

PREFACE

Prawns and shrimps occupy an important place in the marine Fisheries of India. The present prawn production of the country, contributed by penaeid and non-penaeid prawns, is of the order of about 0.2 million tonnes annually. The penaeid prawns, forming about 62% of the total marine prawn catch, greatly influence not only the prawn production of the country, but also the sustained growth and development of the marine products export trade. The intense exploitation of the penaeid prawn resources over the time and space has resulted in near stagnation or declining trend in their production in recent years. This situation has lead to an urgent need to develop the prawn culture in the coastal waters to augment the production and to an awareness to change over the prevailing traditional prawn culture practice to the more beneficial system of culture entailing selected fast growing species, supplementary feeding and effective water management. With the advent of hatchery technology for production of penaeid prawn seed and other technological advancements, the prawn culture fisheries is now witnessing a rapid growth in several regions including India.

Feed is one of the major inputs in the hatchery production of prawn seed and their subsequent culture in the grow-out ponds to marketable size. Among the different types of feed, the development of nutritionally balanced compounded formula feed has gained considerable attention due to its distinct advantage of preparation and mass production using low-cost ingredients and its use off-the-shelf wherever and whenever required. In fact, this aspect has been given top priority

in the aquaculture programmes.

A comprehensive knowledge of the nutritional requirements and related aspects of the candidate species selected for culture and of the characteristics of the food sources used in the formulation and preparation of the compounded diet, is an essential prerequisite for evolving balanced feeds. Over the past 20 years, there has been considerable progress in the study of dietary nutrient requirements of fishes and shellfishes including prawns. Several compounded feeds using a variety of conventional and non-conventional ingredients and having different levels of protein, lipid, carbohydrate, vitamins and minerals have been developed and some of them are being used in the semi-intensive and intensive culture of prawns abroad. As the efficacy of the compounded feed, among other factors, depends greatly on the judicious manipulation of the selected ingredients and since the cost of feed plays a significant role in the economics of the overall prawn culture operation, the search for more suitable and economical food sources and their evaluation vis-a-vis the nutrient profile, nutritional and growth requirements of the cultured species is still continuing vigorously.

In India, directed research on penaeid prawn nutrition was taken up only recently when the aquaculture of prawns gained momentum. One of the important penaeid prawns sought for culture and has great potential is Penaeus indicus, H. Milne Edwards. The Central Marine Fisheries Research Institute working on different aspects of culture of this species over the past one and half decades, has developed a hatchery technology

for mass production of its seed and has suggested several improvements on its farming in the grow-out systems. One of the areas of active research in this direction has been on the nutrition of the species with a view to develop suitable feed not only for hatchery production of seed, but also in the field culture. As part of this investigation, the present study, on the evaluation of different protein and carbohydrate sources and mineral requirements for the juvenile P. indicus was taken up and the results obtained are embodied in the thesis.

The thesis is parted in four chapters. In the first chapter, the evaluation of four purified proteins, albumen (egg), casein, fibrin (blood) and gelatin and nine natural protein sources - five animal materials (clam meat, fish meal, mantis shrimp, prawn waste and silkworm pupa), four plant materials (coconut cake, gingelly cake, groundnut cake, single cell protein Spirulina) for the juveniles of P. indicus, is presented. These evaluations are carried out employing the standard methods of nutritional biochemistry by determining the digestibility, biological value (BV), net protein utilization (NPU), protein efficiency ratio (PER) and growth.

In the second chapter, seven different sources of carbohydrates - three monosaccharides (fructose, galactose, glucose), two disaccharides (maltose, sucrose) and two polysaccharides (glycogen, starch) were evaluated in the diet of P. indicus. The effect of carbohydrate level in the diet on digestibility, growth, food conversion ratio and survival were

investigated and discussed. The role of cellulose in the diet of prawn was elucidated.

The third chapter contains the results of the studies on the requirement of six minerals (calcium, phosphorous, copper, zinc, magnesium and manganese) in the diet of P. indicus. The requirement of each of the minerals was determined by not only measuring the growth, food conversion ratio and survival but also by investigating the relationship between the dietary levels and body levels of each mineral.

Based on the information obtained in the present study, a purified diet and a practical feed were formulated, prepared and fed to P. indicus in long term feeding experiments in the laboratory, and the results were compared with those of a conventional prawn feed. The prospects of using the purified diet as a basal diet for nutritional studies on prawns in this region and the practical feed for the culture of penaeid prawns are discussed in the fourth chapter.

Nutritional research on the prawn P. indicus was initiated by the author by studying the relative efficiencies of some proteins and the effect of protein (Ahamad Ali, 1982a), carbohydrate (Ahamad Ali, 1982b) levels in the diet on growth, food conversion ratio (FCR) and survival. Subsequently, different sources of lipids were evaluated and the role of vitamin and mineral mixtures in the feed of the same prawn were studied. The relative efficiencies of different binding materials in preparing water stable feed pellets were investigated (Ahamad Ali, 1986). Using the experience gained in the field of nutrition,

feed formulation and feed preparation techniques, the author evolved certain compounded formula feeds with locally available feed ingredients for feeding the larvae (Mohamed et al., 1983), Post larvae (Ahamad Ali and Sivadas, 1983) and juveniles (Ahamad Ali and Mohamed, 1985) of P. indicus. However, gaps still existed in the knowledge, especially on the carbohydrate, minerals and protein nutrition of this prawn and these aspects have been taken up for investigation in the present study.

As envisaged, the results obtained in the present study have provided valuable information on the missing links in the protein, carbohydrate and mineral nutrition of penaeid prawns in general and of P. indicus in particular. The data are immensely useful in the selection of a better protein source for formulating suitable and economical compounded feeds for use in feeding the prawns on large scale culture. The investigations on carbohydrate nutrition have great practical utility in formulating high efficiency - low cost practical feeds. The information obtained on mineral requirements would go a long way in preparing nutritionally more balanced feeds, thus contributing to the establishment and promotion of an organised prawn culture industry in the country.