GENERAL INTRODUCTION
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Production of sea food is derived from both capture and culture fishery. Although the capture fishery is most important contributor of food, but has its own limitations. The world’s capture fisheries production estimated at 70 million tonnes per year during 1970-75 could be increased only to 100 million tonnes per year with the help of scientific management of the available resources (Wheaton, 1977). On the contrary, the total world production through aquaculture was 12 million tonnes for the year 1986 (FAO, 1989) and which could be increased to many folds by tapping 108 million hectares of potential area available for aquaculture through introduction of modern and advanced culture techniques. Thus, aquaculture holds the key for more food production to supplement the land based crop and live stock production.

Existing trends indicate that, shrimp farming has a greater potential all over the world. The increase in consumer demand for shrimp has given great impetus to shrimp farming in recent years. Production of farmed shrimp in 1987 was estimated to be around 1,75,000 tonnes and is growing rapidly (Mylwaganam, 1988). In developed countries super-intensive, intensive and semi-intensive prawn culture practices are followed, while in the developing countries,
it is still restricted to extensive type. For the intensive and extensive farming of prawns, the availability of seeds (young stages) from the wild is insufficient due to many constraints, such as seasonal abundance, large variation in quantity and unwillingness on the part of fishermen to collect the seeds out of fear of depletion of the natural recruitment of the fishery. Since the successful rearing of the larvae of *Penaeus japonicus* by Hudinaga (1942) under laboratory conditions, technological innovations have substantially helped in enhancing the highest survival rates of prawn seeds on large scale to meet out the growing demands.

In the hatchery system, the prawn larvae are generally reared until they attain stockable size of 15 to 20 mm. However, the rearing of the larvae and post larvae to the stockable size is a critical task. The nauplii utilise their internal yolk as food and after metamorphosis, the protosoea and early mysis larvae feed on phytoplankton. The late mysis and post larvae are zooplanktivores. Hence, these stages are vulnerable to starvation if adequate supply of proper food is not provided. Thus the proper choice of feed is of vital importance in determining the success of an hatchery.
Generally in hatchery operations the food provided for the larvae are of three types viz., live, artificial and a combination of live & artificial feeds. In the case of live feeds an early breakthrough was brought about by Hudinaga (1942), who successfully reared the larvae of *P. japonicus* on live feeds. The protozoa and early mysis stages were fed with a diatom, *Skeletonema costatum*, while *Artemia* nauplii became a staple food for late mysis and post larvae.

Several workers tried to rear the early prawn larvae using various species of phytoplankton namely Chaetoceros, *Nitzschia, Tetraselmis, Thalassiosira* etc. (Liao and Huang, 1973; New, 1979; Muthu, 1980). The late mysis and post larval stages were fed by zooplankters such as *Artemia* nauplii (Branchiopod), *Brachionus plicatilis* (Rotifer), *Tigriopus* sp, *Tisbe* sp, *Buteromora* sp, (Copepods), *Panagrellus* sp, (Nematod) and *Moina* sp, *Daphnia* sp, (Cladoceran) (Shigueno, 1969; Gopalakrishnan, 1976; Maguire, 1979).

Various types of artificial feeds either individually or in combination with live feeds were tried by several workers (Imamura and Sujita, 1972; Qasim and Basteron, 1974; Hirata et al., 1975; Jones et al., 1979; Hameed Ali, 1980; Sumitra-Vijayaraghavan and Ramadhah, 1980; Alikunhi et al., 1982; Hameed Ali et al., 1982; Mohamed et al., 1983), but none of them have yet been proved more efficient than live food.
Despite the best efforts of scientists the world over, no artificial diet has yet been produced that supports long-term growth and survival comparable to that of live food organisms (Bromley and Howell, 1983; Cowey and Tacon, 1983). Even the most advanced artificial diets such as microencapsulated diets have achieved only limited success in replacing the live foods.

All over the world, the prawn hatchery both at experimental and industrial level have to rely heavily on live foods. A multifarious group of zooplankters are being used as food organisms in hatcheries. Among them species of Artemia nauplii, Brachionus, Tigrionus, Tisbe, Buteromora, Pseudodiaptomus, Acrocladus, Fanagrellus, Daphnia and Moina are widely used for rearing late mysis and post larvae of prawns.

The brine shrimp, Artemia salina has been found to be an excellent food for a diverse group of cultivable organisms. Kimne (1977) has indicated that more than 85% of the marine animals cultivated so far have been offered A. salina as feed. In the shellfish and finfish hatcheries the Artemia sp are offered to the larval stages in the form of freshly hatched nauplii (Brick, 1974; Sulkin et al., 1976; Mansi and Maddox, 1980; Johns et al., 1981). About 50 strains of brine shrimp have so far been registered from various countries and continents. However, not all of them perform equally well
and variation does exist. Sorgeloos (1980) has reviewed the nutritional value of *Artemia* nauplii for various cultured species along with reasons for the poor performances of certain strains.

Freshly hatched *Artemia* nauplii were found to be a better food source to the larvae of *Penaeus monodon*, *P. indicus*, *P. kerathurus*, *Metapenaeus monoceros*, *M. ensis*, *M. endevouri*, *Macrobrachium rosenbergii* (Sorgeloos-unpublished) and *P. semisulcatus* (Al-Hajj et al., 1983). In recent years the use of decapsulated cysts of *Artemia* in rearing the larvae of *P. monodon*, *M. ensis*, *M. endevouri*, *M. rosenbergii* (Lavina and Figueroa, 1981) and *M. monoceros* (Royan, 1980) have shown good survival rate. The larvae of penaeid shrimps have been observed to accept the frozen nauplii equally well as that of live *Artemia* nauplii (Mock et al., 1980).

The rotifer, *Brachionus plicatilis* has been used as an excellent food source for rearing larvae of various kinds of small freshwater and marine fishes (Theilacker and McMaster, 1971; Gatesoupe and Luquet, 1981; Watanabe et al., 1983). It has been reported that, due to their small size, rotifers can be introduced into the culture tanks when the larvae are in protozoal stages (Bl-Amad, 1982; Al-Hajj et al., 1983). However, the larvae of *P. japonicus* did not show much variation in growth when fed with either frozen or live rotifers (Yamasaki et al., 1981; Yamasaki and Hirata, 1982).
Copepods form an important food in rearing of advanced larval stages of prawns. The post larvae of *P. japonicus* were reared successfully using copepods (Hudinaga and Kittaka, 1966; Shigueno, 1969; Liao and Huang, 1973). The copepods were found to be the most common food of very young fishes (Blaxter, 1965). The fish larvae of Atlantic herring (*Clupea harengus*), pilchard (*Sardina pilchardus*), anchovy (*Anchoa mitchilli*), scaled sardine (*Harengula percolae*), sobaity (*Acanthopagrus cuvieri*) and milk fish, (*Chanos chanos*) were reared successfully using copepods as feed (Blaxter, 1969; Rosenthal, 1969; Detwiler and Houde, 1970; James and Al-Khars, 1984; James and Thirunavukkarasu, 1986).

Among the freshwater zooplankton, the organisms belonging to cladoceran group have been widely used in shellfish and finfish hatcheries. Although they are freshwater inhabitants but have been successfully used in the frozen conditions to feed marine organisms (Norman et al., 1979). Two important genera viz. *Daphnia* and *Moina* have been established as sole live food organisms in culturing fish fry (Iveleva, 1973; Masters, 1975; Chen, 1979), penaeid prawn larvae (Muthu, 1980) and non-penaeid prawn larvae (Aniello and Singh, 1980).
The subsistence of any organism mainly depends on the nutritive value of the feed, in terms of the availability of protein, lipid, carbohydrate, vitamin and minerals at an appropriate level. An important determinant of the overall nutritional value of any foodstuff is its lipid content (Schauer et al., 1980). Lipids are the major source of metabolizable energy and are directly related to the growth of the organisms (Pandian, 1975).

In particular, four specific dietary fatty acids, linoleic (18:2\omega 6), linolenic (18:3\omega 3) eicosapentaenoic (20:5\omega 3) and docosahexaenoic (22:6\omega 3) are now known to be essential for good growth and survival, in view of the limited ability of prawns to synthesize them de novo (Wickins, 1986).

Several workers have reported that Artemia and other zooplankters have shown variation in fatty acid profile in various types of food (Hinchcliffe and Riley, 1972; Claus et al., 1979). The rotifers fed exclusively on baker’s yeast lacked the highly unsaturated fatty acids; enrichment with algae for 8-24 hours, fulfill the essential acids. Artemia have been classified into two types according to the fatty acid composition. The freshwater type; containing a high concentration of 18:3\omega 3 which is an essential fatty acid for freshwater fishes and other the marine type which is high in 20:5\omega 3 required for marine fishes (Watanabe et al., 1978).
The copepods *Tigriopus* sp. and *Acartia* sp. contain relatively high amount of 20:5ω3 irrespective of culture media and organisms (Watanabe *et al.*, 1980). The *Daphnia* sp. and *Moina* sp. have shown low fatty acids when fed with yeast, but gained the high contents of 20:5ω3 when fed with poultry manure and algae. The observations manifest the importance of essential fatty acids in the dietary requirements of live food organisms.

The maintenance, repair and growth of body tissues are mainly controlled by the availability of protein. It is therefore, essential that dietary protein be well balanced with essential amino acids (Seidel *et al.*, 1980) and be available at an optimum level. In penaeid and non-penaeid prawns the amino acids, namely arginine, histidine, leucine, isoleucine, lysine, methionine, tryptophane, phenylalanine, threonine and valine have been proved to be highly essential (Cowey and Forster, 1971; Watanabe, 1975; Miyajima *et al.*, 1977; Kanazawa and Teshima, 1981).

In prawns the carbohydrates are not an essential component of the diet and its levels are of secondary importance when compared to lipids and proteins. Nevertheless, the nutritive value of carbohydrates has been assessed by a number of workers (Kitabyashi *et al.*, 1971; Andrew *et al.*, 1971;
1972; Sick and Andrews 1973). The protein sparing action of carbohydrate as indicated by Ali (1982), elucidated that the carbohydrate levels in the diet can be enhanced up to 40% to offset higher levels of protein in feed, thereby bringing down the cost of feed preparation.

The nutritive value of live food organisms show variation when cultured on different varieties of food ingredients. Their nutritive value could be modified according to the requirement of larvae, through enrichment with algae and fortified products (Hinchcliff and Riley, 1972; Wickins, 1972; Watanabe et al., 1978; Claus et al., 1979; Sakamoto et al., 1981).

It is well understood that the food value is species specific and hence study was conducted to assess and compare the food value of zooplankters viz., Artemia nauplii (Brachipoda), Brachionus plicatilis (Rotifera), Nitocra orientalis (Harpacticoidea), Pseudodiaptomus annandalei (Calanoida), Oithona sp. (Cyclopoida) and Ceriodaphnia cornuta (Cladocera) as feed to the post larvae of Penaeus merguiensis.

The thesis embodying the results of investigations comprises of two parts.
Part I comprises of: 1) Production of rotifer (B. plicatilis), harpacticoid copepod (N. orientalis), calanoid copepod (E. annandalei) in different salinity conditions. 2) Production of rotifer in different cell densities of a microalgae. 3) Production of copepods and cladoceran under different feeds. 4) Mass culture of rotifers, copepods and cladocerans and 5) The nutritive value of zooplankters to evaluate the nutritional status by proximate analysis, amino acid composition and calorific content.

Part II deals with the evaluation of the efficiency of zooplankters feed on post larvae of P. marguiensis.

A concise summary revealing the salient findings of the investigations is also given separately.

The tables are inserted at appropriate places in the text. Illustrations are given wherever necessary. The references referred in the text are cited at the end of the thesis.