and legal policies drafted in many countries. The development and management of aquaculture is likely to fall within the scope of various pieces of legislation and the expertise of various institutions. Aquaculture activities need to be carefully monitored and controlled because of the numerous interests involved, the diversity of natural resources used the variety of institutions concerned, involvement of a wider range of stakeholders from both public and private sectors. FAO insist that "9.1.1 States should establish, maintain and develop an appropriate legal and administrative framework which facilitates the development of responsible aquaculture" (Code of Conduct for Responsible Fisheries (CCRF), Article 9).

Indian Scenario

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. 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 3,868 t in 1980 to 1,97,339 t in 2008. This pheno menal increase in production indicates the magnitude of utilization of water resources for coastal 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. 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. 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. Recently marine finfish and lobsters farming in marine cages have also been demonstrated successfully in India. List of mariculture practices are details in the table below.

Table 1.Mariculture farming systems prevalent in India

Sl.	Resource	Location	Type of farming	Farming status	Status regarding lease
1	Shrimps*Penaeus monodon*, *Fenneropenaeusindicus*, *Metapenaeusdobsoni*, *M. monoceros*	Intertidal/ subtidal	LandBased (ponds)	Commercial in some Maritime	Lease policiesexists states guided by rulesframed by AAI
2	Oysters*Crassostrea madrasensis*	Intertidal/ Sub tidal Openwaters	Off-bottom (Rack andren)	Commercialin Kerala	Lease policiesexist in somemaritime states
3	Mussels*Perna virdis*	Intertidal/ Sub tidal Openwaters	On bottom, off-bottom(racks, lines, rafts)	Commercial in Kerala	Lease policiesexist in some maritime states
4	Pearl oysters *Pinctada fucata P. margaritefera*	Bay/lagoons/ Oceanic open waters	Off bottom (rafts,cages)	Experimental (Commercializaton-Transitionphase)	None
5	Clams(*Papahia malabarica Villorita cyprinoids*)	Interdical/Sub tidal Open waters	On-bottom	Semi-commercial In Kerala,Karnataka	None
6	Crabs Scylla serrata	Intertidal/ Sub tidal	Cages/lanbased	Commercial fattening	None
7	Lobsters *Panulirus homarus,Thenus orientalis*	Near shore	Land based (Ponds/cages)	Commercial fatte-ning / Experimental	None
8	Finfishes	Open sea Coastal fixedcages	Sea cages Land basedponds,	Experimental/ Commercial Commercial, experimental	None Lease policiesexist in somemaritime states

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 200 km 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 which also has a draft mariculture policy that 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 and needs to be corrected in consultation with research organization. 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 ha area while private company is eligible for 100 ha area. Allotment is made by the Revenue Departments authority. It is now essential that leases (short-term or long term) giving the aqua culturist 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 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 formariculture lease in open water bodies

Principle		Policy guided by
1	Common property useconflicts	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 limited 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. 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. These aquaculture activities are conducted in open waters where there are other common users, to legally recognize mariculture has become inevitable. 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.

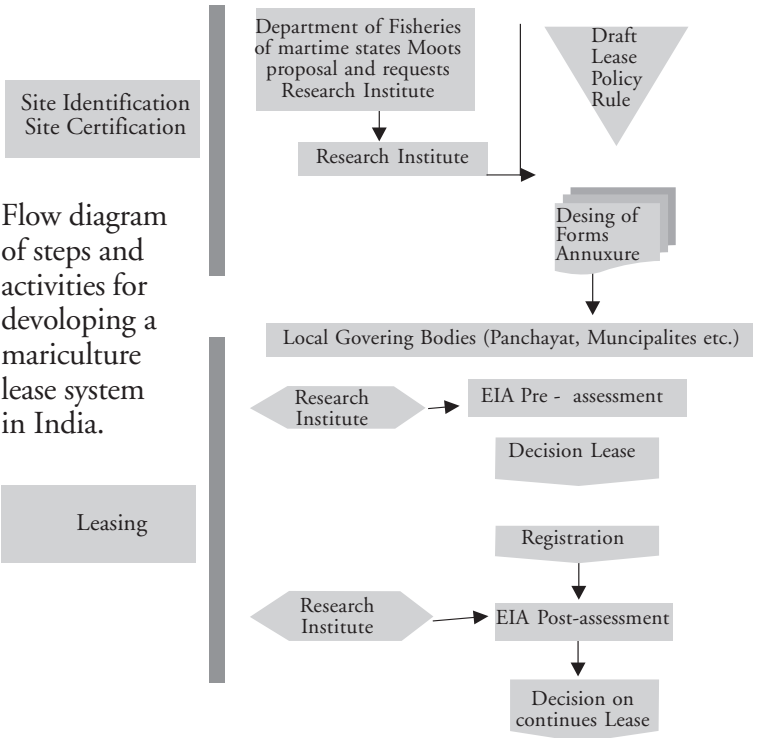
Modalities for implementing a lease: (eg. bivalve farming)

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. Farmers can submit their requests to the state fisheries departments and after evaluation based on the approval by the competent authority can be registered.

1. 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 shore lands, known riparian owners as they are listed in the panchayat or state property tax records.
2. 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.
3. 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.

4. The applicant should provide information regarding the financial resources available to operate, accurate and complete cost estimates.
5. The applicant shall submit a resume or other documentation as evidence of technical expertise and capability to implement the proposed project.

The local governing body makes decision on the lease while registration of the farms should be mandatory. Besides being helpful to determine the levels to which carrying capacity ahs been reached for the region, to indicate the origin of the farmed production. After the farms are registered and prior to stocking, the sediment and benthic faunal assemblage study (Pre stocking EIA) should be done. Similar study should be done and corrective measures taken if negative impacts are identified. A Flow diagram of steps and activities for developing a mariculture lease system in India is given below.



Flow diagram of steps and activities for devoloping a mariculture lease system in India.

Policy of Framework

The objective of the policy framework is to encourage responsible open body mariculture in the Indian coastal ecosystems. It should promote a decision making process that is transparent, efficient, coordinated and credible with the entire process taking 3-4 weeks. It should employ a precautionary approach to avoid and minimize environmental impacts and promotes integration into the ecosystem.

It should be consistent with existing Indian laws and Agency responsibilities and be consistent, to the maximum extent possible, with the coastal water environmental and aquaculture policies of adjacent nations; also consistent with India's obligation under International agreements. The policy should be adaptive, and should promote the opportunities for innovation, data collection and continual learning

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 structure. State Governments in consultation with competent research institutions 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. There are various Monitoring and Administering Agencies involved in various legislatures and mariculture entrepreneurs has to be need to be given guidelines to abide by the different legislations by different organizations.

Monitoring and Administering Agencies

The monitoring process envisaged in this policy frame work should necessarily vest with a research institute. The admini stering 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. There should be considerable synergy between monitoring and administering agencies for sustainable mariculture development in the country.

Table 3.Institutions responsible for decision–making

Organization	Responsibilities
Ministry of Environmentand Forests	Management of resources in the coastal water
Ministry of EarthSciences	Scientific monitoring of the marine environment,management of resources in the high seas
Ministry of Agriculture	Development of fisheries, aquaculture, fish processing
Ministry of WaterResources	Erosion
Ministry of SurfaceTransport	Ports, shipping etc.
Ministry of Petroleumand Natural Gas	Offshore installation, coastal refineries, pipelines etc.
Ministry of Tourism	Tourism activities in coastal regions
Ministry of mines	Mining activities in coastal regions

Highlights of major policies and programmes

From 1897 onwards various legislations are brought by various agencies and most important legislations are listed below.

Table 4. List of important legislations

Year	Relevant Acts, programmesand policies	Salient features and Amendments
1897	Indian Fisheries Act	Offers protection to fisheries againstexplosives or dynamites
1908	Indian Ports Act	Enactment relating to ports and portcharges
1958	Merchant Shipping Act	Control of pollution from ships and offshoreplatforms
1972	Wildlife Protection Act	Offers protection to marine biota
1974	Water (Prevention and	Control of pollution from Control of Pollution Act) land-basedsources includes tidal waters
1978	Marine fishing RegulationAct	A model act, which provides guidelines to the maritime states to enact laws forprotection to marine fisheries by regulating fishing in the territorial waters.
1980	Forest Conservation Act	Protection to marine biodiversity
1982	Coastal Pollution ControlSeries	Aims at assessing the (COPOCS) programme) pollution status ofcoastal waters.
1986	Environment ProtectionAct	Under this, the Coastal (EPA) Regulation Zone1991 has been notified.

1991	(underEPA,1986)	Coastal Regulation ZoneNotification Regulations on various activities in coastalzone.
1991	Deep Sea Fishing Policy	Allows foreign fishing vessels into Indianwaters beyond 12 nautical miles
1991	Coastal OceanMonitoring and	Assesses the health of Prediction systems coastal waters (COMAPS Project)
1995	UNCLOS	A new international order established foroceans Provides a comprehensive legalframework for integrated treatment ofissues relating to oceans and seas
1996	Coastal Zone Management	Supreme CourtIntervention Plans (CZMPs) that all the Coastal states prepare their CZMPs by1996.
1997	Ocean Observation and Information	Generate reliable 1998 oceanographic datavarious projects of DOD were restructured
1998	Integrated Coastal andMarine	Aims at integrated Area Management management of coastaland (ICMAM Project) marine areas.
2000	The Biodiversity Bill	With an aim to protect and conservebiodiversity and sustainable use

Although enriched with vast natural resources and numerous potential species, the sea farming practices have not picked up in

the country, perhaps due to the lack of a policy for usage of open water bodies. The coastal areas of the country are densely populated and their major occupation is related to fishing and ancillary activities. Therefore, demarcation of suitable areas for a relatively new venture such as mariculture may invite multi user conflicts. Therefore, to initiate such projects, it is very important to involve the local community and frame suitable policy for aquaculture. Coastal Aquaculture in the open waters requires statutory support and the Government is yet to take major policy decision in this regard. Therefore, any major effort for commercialization of the technology for mariculture of various species will depend on an effective policy framework. ■