GENERAL INTRODUCTION
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Crustaceans comprising numerous edible species of prawns\(^1\), lobsters and crabs inhabiting different ecosystem form significant portion of the aquatic food resources of the world. India has ever remained one of the major contributors to the world production of marine crustaceans. The country’s average annual production of 0.29 million tonnes during 1984-1995 formed about 8% of the total crustacean landings of the world and 60% of the Indian Ocean.

Among the crustaceans, prawns are the most commercially exploited group and hold premier rank by virtue of their importance as an esteemed food of gourmet and on account of their high export value. As in the case of most tropical region, the prawn fisheries of India is multispecies in nature. The common species supporting the prawn fishery in India belong to two major categories namely the penaeid prawns and caridean prawns. Among the penaeids, members of the family Penaeidae are the most highly preferred for export on account of their larger size and higher unit value as compared to other categories. The penaeid prawns constitute the backbone of the seafood export industry of the country. Among the fishery products exported from India during 1994-95 shrimp was the principal commodity forming 33.01% in volume (101751 t) and 70.21% in value (2510.94 Crores) (Varghese, 1996).

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\(^{1}\) There is no consistency in the usage of the terms, “prawns” and “shrimps” to denote any particular group of Natantia (Holthuis, 1980). In the present work, these terms are used analogously.
The penaeid prawns with an average annual landing of 1.96-lakh t constituted 7.6% of the total marine fish landings of India during 1996-97. Kerala with 67838 t of penaeid prawn catch during this period (1996-97) accounted for 35% of all India and 46% of west coast landings of penaeid prawns (CMFRI, annual report 1997-98, 1998-99).


*Trachypenaeus curvirostris* (Stimpson 1860) known as, ‘southern rough shrimp’ (FAO name) and 'Pullan' (common vernacular name used in the industry) which was available till recently in stray catches only has of late acquired the status of a commercially important marine penaeid prawn of
India. During 1995, *T. curvirostris* catch constituted 10% of the marine penaeid prawn landings at Sakthikulangara. *T. curvirostris* attains a maximum length of about 103 mm and has a very good market. In Kerala till recently a fishery for this species was nonexistent with only stray recordings in the prawn landings. However substantial increase in the catches of southern rough shrimp has been noticed along the Kerala coast from the late eighties onwards, due to advent of multiday fishing and changes in the fishing pattern involving shrimp trawling in deeper grounds and introduction of night fishing. Practically there is no information on the fishery and biology of *T. curvirostris* from the fishing grounds off Kerala coast or for that matter from any where along the coast of India. Thus realising the growing importance of *T. curvirostris* in the capture fisheries, it was felt, that it would be ideal to carry out detailed study on this species for rational exploitation and management of its fishery. Hence, the present work entitled, "Biology, fishery and population characteristics of the southern rough shrimp *Trachypanaeus curvirostris* (Stimpson 1860) in waters off Quilon, south west coast of India" was undertaken during 1996-97.

pescadoreensis from Palk Bay off Mandapam. Details on the study made by different research workers on *T. curvirostris* are given in the relevant chapters of the present work.

Suseelan *et al.* (1989) reported the occurrence of *Trachypenaeus* species in various depth zones in exploratory trawling conducted off the coast of India.

*T. curvirostris* spends its entire life in the sea itself and does not enter the estuaries and backwaters. Hence the biology and fishery of this species was studied from the trawling grounds off Quilon (Sakthikulangara). Sakthikulangara Fisheries Harbour, which is one of the major fish landing centres of Kerala coast, was selected to collect the data on catch and effort and other biological aspects on the southern rough shrimp harvested from inshore regions. The location of the study centre is shown in Figure 1.

The thesis is laid out in seven chapters comprising TAXONOMY, FOOD AND FEEDING HABITS, AGE AND GROWTH, REPRODUCTION, LENGTH-WEIGHT RELATIONSHIP, FISHERY AND POPULATION DYNAMICS.

In the first chapter, the systematic status of *Trachypenaeus curvirostris* (Stimpson, 1860) with an objective to confirm the identity of the species and its general distribution are given. Each of the remaining chapters has been partitioned into various sections such as introduction, material and methods,
Figure 1. Location of the study centre.
results and discussion. Study of food and feeding habits and assimilation are of fundamental importance in understanding the rate of growth, population concentration, gonadal maturation and other metabolic activities. Hence the details on the food and feeding habits of *T. curvirostris* from inshore regions were studied and given in the second chapter. In order to get a summary picture of frequency of occurrence as well as volume of various food items the method of 'Index of Preponderance' (Natarajan and Jhingaran, 1961) was used. Based on the Index, the importance of each individual food item was determined. Variations in food and feeding habits based on size and sex in its natural environment was studied and discussed. Seasonal and diurnal variation in feeding habits and intensity of feeding were also carried out.

Knowledge of age and growth is one of the basic requirements for the study of population dynamics of any resource, which in turn helps to evolve suitable management policies. The age and growth of *T. curvirostris* have been studied by using von Bertalanffy growth model (von Bertalanffy, 1938) and the results are given in Chapter 3. The model involves three parameters namely the asymptotic size, growth coefficient and age of individual at zero size. The first two parameters were estimated by modal progression and Ford-Walford method (Ford, 1933; Walford 1946) and the age at zero size by Gulland's method (1969). Alternatively, these parameters for the above model were also estimated by ELEFAN I method (Pauly and David, 1981).

In the next chapter on reproduction, the details on size at maturity of males and females of *T. curvirostris*, the different stages of maturation in
females along with ova diameter of the respective stages and fecundity are
given. The particulars on the spawning season, spawning population in the
fishery, spawning frequency and sex ratio are also included. The length-weight
and other dimensional relationship of *T. curvirostris* are given in the fifth
chapter.

The Sakthikulangara Fisheries Harbour was visited regularly during
1996-97 and the details on prawn fishery carried out by shrimp trawlers were
collected. In the sixth chapter on fishery, the following details are given: the
general trend of prawn fishery of Kerala during 1996-97, the prawn fishery of
Sakthikulangara, effort fluctuations, species composition of the prawn catch,
the fishery of *T. curvirostris* year-wise and for the total period of study (1996-
97), its fishery season, peak period of occurrence and seasonal movement etc.

In the final chapter on population dynamics, the instantaneous rate of
total mortality (Z) natural mortality (M) and fishing mortality (F) of *T.
curvirostris* are given. Estimation of 'Z' was done using 1. Catch curve
method of Pauly (1982), 2. Cumulative catch curve method of Jones and van
method (1987). The natural mortality rate (M) was estimated by Rikhter and
Efanov's formula (1976). Using the input from the length cohort analysis, the
effect of fishing on yield was determined by following Thomson and Bell
yield model (1934). Yield per recruitment model (Beverton and Holt, 1957)
was used to study the effect of first capture and fishing mortality on the yield
of *T. curvirostris*. The present position of southern rough shrimp stock in relation to fishing intensity is also explained in this chapter.

The salient features of the present study on fisheries biology and population characteristics of the southern rough shrimp, *T. curvirostris* are summarised followed by a list of reference cited in the text.