CHAPTER 1

INTRODUCTION

Aquaculture is cultivating aquatic organisms by providing suitable environmental conditions and harvesting the production for human and animal consumption. It plays a significant role in world economy in the recent years. Shrimp, with its universal appeal and high unit value has revolutionised the world seafood trade. Coastal aquaculture in India is of recent origin. In India, the word aquaculture is synonymous with shrimp culture. Aquaculture is an industry, which could satisfy a range of national priorities for socio-economic development and was seen as an alternative to agriculture and also as a means of generating employment and foreign exchange. A rapid growth in the world population, which is expected to touch a mark of 8.2 billion by the year 2025 (A.D.), has placed a severe stress on agriculture and fisheries (Vibhavari and D'souza 1998). In the World Aquaculture International Conference held at Puerto Rico in 1991, the assumptions were that the production of capture fishery may reach 100 million tons and the availability of fish and seafood will be stay at 19.1 kg per capita/year. For this, aquaculture has to fill up a gap of 19.6 million tons by the year 2000 A.D. 37.5 million tons in 2010 A.D. and 62.4 million tons by 2025 A.D. to meet the requirements of the increasing population (Csavas 1994). The gap between the demand of the rapidly increasing global population with the stagnating and even declining production of capture fisheries has to be bridged over by aquaculture production.
Aquaculture is a natural resource based industry and practised only in the fallow, unfertile and unproductive wastelands, which are not suitable for any other practices such as agriculture. Aquaculture is the best alternative for the production of food, which contains rich protein and minerals. Since aquaculture involves people, environment and technology the prospective industry should strive to make it ecologically sustainable and socially acceptable. Due to the high profit, economic viability of the industry, low labour requirement, suitable soil and environmental conditions, and encouraging market for the product, aquaculture has expanded rapidly in a very short span of time. This expansion has led to the encroachment of highly fertile agricultural lands and in some instances unplanned development has caused environmental degradation. Crowding of farms in certain locations and unplanned and uncontrolled developments caused saline intrusion, which in turn has affected the water table and the agricultural lands. Besides this, mangroves, the ecologically valuable environment, has been extensively affected in many countries such as, Taiwan, Thailand, China, Philippines and Indonesia. Also, a few instances of multi user conflicts have become the cause of social tension in some places of India. For the industry to be eco-friendly and sustainable over a long period, it has to be carried out within the environmental limits (Shanthanakrishnan and Viswakumar 1995).

1.1 STATUS OF AQUACULTURE IN THE WORLD

The ever increasing demand in the world for shrimp and the short supply from capture fisheries, has led to the growth of commercial shrimp farming in the early eighties, which has become an important industry during the late eighties. The world annual shrimp production through farming has been estimated as 100 million tons (Csavas 1994). Among the different kinds of
aquaculture practised, the outlook for shrimp culture appears, quite promising over the tropical and subtropical countries. In 1997 the global marine shrimp production was estimated as 6.60,200 million tons (Rosenberry 1997). It is estimated that more than 1 million hectares of water spread area is being utilised and there are about 50,000 farms spread over 45 countries. The major contributors are China, Thailand, Taiwan, Equador, Indonesia, India, Japan and Philippines. The high returns from the shrimp culture drew small and marginal farmers as well as corporate entrepreneurs into the business. As a result, various types of shrimp culture practices were adopted i.e., extensive, semi-intensive, and improved-extensive methods (Paulraj 1998). The complexity of aquaculture is a multi-disciplinary activity, which is even more complex than agriculture, perhaps that is one of the reasons for the late start of modern aquaculture. Asia, particularly China has dominated in aquaculture developments in the world right through the history, while this could be considered as the beginning of the traditional aquaculture (Kutty 1999). Among the top five countries, China accounted for 67% of the total world aquaculture production in 1996. Almost 70% of worldwide shrimp production originate from developing countries that are in Asia. Indonesia is the major exporter of shrimp with 80,000 million tons of shrimp exported during 1997. In 1997, the major contributors were Thailand (1,50,000 million tons), China (80,000 million tons) followed by Indonesia (80,000 million tons), India (40,000 million tons) and Bangladesh (34,000 million tons) (Jory 1998 and Rosenberry 1998).

According to the Food and Agriculture Organisation (FAO 1998), the world aquaculture production has increased from 10.64 million metric tones in 1987 to 26.38 million metric tons in 1996. After 1996 due to the high profit, viability, suitable soil and environmental conditions encouraging market for the product, aquaculture industry has expanded rapidly (Kutty 1999). The
continuous increase in the intensity of aquaculture has caused several problems in a very short duration and due to the continuous crop failure, the industry has collapsed eventually. The first national collapse in shrimp culture was observed in Taiwan followed by partial collapse in China, Indonesia, Thailand, Philippines as well as in India. This has resulted in several complex social problems and litigation at national and international levels. This reduction has resulted in increased economic problems in various parts of the world. In Japan, aquaculture imports continued to decline during 1996 and the first half of 1997. It picked up slightly again in 1998 but has not yet reached the levels that were expected. In Taiwan and Indonesia also aquaculture production declined in 1996-97. During 1996, world production had declined to about 10% when compared to the previous year of 1995. In 1997, the global production of farmed marine shrimp has been estimated at about 660,200 million tons representing a decrease of about 5% from the 693,000 million tons estimated in 1996 that dropped from the previous year production of 712,000 million tons in 1995 (Jory 1998 and Rosenberg 1997).

1.2 STATUS OF AQUACULTURE IN INDIA

India has a long coastline of over 7,500 km, with several brackish water lakes, estuaries, lagoons and backwaters. The tropical climate with adequate rainfall and good soil conditions makes it ideal for shrimp culture. The brackish water area available in our country is estimated to be about 1.2 million ha of which only around 68,232 ha are now under shrimp farming (Pillai 1997), mostly following the traditional and partly the extensive and semi-intensive methods of culture (Sakthivel 1997). The major states in India, where aquaculture is practiced in the order of importance are West Bengal, Gujarat, Andhra Pradesh, Maharahstra, Orissa, Kerala and Tamil Nadu. The traditional
Paddy cum prawn farming is being carried out in West Bengal, Kerala, Karnataka and Goa in about 50,000 ha. The country has 56 varieties of shrimps of which four species have been considered commercially suitable for aquaculture so far. They are *Penaeus monodon*, *Penaeus indicus*, *Penaeus semisulcatus* and *Penaeus merguensis*.

Aquaculture in India has grown from subsistence activity in early forties to an enterprise, incorporating scientific and technical inputs by the late eighties. The production under the traditional system is very low, ranging from 200 to 500 kg/ha/crop with low valued prawns. In scientific system, the production level increased from 500 to 2000 kg/ha/crop.

The attractive return from shrimp culture has brought small and marginal farmers as well as corporate entrepreneurs into the business. As a result, a variety of shrimp culture operations were developed i.e. extensive, semi-intensive, intensive and improved intensive. In India, in the year 1984, a total area of about 43,000 ha. was under shrimp culture. Extensive system was practised in most of the areas. It yielded a total production of 15,000 tons with an average yield of 0.4 tons/ha. Shrimp culture witnessed a rapid growth during the next few years. A total of 100,700 ha was brought under aquaculture during 1994-95, leading to a production of 83,000 tons and an average yield of 0.8 tons/ha. In 1996-1997, there was a substantial fall in the production and the rate was about 70,000 tons with an average yield of 0.52 tons/ha. Since that time, though the area under farming increased to 1,36,000 ha, the production rate had declined after reaching a maximum of 0.82 tons/ha in 1995 (Kutty 1999).
After 1997 shrimp farms in India have experienced an opposition from some residents of the coastal villages and environmentalists. Supreme Court of India has also ordered the demolition of all the semi-intensive farms within the Coastal Regulation Zone. This has resulted in several complex, social and environmental problems and litigation at national level in the country. The shrimp production development in India has thus suffered a setback in the intensity of aquaculture and per hectare production.

1.3 AQUACULTURE TECHNOLOGY IN INDIA

Generally, four types of aquaculture are followed in India i.e., traditional, extensive, modified extensive and semi-intensive.

1.3.1 Traditional System

Traditional shrimp farming in India is practiced in West Bengal, Kerala, Karnataka, Goa and Maharashtra. In this system, the incoming tidal water is allowed to enter the pond through a sluice gate. The young ones of shrimps along with fingerlings of fishes are brought by the tidal water flux entering in these farms and allowed to grow for 30-35 days and harvested periodically. There is no control over the species specificity, quantity and predators, which results in unpredictable production (200-500 kg/ha/season).

1.3.2 Extensive System

Extensive system is an improved traditional system and is considered as a simple culture method. Either traditional ponds are converted or new ponds are constructed. Water is drawn from the nearby creeks through tidal
fluctuation or by pumping or both. Selective stocking of desired species either collected from the wild or from hatchery is stocked at a rate of 4 to 6 nos/m², depending on the species. Supplementary feeding is done as per requirement and production varies from 0.5 to 1.0 tons /ha/crop.

1.3.3 Modified Extensive System

In modified extensive system, cultured ponds are stocked in optimal stocking density taking into consideration the carrying capacity of the pond with suitable fast growing species. Seeds are mostly procured from the hatcheries. The stocks are fed with supplementary feed. Proper water management facilitating better exchange of water is done. Stocking density in this method varies from 5 to 10 nos/m². Production rate varies from 1 to 3 tons /ha /crop.

1.3.4 Semi-Intensive System

In this system, 0.2 to 2 ha size ponds are used. Water depth is maintained between 0.8 and 1.5m. Water exchange is done to a level of 10-20 % per day. Generally, a nursery phase is also included. Stocking rate is from 20 to 24 nos/ha. Aeration and suitable supplementary feed are provided. Production rate varies from 4 to 5 tons/ha/crop for a culture period of 4 to 5 months.

1.4 PRESENT STATUS OF AQUACULTURE IN TAMIL NADU

Tamil Nadu has a coastline of approximately 1000 km and accounts for 16 percent of India’s total marine production and ranks third among the
exporting states that earn foreign exchanges. Tamil Nadu has a potential area of about 56,000 ha for shrimp culture (MPEDA 1994), of which, only 1935 ha are reported to be under farming of Rs. 5000 crores every year (Shaleesha 1995). The areas under shrimp farming in different coastal districts are given in Table 1.1. Sizeable extents of problematic soil are also available in the coastal regions of Tamil Nadu.

Table 1.1

District wise details of shrimp farms in Tamil Nadu

<table>
<thead>
<tr>
<th>District</th>
<th>Area Under Culture (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kancheepuram</td>
<td>295.50</td>
</tr>
<tr>
<td>Ramanathapuram</td>
<td>122.40</td>
</tr>
<tr>
<td>Tuticorin</td>
<td>309.55</td>
</tr>
<tr>
<td>Nellai</td>
<td>011.70</td>
</tr>
<tr>
<td>Kanyakumari</td>
<td>003.10</td>
</tr>
<tr>
<td>South Arcot</td>
<td>282.13</td>
</tr>
<tr>
<td>Villupuram</td>
<td>006.00</td>
</tr>
<tr>
<td>Thanjavur</td>
<td>196.93</td>
</tr>
<tr>
<td>Nagapattinam</td>
<td>630.00</td>
</tr>
<tr>
<td>Pudukottai</td>
<td>007.06</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1935.19</strong></td>
</tr>
</tbody>
</table>

Source: Durairaj (1995)

In Tamil Nadu, improved extensive method or modified extensive method by utilising both brackish and sea water sources are mostly followed. In
some places semi-intensive farming system has also been practiced and these are located in Sirkazhi, Nagapattinam, Chidambaram, Thanjavur, Cuddalore districts and Karaikal, the union territory of Pondicherry. It is estimated that about 70% of the existing farms in the state practise extensive culture and in a few areas semi-intensive method. During 1993-94, 12,000 tons of shrimp worth of Rs.388 crores with a share of 75% of total marine products was exported from Tamil Nadu.

Tamil Nadu had 33 hatcheries under operation with a total production capacity of 2000 million seeds per annum on the marine sector in 1996. It is estimated that about 30% of the total water spread culture area i.e. 610 ha is under semi-intensive system and produces 4 tons and above per ha/crop. Around 40% of the area (815 ha) is under modified extensive system of culture producing 2 to 3 tons/ha/crop and the remaining area is under extensive farming with a production of 1-1.5 ton/ha/crop. In 1995, the Tamil Nadu government enacted the Aquaculture Regulation Act. As per the provision of the act, each farmer must get an advance license from the government before implementing aquaculture operation.

Despite all these developments, brackish water prawn farming has started picking up only during the last ten years. Since river mouths are closed and fresh water flows are reduced during summer, salinity in the estuaries increases thereby affecting the growth of prawn. Tidal amplitude is also very low. A few estuaries such as Muthupet swamp, Killai backwater, Vedaranniyyam canal etc. are found to be good for aquaculture development. The State Government has announced a policy and taken steps to allot land to entrepreneurs and co-operative societies of fishermen. Some enthusiastic
entrepreneurs have started utilising the salt pan areas for prawn farming with encouraging results (MPEDA, 1994).

1.5 NEED FOR AQUACULTURE

In a country like India with a vast coastal area, ever-increasing population and the consequent pressure on scarce resources, aquaculture provides solution in more than one way. It provides gainful employment to thousands of people. A properly maintained aqua farm is eco-friendly and it is a good source of earning foreign exchange. Aquaculture provides rich protein, minerals and vitamins for the ever increasing population. In certain cases the treated effluent water from the aquafarms enhances the plankton production in the receiving water bodies. Aquaculture also contributes to the additional income of rural people through reuse of degraded lands. Experience in many developing countries indicates a reasonable income from aquaculture production. Hence, aquaculture needs to be developed on a large scale and in a sustainable manner.