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3 COUNTRY REPORT

V. Sundararaj, M. Devaraj, and M.J. Prince Jeyaseelan

Prawn Farming in India

India contributes about 4% of the world aquaculture prawn production. Prawn farming provides excellent employment opportunities and generates income, particularly to India's coastal villagers. It, however, has caused impact on land and water resources use. India has about 55 prawn species, 11 of which are suitable for coastal culture. With all these, along with available natural resources, favorable climate, greater awareness of prawn farming, availability of trained human resource, and government and research support, India's prawn farming industry is expected to develop further.

INTRODUCTION

India topped the list of leading prawn producing countries in the world in the 1970s and the 1980s, mainly because of her capture fisheries production. The Indian contribution to global prawn production, through capture and captive fisheries, is now around 0.2 million tons, which is about 9% of the world total. According to 1989 estimates, Indian-farmed prawns (0.025 million tons) accounted for merely 4.2% of the global aquacultural prawn production (0.59 million tons) (Infofish 1990a; MPEDA 1989).

In the global scene, cultured prawn production showed tremendous increase in growth to nearly 200% over 5 years from 1984–1985 to 1988–1989 whereas the Indian-farmed prawn growth during the period was around 115% with an average annual growth of 23%. Thus, in 1989, India ranked seventh in global prawn culture production. Mainland China and Indonesia contributed 33.7% and 15.2% through extensive farming techniques and ranked first and second by raising *Penaeus chinensis* and *Penaeus monodon*, respectively. Thailand has been adopting semiintensive system, a transitional stage of intensive prawn farming, and has been able to keep up with Indonesia in culture prawn production by raising mainly *P. merguiensis* and *P. monodon*. The Philippines ranks next by producing 8.4% of cultured prawn, which is essentially of grass prawn produced in intensive systems of farming (Infofish 1990a; MPEDA 1989; Tan and Cruz 1988).

Taiwan, which was exporting about 0.05 million tons of cultured prawns annually to Japan, suffered a setback in the production of cultured prawns recently, with its exports falling to a mere 9,000 tons of frozen prawn in the last two years. As a result, Taiwan came down from the first position that she held in export of farm produced prawns to Japan to ninth position now.

Appreciation of currency due to a buoyant economy associated with an increase in land and labor costs, certain defects in the intensive farming system and increased local consumption could be responsible for the drastic failure of the prawn aquaculture industry in Taiwan (MPEDA 1989; Tan and Cruz 1988).

India, which ranked third by exporting 0.032 million tons of frozen prawn to Japan, occupied the fourth rank in two years because of the rapid growth of the prawn farming industry in other Asian countries. According to 1988 statistics, India ranked sixth in Asian culture prawn production (Tan and Cruz 1988; Infofish 1990b).

In 1988–1989, culture prawn production in India constituted 0.75% of the country's total fish production and 11.8% of total prawn production from culture and capture fisheries. Out of 0.2 million tons of Indian prawn production through capture and culture fisheries, only 28.5% was of high quality and exported for

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earning foreign exchange while the rest found their way into the local market.

IMPORTANCE OF PRAWN FARMING IN THE INDIAN ECONOMY

With the fall in economic growth globally (from 4.4% to 3.1% between 1988 and 1989) and in developing countries (from 4.5% in 1988 to 3.4% in 1989) recorded recently, the UN predicts further slow down in the 1990s. Even amid such global failures, Indian marine products export increased by 19.4% by quantity and 6% by value between 1988–1989 and 1989–1990, reflecting the potential that prawn farming holds for the country's economic growth.

According to 1989–1990 provisional estimates, India imported around Rs. 370 million (Rs. 17.26 = US$1, as of 24 August 1990) worth materials and exported nearly Rs. 280 million worth of goods, leaving a deficit in foreign trade. By gearing up prawn farming activities to produce quality and value added products, India can step up export and bridge the gap to some extent.

India has 129 million hectares of wasteland and 35 million hectares of degraded forest land spread throughout the country. Coastal lands with meager or no vegetation constitute a sizable portion of the total wasteland. Prawn farming in coastal wastelands will help uplift the Indian economy by converting the "waste" into wealth.

India has a total of about 240 million rural labor force. The substantial coastal labor force with unemployment problems could be well deployed for prawn farming at internationally competitive production costs.

The current Indian food grains output (1989–1990) is 179 million tons and fish production from culture and capture fisheries is 3.15 million tons including 0.025 million tons of cultured prawns. This gross mismatch owes primarily to the near total neglect of aquaculture. Aquaculture of fishes and prawns will boost income of farmers suffering from low agricultural productivity and fluctuating prices of agricultural produce.

STATUS AND POTENTIAL

There are conflicting reports about the availability of brackishwater area (MPEDA 1989, 1986; James 1990; Sakthivel and Ganapathy 1986; Ghosh et al. 1986). Brackishwater areas, which include estuaries, mangroves, backwaters, lagoons and saltwater lakes, could be used for aquaculture purposes by constructing farms of appropriate designs. Such cultivable brackishwater areas account for 1.4 million ha of which about 58,000 ha area are used for prawn farming. Statewise details of total cultivable brackishwater area and the area under prawn culture now are shown in Table 1.

Table 1 Total Cultivable Brackishwater Area and Area Under Culture, By State In Ha

	ESTIMATED BRACKISHWATER AREA	*AREA UNDER CULTURE*	*IDENTIFIED AREA AWAITING DEVELOPMENT*
West Bengal	405,000	33,210	25,000
Orissa	80,000	3,165	32,000
Andra Pradesh	150,000	3,500	17,000
Tamil Nadu	56,000	250	15,000
Pondicherry	800		
Kerala	242,000	8,185	17,000
Karnataka	8,000	1,800	n.a.
Goa	18,500	6,500	n.a.
Maharashtra	80,000	1,800	14,000
Gujarat	376,000	100	2,000
Total	1,416,300	588,510	122,000

n.a., not available
Source: Ganapathy (1989)

CULTIVABLE SPECIES

About 55 species of prawns occur in India. Out of these, 11 species of penaeid prawns are listed as suitable for culture in the saltwater along the coastline (Silas 1980). They are given in Table 2. However, considering the total bioeconomic matrix of the penaeids, *P. monodon*, *P. indicus* and *P. semisulcatus* emerge as the most suitable species. Their biological and cultivable features are shown in Table 3. *Penaeus japonicus*, which is also now reported to be available in fair abundance along the northwest coast of India could also be considered and cultured.

Table 2 Current and Candidate Culture Prawn Species in India

Penaeus monodon
Penaeus indicus
Penaeus semisulcatus
Penaeus merguiensis
Metapenaeus monoceros
Metapenaeus affinis
Metapenaeus dobsoni
Metapenaeus brevicornis
Parapenaeus stylifera
Parapenaeopsis sculptilis
Parapenaeopsis hardwickii

Table 3 Characteristics of Three Important Prawn Species in India

	PENAEUS INDICUS	PENAEUS MONODON	PENAEUS SEMISULCATUS
Common Name	Indian white prawn	Black Tiger Prawn	Green Tiger Prawn
Availability	East and West coasts	East and West coasts	East Coast
Abundance	Karnataka, Kerala, Tamil Nadu, Andhra Pradesh, Orissa and West Bengal	Bheris of W.B., Chilka lake, Orissa and Andhra Pradesh	Less abundant East coast of T.N., Andhra Pradesh, Bheris of W.B.
Feeding Habit	Omnivorous	Omnivorous	Generally carnivorous
Maximum Growth	228 mm	336 mm	250 mm
Size at First Maturity	130 mm	60 gm wt.	23 mm (carapace length)
Fecundity	68,00-731,000	300,000-700,000	67,900-660,900
Postlarval Availability	Near shore and brakishwater round the year	Near shore and brackishwaters seasonal less available	Less availability in the coastal waters
Induced Breeding	Successful-seed produced in hatcheries	Successful-seed produced in hatcheries	Successful yet to produce in hatcheries
Culture	widely done	Next to *P. indicus*	Limited
Salinity Tolerance	Tolerates higher salinity (4-40% a species for summer)	Prefers low salinity (0.5-34% suitable forr monsoon crop)	Good for sea water salinity (19-40%)
Maximum Yield	8 tons/ha/crop	7.5 tons/ha/crop	—

TRENDS IN CAPTURE AND CULTURE PRAWN PRODUCTION

Prior to the 1960s, the nonpenaeid prawns dominated the Indian prawn capture fisheries landings with penaeid prawns contributing about 5% and nonpenaeid prawns about 7.4% to the total marine fish landings. In the pre-1960s, the total prawn production from capture fisheries did not exceed 90,000 tons. Between 1961 and 1970, penaeid prawns dominated the total prawn catch, which attained a maximum of 0.13 million tons in 1970.

In 1973, there was a sharp increase in total prawn landings in India with penaeid prawn production from the wild becoming twice that of nonpenaeid prawns. After a steep fall in production in 1977, a record 0.25 tons was attained in 1980, which was 15% of the global prawn landings After a steep fall in production in 1977, a record 0.25 tons was attained in 1980, which was 15% of the global prawn landings (CMFRI 1969, 1980; SanthanaKrishnan 1985). In recent years, total prawn production in India fluctuated between 0.16 million tons and 0.20 million tons.

From time immemorial, traditional methods of brackishwater aquaculture exist in four pockets in India, namely, West Bengal, Kerala, Goa and Karnataka, which contribute considerable quantities of prawn to Indian farmed prawn production. Extensive and semiintensive prawn farming came in practice very recently (less than a decade) in Indian aquaculture and are becoming increasingly popular with potentially strong impact on the foreign exchange earnings in particular and on the Indian economy in general. As the prawn capture fisheries are intensively exploited by a fleet of around 20,000 small mechanized trawlers (28–32 feet) with much little scope for production increase, it is necessary to step up semiintensive and extensive prawn farming practices to augment foreign exchange earning and to sustain the seafood processing industries. In 1985, about 300 seafood processing plants in India worked at only 225% capacity even during peak fishing seasons (Sakthivel 1985).

Cultured prawn production in India increased from about 11,000 tons to 23,600 tons within 5 years (1984–1985 to 1988–1989). The traditional prawn farming areas are gradually transforming into extensive prawn farms and the extensive farms are switching over to semiintensive methods of cultivation. As a result, newer areas are being identified and developed into modern prawn farms. The area under prawn farming in India increased from 43,000 ha to 58,000 ha in the past five years. In 1985, the Marine Products Export Development Authority (MPEDA) identified around 36,000 ha of area for prawn aquaculture development while the area thus identified increased to 122,000 ha in 1989and systematic farm construction activities have already been initiated.

Traditional paddy cum prawn farming is being carried out in West Bengal, Kerala, Karnataka and Goa in about 50,000 ha. One crop of paddy during the rainy season (low saline period) and one crop of prawn during summer season are cultivated in the low lying coastlands in these states. Under this farming system, after the harvest of paddy, the juveniles of prawns and fishes in the incoming tides are trapped in the brackishwater fields and harvested at fortnightly intervals. There is no control over the quality or quantity of the seed material, autostocked in this system. The juve-

nile prawns do not get sufficient time to grow and therefore, the production is very low, ranging from 200 to 500 kg/ha/season, lasting up to six months (Ganapathy *in press*).

The new areas developed into prawn farms in the states of Andhra Pradesh, Orissa, Tamil Nadu and Kerala have reached better production level of 500 to 2,000 kg/ha/crop of 3 to 5 months in semiintensive culture methods. While the small farmers could achieve a production rate of 500 to 1,000 kg/ha/crop, the progressive farmers could harvest 1,500 to 2,000 kg/ha/crop of 4–5 months. The highest production of 7,500 kg/ha/crop was achieved by M/s Hindustan Lever Ltd. in the lower Sunderbans in West Bengal. Recently in Tuticorin (Tamil Nadu), the Victory prawn farm has been able to increase production to 8 tons (*P. indicus*)/ha/crop with a stocking density of 5,000,000 seeds/ha. The point to note as unique here is that the farm is typically sandy, which is normally considered unsuitable for prawn farming. However, with almost continuous seawater pumping into the farm to compensate all kinds of water loss and to facilitate constant flushing, coupled with intensive stocking, intensive feeding with energy diet, squid waste and low value marine fish, very high production has been made possible for the first time. This has opened new vistas in prawn farming. New areas are being added on by increasing number of entrepreneur from various sectors interested in diversifying into prawn farming. Some parties are putting up 100% export oriented fish farms at huge capital cost. Most state governments are taking adequate steps to allot government owned coastal lands to private industries and small farmers for prawn farming. The government of Tamil Nadu has allotted 800 ha of coastal lands recently various target categories of prawn farmers.

Many kinds of prawn culture practices have been followed in India. Among them, farming prawns along the sandy coasts, lined by polyethylene sheets and pen culture in backwaters though proved technically viable, failed in their economic feasibility. The profitable practices or systems of farming (based on water source or watering source and farming intensity) as shown in Tables 4 and 5.

SEED

Most of the farmers still depend on wild seed, collected from brackishwaters for farming. Such natural seeds suffer from several limitations. Some are able to use hatchery produced seeds from limited supplies. The details of hatcheries available to use hatchery produced seeds now in India with their production capacity are shown in Table 6.

It is planned to bring 100,000 ha of brackishwater area under prawn culture by 2000. In this plan, 75,000 ha will be under extensive culture, 20,000 ha under semiintensive culture and the rest 5,000 ha under intensive culture. The stocking densities proposed for intensive and semiintensive culture practices are 2,50,000 postlarvae/ha and 1,00,000 postlarvae/ha, respectively. At the rate of 2 crops/year, the seed required for intensive and semiintensive prawn culture would be 6,500 million. With 6,000 million seed required for the extensive farms, the total seed requirement is 12,500 million. Considering the fast growth of the prawn farming industry, expansion of farm area and higher stocking densities, the seed produced now is quite inadequate. The supply could be met by hastening the establishment of large number of hatcheries.

FEED

Nutritionally balanced prawn feed is not available in sufficient quantities in India. The animal feed industry is in the process of developing nutritionally balanced feeds for semiintensive prawn farming. Some feed manufacturers have partly succeeded in commercial prawn feed manufacture and have been marketing in the last two years. However, most of their feeds are characterized by low food conversion ratios (Sukumaran 1990). Therefore, it might be necessary to import quality feeds to ensure high rates of production; duty free import of feed is being arranged by MPEDA to help the farmers. The local production of quality feeds from a wide spectrum of raw materials available in the country calls for concentrated research effort in the Universities and the national fisheries institutions, which should be supported by both national and international funding agencies.

There are now 12 Indian companies manufacturing prawn feeds. The composition details of these feeds are not available. However, the crude protein level in these feeds ranges between 30 and 40% and their FCR values vary from 2 to 5. Details of the feeds manufactured by the stabilized companies in India are furnished in Table 7.

The present Indian prawn feed requirement is 1,53,600 tons. About 200,000 tons of feed will be required by 2000 when 1,00,000 ha of brackishwater area is expected to be brought under culture (Paulraj 1990).

Table 4 Different Systems of Prawn Farming in India Based on Water Sources

SYSTEM	PLACE	SPECIES CULTURED	STATUS OF CULTURE	DAYS OF CULTURE	YIELD
Traditional culture systems (Tidal Fed System)	Bheris of West Bengal and paddy fields of Kerala	*Penaeus indicus, P. monodon, M. dobbsoni, M. monoceros*	Extensive method	180	200-500 kg/ha/season
Tidal and Pump fed system	Arumuganeri	*P. indicus*	Extensive	120	660 kg/ha/crop
Seawater pump fed system	Veppalodai	*P. indicus*	Semiintensive	224	1,600 kg/ha/crop
Seawater pump fed system	Vembar	*P. indicus*	Extensive	100	500 kg/ha/crop
Brackishwater pump fed system	Pazhayakayal	*P. indicus*	Semiintensive	140	1,000-1,200 kg/ha/crop
Borewell (sub-soil) pump fed system (Abandoned salt pans)	Tuticorin	*P. monodon*	Semiintensive	110-120	1,200-1,500 kg/ha/crop
Mangrove water pump-fed system	Sundarbans	*P. indicus, P. monodon*	Transitional stage of intensive	120-150	6,000-7,500 kg.ha/crop
Seawater pump-fed system	Veppalodai	*P. indicus*	Transitional stage of intensive	120-150	6,500-8,000 kg/ha/crop

Table 5 Different Intensities of Prawn Farming Practices and Their Unit Productivity Area in Ha

FARMING PRACTICES	AREA (HA)	PRODUCTIVITY
Traditional prawn farming	50,000	200-500 kg/ha/crop
Extensive prawn farming	8,000	500-600 kg/ha/crop
Semiintensive prawn farming	325	1,000-2,000 kg/ha/crop
Transitional stage of intensive prawn farming	50	6,000-8,000 kg/ha/crop

Table 6 Major Prawn Feed Manufacturing Companies in India Cost in Rs/Kg

FIRM	PROTEIN	FCR	COST
The Tata Oil Mills Company, TOMCO Ltd.			
• Premium feed	Crude protein, 30–32% Lipid, 6–8% Fiber, 3–5%	3:1	6.25
• High Growth Feed (3 mm pellets)	Protein, 30-40% Lipid, 8-10% Fibre, 3-5%	2:1	9.00
M/s Mysore snack foods, Bangalore	n.a.	11.38:1 in laboratory, 4-5:1 in farm	n.a.
Vetcare, Bangalore	Up to 40%	n.a.	n.a.
M/s HIM Feeds	n.a.	2.12:1	12.00
M/s Ruminant Feeds, Salem	Protein, 14% Protein, 30%	n.a. 2.13:1	2.25 5.25
M/s Lakshmi Agro Products, Vijayawada	n.a.	5:1	6.00
M/s Intersea Export Corporation, Madras	Protein, 40%	n.a.	n.a.
Hindustan Lever Ltd., Andheri, Bombay	n.a.	3:1	10–15

n.a., not available.

Table 7 Prawn Hatcheries In India

NAME AND LOCATION	YEAR ESTAB-LISHED	OWN-ER-SHIP	PRODUC-TION CAPACITY	SPECIES PRODUCED
Prawn Hatchery CIBA, Narakkal, Kerala	1977	G	n.a.	*Penaeus indicus*
Crescent Hatchery Alikode, Kerala	1978	P	n.a.	*P. indicus*
Prawn Hatchery Hindustan Lever Ltd., Muttukadu, Tamil Nadu	1983	P	10 million	*P. monodon*
TASPARC (MPEDA) 48-7-9 Sreenagar, Vishakhapatnam, Andhrapradesh	1986	G	40 million (raised to 100 million)	*P. monodon*
CIBA Enore, Madras, Tamil Nadu	1986	G	n.a.	*P. monodon*
OSPARC (MPEDA) Golapur-on-sea (Ganjan) Orissa – 761 002	1986	G	25 million	*P. monodon*
MPEDA's Shrimp Project Complex, Vallarpadam, Kerala	1986	G	10 million	*P. monodon P. indicus*
Tamil Nadu Fisheries Development Corporation Neelankarai, Madras, Tamil Nadu	1987	G	20 million	*P. indicus P. monodon*
State Fisheries Department Maharashtra	1987	G	15 million	*P. merguiensis*
Deejay Hatcheries Hanovar – 581334 Karnataka	1988	P	n.a.	*P. monodon*
Mary Prawn Farm Veppalodai, Tuticorin, Tamil Nadu	1988	P	2 million	*P. monodon*
Pioneer Aqua Farms Tuticorin – 628 001 Tamil Nadu	1989	P	10 million	*P. monodon*
Victory Aqua Farms Pathinamaruthur Tuticorin, Tamil Nadu	1989	P	50 million	*P. monodon P. indicus*
State Fisheries UNDP-aided hatchery Goa	1989	G	25 million	*P. monodon*

G, Government. P, Private

The protein requirement of penaeid prawns seems to vary considerably. Optimum protein level (OPL) on dry matter basis in the diet of *P. chinensis* was reported to be 28–32% whereas in *P. japonicus* the values varied from 40 to 60% (NRC 1983). Optimum protein level for *P. japonicus* has been reported to be 60% (Deshimaru and Shigueno 1972) and 55% (Deshimaru and Shigueno 1972, *see* Pandian

1989). According to few other reports, the OPL for the same species was 50% (Deshimaru and Kuroki 1974) and 35% (Balazs, Ross and Books 1973). *Penaeus monodon* requires 38–46% protein, depending on size (Chiu 1988). Another experiment indicates that *P. monodon* requires 40% optimum protein level in the diet (Alava and Lim 1983). The protein requirement in the diet of *P. indicus* was reported as 43% (Colvin 1976) and in *P. merguiensis*, it was 42% (Sedgwick 1979) and 50% (Aquacop 1978). The protein requirement and conversion efficiency values in respect of the genus *Penaeus* itself comprising more than 25 species have been expressed in very general terms by some (Pandian 1989). Unfortunately, most of the prawns were limited to juveniles. Moreover, in most of these experiments, high quality protein such as caesin, fish meal, squid meal, prawn meal and soybean meal alone were used instead of cheap sources of protein (Chiu 1988; Aquacop 1978). Geographic variation in composition of protein in the ingredients of feed was also pointed out (Watanabe 1988). Generalizing a common feed for the different species of prawns with no reference to intensities of culture, geographic location and water quality should be avoided. Any master plan for R&D in prawn feed should consider the following:

1. Performance of prawn feed in relation to the genetic potential of the candidate species in maximum size, life span, growth rate in different phases and size at first maturity.
2. Performance of feed in different stocking densities under extensive, semiintensive and intensive systems (10,000 individuals to 100,000, 100,000–400,000 and 500,000–1,000,000 individuals of PL20, respectively) in ponds of various sizes (with 1–100 ha, 0.2–0.5 ha and 0.03–0.1 ha, respectively) and depths.
3. Performance of feed in different soil and water fertilities (including major and micronutrients) in extensive and semiintensive systems and in varying levels of water fertility alone in cement ponds meant for intensive prawn culture.
4. Performance of feed in different organic and inorganic fertilizer loadings.
5. Performance of feed in different geographic locations and climatological parameters.
6. Performance of feed in various levels and fractions of food organisms (bacterioplankton, nanno phytoplankton net, phytoplankton, microzooplankton, mesozooplankton, macrosooplankton, epiphytes, epizooites, benthic algae, lab-lab and benthic fauna) in ponds subjected to varying intensities of culture operations, giving due weight to percentage of water exchange per day (which varies up to 50% and 300% per day in semiintensive and intensive systems, respectively) and density of the stock.
7. Performance of feed in different species under ideal and stressed conditions (which vary from species to species and in different stages) with varying levels of salinity, temperature, oxygen, carbon dioxide, unionized ammonia, nitrite and pH in the water by carefully monitoring the changes in diurnal cycles in all the three systems and in addition tidal and lunar cycles in extensive and semiintensive systems.
8. Feeds with varying levels of COD, calorific values, essential amino acid fractions, chitin of animal origin (to minimize cannibalism), chitin and protein of plant origin (to minimize pollution of water and thereby the rate of water exchange), carbohydrate, lipid, microbial load, vitamins, minerals, antibiotics, palatability, consistency, digestible portion, digestible protein, food conversion efficiency, protein efficiency ratio, biological value and net protein utilization could be tried for each species to assess the performance of various intensities of culture operation.
9. Performance of feed as the prawn stock reaches the carrying capacity of the pond, as the prawn reaches the size at which it moves toward the sea, and in times of over accumulation of metabolites in the absence of appropriate microbial load for degradation, when the population will be subjected to stress.

ENVIRONMENTAL CONDITIONS AND WATER QUALITY

The prawn farming systems, depending on their geographical locations and their water source show varying environmental conditions both seasonally and annually. The major environmental challenges for prawn farming in the different maritime states are provided in Table 8. Among these states, Tamil Nadu seems more affected environmentally. However, due to technical support and management perfection, prawn farming is toward development.

Water quality is maintained in the existing farms mainly by tidal exchange, while a few farms resort to pumping. In advanced systems of high stocking, regular water exchange and aeration are followed. M/s Hindustan Lever Ltd., (W.B.), M/s Victory Aquafarm Ltd., M/s Centuary Farm Ltd., M/s Sudharsana Farm Ltd., and M/s Pioneer Aquafarm Ltd., (TN) are few examples. All these farms are managed by

Table 8 Constraints in Brackishwater Prawn Culture in India

NATURE OF CONSTRAINT	APPLICABILITY
Cyclone and flood	Orissa, Andhara Pradesh
Seed availability	Almost all coasts
Low Tidal amptitude	Tamil Nadu
High Tidal Amplitude	Gujarath, Andhra Pradesh, Maharastra, Orissa
High Salinity	Tamil Nadu, Andhra Pradesh, Kerala, West Bengal
High temperature	Gujarath, Andhra Pradesh, Tamil Nadu
Sandy Soil	Tamil Nadu
Crab Population	Andhra Pradesh, West Bengal, Kerala
Diseases	Tamil Nadu, West Bengal, Keral, Karnataka
Pollution	Kerala, West Bengal

scientists, technically trained personnel or foreign technicians.

POLICY INITIATIVES

Most of the brackishwater areas in the country belong to the state governments. Therefore, for speedy development of prawn aquaculture, maritime states like Orissa, Andhra Pradesh, Tamil Nadu, Gujarat and Maharastra have introduced land leasing systems to allot lands for prawn farming. Tamil Nadu has already distributed 800 ha of coastal lands to farmers of different categories for undertaking extensive, semiintensive and intensive farming practices. Since prawn farming is not as simple as carp culture and since it is capital intensive, efforts are under way to help farmers with financial and technical assistance to bring the allocated areas under active prawn farming. Financial and educational institutions (like the fisheries colleges) in the country are in the frontline, providing financial and technical knowhow, respectively. The farmers, administrator, bankers, researchers and the extension workers are brought together under one forum by the fisheries departments for discussing and meeting the needs of the farmers. The role played by the MPEDA in this regard in the country is commendable.

The declaration of the Brackishwater Fish Farmers' Development Agencies (BFFDA) in selected states promise ample scope for steady development in prawn farming similar to the development in inland fish production under the Fish Farmers' Development Agencies (FFDA). BFFDAs and FFDAs are agencies committed to brackishwater and freshwater fish farmers' development tasks.

MPEDA ACTIVITIES

The development of aquaculture is being primarily looked after by the Ministry of Agriculture and the concerned state governments. However, realizing the importance and necessity, the MPEDA has initiated a scheme to promote prawn farming with the major objective of augmenting export production of prawn from India by establishing field offices in all maritime states exclusively to promote prawn farming in the coastal regions. The technical staff attached to these offices work in close cooperation with the Fisheries Departments of the respective states. Farmers and entrepreneurs are supported from site selection till harvest. It also conducts short term training courses to farmers, organizes farmers' meetings and seminars and arranges interstate study tours for the benefit of farmers. Inputs such as seed, feed, and mahua oil cake required for prawn farming are also arranged on cost basis. About 4,000 farmers have so far registered with the MPEDA to avail the technical assistance schemes for development of new prawn farms, establishment of seed banks and prawn hatcheries, Considerable areas have been surveyed sofa rand 670 project reports have been issued for development. About 3,400 farmers have been trained on prawn farming and about 5,500 ha have been brought under scientific prawn farming in many parts of the country.

ROLE OF THE MINISTRY OF AGRICULTURE, GOVERNMENT OF INDIA

Since most of the brackishwater areas in the country are under the control of the state governments, the Ministry of Agriculture, Government of India has issued guidelines for leasing of brackishwater lands for prawn farming. Under guidance, the brackishwater areas are being earmarked only for aquaculture. It has also suggested that 60% of the brackishwater area, involving less capital investment on development may be given to fishermen and small and marginal farmers with financial and technical support through central and state government schemes. Twenty percent of brackishwater areas, which require medium size capital investment may be leased to medium entrepreneurs and the balance of the land involving high investment may be leased to progressive entrepreneurs who may have financial backing and management capacity for introducing advanced technology. Based on the above guidelines, states like Orissa, Andhra Pradesh, Maharashtra, Gujarat, Tamil Nadu and the

Union Territory of Pondicherry have already framed land leasing policies to lease out lands to various categories of people. The Ministry of Agriculture is also assisting the maritime states to establish Brackishwater Fish Farmers' Development Agencies (BFFDA) to promote prawn farming in the states by meeting 50% of the cost of the projects. While considering the services if the FFDA in inland fish culture and achievements, it is necessary that BFFDAs are also established for similar developments in brackishwater farming, particularly prawn farming.

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