XI GENERAL OBSERVATIONS

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From the foregoing sections it may be seen that against the background information on the biology and resources of the prawn species now available, an attempt is made to give a comprehensive account of the present status of their fishery in India which ranks pre-eminently high among the shrimp producing countries of the world. There has been no intention to give a complete account of the varied items of prawn investigations undertaken at this Institute and other organisations in this region but to sieve out and highlight only the basic facts which are relevant to the exploitation and management of the resources.

The more important prawn species supporting fisheries in this region have been fairly well-known since the pioneering work of Alcock and Anderson (1894). Yet, in respect of a large number of prawn species, there has been a great deal of confusion of their synonimies and nomenclature. Some of the penaeid prawns now regarded as belonging to distinctly separate species were clubbed along with closely related forms. A real break through has been effected when the Central Marine Fisheries Research Institute undertook the crustacean fishery investigations over two decades ago. At the very outset all the commercial species have been carefully re-examined, identified and systematically classified establishing their synonimies. Since then more and more species hitherto not known from the seas around India have been reported upon. This only shows that our knowledge of the species abundance in this region is far from complete. We are dealing with a group, most of the member species of which have an extensive range of distribution over the entire-Indo-Pacific region and it is therefore not surprising that almost any exploratory survey carried out especially in deep waters brings to light some interesting forms which commonly occur elsewhere in the Indo-Pacific. With the present back-ground information on the subject and the well-trained personnel readily available, it

should be possible to devote some attention in future too to study the systematics, for this knowledge is pre-requisite to any biological investigation. It is needless to say that biological investigations are of little value if they are riddled with taxonomic inaccuracies arising out of mistaken identity of the concerned species.

Of primary importance in the estimation of resources are the catch statistics which the Institute has been able to furnish not only in respect of prawns but also of all other groups in the marine fish landings. The regional distribution pattern of the penaeid and non-penaeid groups of prawns has been studied and their seasonal fluctuations have been assessed. The production trends of crustaceans, especially prawns in our marine fish landings are comparatively more stable than those of some of our pelagic fish species like the oil sardine and the mackerel which are subject to violent and unpredictable fluctuations. In the ten year period of 1959-1968 the annual averages of the penaeid prawns, the non-penaeid prawns and other crustaceans have formed 47,538 (56.10%), 34.161 (40.32%) and 3,035 (3.58%) metric tons respectively, the total crustaceans amount to 84,734 metric tons comprising 10.89% of the annual average of all marine fish estimated at 777,733 metric tons. In the state –wise landings, Maharashtra has ranked first contributing to the extent of 47.82%, Kerala 27.25%, Tamil Nadu (Madras) 6.67%, Andhra 5.77%, Gujarat 5.41% West Bengal and Orissa 4.01% Mysore 1.90% and other areas 1.17% to the total crustaceans. More than 85% of the prawn catch comes from the west coast landing centres.

The penaeid prawns are generally of large size and are of higher value than the non-penaeid prawns as the former are in great demand by the processing concerns that cater to the needs of foreign markets. Although Maharashtra's prawn landings are the highest among those of the maritime states, the bulk of the catch i.e.,77.77% is formed of non-peneid species and only 22.13% of the penaeid forms. Kerals's prawn production is very important as the penaeid prawns in the region constitute 98.87% of the total crustacean landings.

In the All-India annual average landings of penaeid prawns in the past ten years, among the important ones, *Metapenaeus dobsoni* has formed 33.81%, *Parapenaeopsis stylifers* 17.17%, *Penaeus indicus* 11.68%,

Metapenaeus affinis, 9.66% *M. brevicornis* 6.89%, *M. monoceros* 4.40% *Parapenaeopsis hardwickii* 3.62% *P. Sculptilis* 2.52%, *Penaeus monodon* 2.78% *Solenocera indicus* 1.34% and *Penaeus merguiensis* 1.34%. *P. semisulcatus* and *P. penicellatus* have formed less than 1% each. Among the non penaeid varieties *Acetes* spp. have constituted 39.56% *Palaemon tenuipes* 17.89%, *P. styliferus* 11.52%and *Hippolysmata ensirostris* about 7%.

In the past two decades, the exploratory fishing vessels of the Government of India surveyed vast regions on the continental shelf both on the east coast and the west coast and helped the Institute to furnish valuable information on the potential prawn resources and their seasonal abundance. The results of these on careful analyses present a clear picture of the distribution pattern of the prawn resources covering different depth ranges across the shelf. A large number of very productive areas have been discovered where the catch rates obtained have proved to be extremely high. In the execution of the collaborated programmes of this Institute with the Governmental organisations, fairly extensive deep sea prawn beds beyond the 100 fathom line on the continental slope and in still deeper regions have been discovered off the southwestern coast and these hold promise of supporting fisheries of some magnitude if carefully exploited. In this connection, it is worth noting that the exploratory fishing by R.V. *Varuna* in depth ranges of 275-374 metres around latitudes 10^0 41'N to 10^0 53'N and longitudes 75^0 08'E to 75^0 21'E has revealed good concentrations of *Aristeus semidentatus,* a fairly large sized prawn suitable for export trade. *Penaeopsis rectacutus, Heterocarpus* spp., *Parapandalus spinipes* and *Plesionika* spp. have also been recorded in fairly high concentrations in adjacent deeper waters.*

While the exploratory surveys carried out have indicated the possible prawn resources in certain regions, by far vast areas on the continental shelf and on the slope beyond remain unexplored. As the ten mile wide coastal belt at present is very regularly and intensively exploited, the future scope for expansion of prawn fisheries depends to a large extend on the as yet untapped resources of the shelf and the slope.

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* Silas, E.G. 1969: *Bull. cent. mar. Fish. Res. Inst.*, No.12.

Biological information on age and rate of growth, food and feeding habits, maturation and spawning of almost all the penaeid prawns and some of the palaemonid species has been gathered in some detail. All penaeid prawns of our coasts are known to breed in the sea. While the larvae and juveniles of *Parapenaeopsis stylifera* remain in the sea for further growth and sexual maturity, those of the other penaeid prawns enter the backwaters and estuaries where they feed and grow for some months and return to sea for further growth, sexual maturity and breeding. Whether it is essential for the juveniles of the penaeid prawns to enter the backwaters and the estuaries to spend a part of their life is not fully known. The factors determining their migrations are as yet little understood. From the study of the distribution of the mature and spent individuals it appears that each species shows a preference to certain specified depth zones.

There is paucity of information on the embryonic and early larval development in regard to many of the marine prawns species of the family penaeidae, because of the attendant difficulties in rearing them under laboratory conditions, but in most cases the planktonic larvae have been traced through successive stages and compared and connected with the adult. Of the penaeid prawns the life history of *Metapenaeus dobsoni* which is the most important of the commercial species has been worked out in great detail at this Insitiute. The diagnostic characteristics of the post-larvae of *Penaeus indicus,M. monoceros, M. affinis, M. dobsoni* and *Parapenaeopsis stylifera* have been studied and keys to their identification have been prepared; information on the postlarvae of the less common penaeidae like *Solenocera indica* is also now available. It is gratifying to note that almost all the planktonic larvae of the commercially important prawns can readily be identified with the available information on the subject. Information regarding members of the palaemonid group is more complete on account of the comparative case with which the early developing stages could be handled under confined conditions for observations. Investigations carried out over a period of some years have shown that the larval and postlarval abundance of certain penaeid prawn species provides an index to determine the magnitude of the forthcoming prawn fisheries in the coastal waters of Cochin.

In regard to *Macrobrachium rosenbergii* the breeding grounds have been observed in slightly saline waters of the Vembanad Lake in Kerala and the nursery grounds for the young in the river system debouching into it. These findings help to promote cultural practices with the readily available stocks of young ones from sources now known. This, with transplantation of the adults or the young ones to other river systems helps appreciably in increasing prawn production.

Prawn trapping in paddy fields which are subject to tidal flow has been in practice on an extensive scale in Kerala. The major portion of the prawn catch is composed of small juveniles, the demand for which in recent years has decreased considerably with the increasing demand for larger-sized ones by the export trade in frozen prawn. However, experimental observations have shown that these fields not merely help capture of prawns but also provide suitable biological environment for life and growth of the juvenile prawns that culturing the juveniles under such conditions for about a month could result in relatively better catches of larger-sized prawns. The knowledge so far obtained on prawn rearing should assist in undertaking cultural practices on a large scale, utilizing the low lying shallow coastal lagoons and backwaters as is being done in some of the southeast Asian countries.

Regarding environment data, a certain amount of basic information on the hydrology and planktology of the waters over the shrimp beds has been collected. Seasonal catch trends have been correlated with cyclical changes in the environmental factors where possible. Particular attention has been given to the study of vertical acceleration of silt laden waters in the regions of "mud banks" during the south west monsoon period where dense congregations of prawns occur supporting fisheries of some magnitude. However, the available environmental data are still incomplete to interpolate the catch data and the causative factors behind the seasonal and annual fluctuations.

The Institute has very early initiated investigations on chloride regulation in prawns with a view to studying adaptations to estuarine and brackish water conditions. The penaeid prawns have an osmotic behaviour similar to marine palaemonids. They have osmoregulatory powers, regulating the chloride content of the blood when they are in the

media of different salinities. The higher salt content of the blood of the palaemonids when compared to other invertebrates is a factor which determines their ability to enter the estuaries and brackish waters. It is also known that sexually mature individuals are less resistant to variations in salinity media. Thus, although a few basic facts about osmoregulation are known, information on varied aspects of crustacean physiology relating to growth, breeding and migration is still lacking. Marking and releasing experiments on some of the more important prawn species have been initiated and it is hoped that these would help in better understanding of the rate of growth, migrations etc.

In the pre-war years the export trade in shrimps from India fetching hardly a few million rupees consisted of sundried, 'semi-dried' and pickled products on a limited scale to the far eastern countries. In the early post-war period a new industry has sprung up for freezing and canning of shrimps and this has so rapidly advanced that India is now the second foremost among the shrimp exporting countries trading with the United States of America which is the world's largest importing country in processed shrimp. India has exported shrimp and shrimp products worth nearly 190 million rupees of foreign exchange in 1968. The industrial concerns who have invested substantial amounts on this business around Cochin, which is the most intensively fished region on our coast for prawns, have rightly an apprehension that the trade in the coming years might be shifted by the increasing competition particularly in the context of the fall in the catch per hour returns and reduction in the average size of the prawns obtained in recent years. Statistical observations so far made at this Institute have not indicated any signs of depletion. Variation in average size is dependent on fluctuation in relative abundance of the different species composing the catches. It may however be admitted that the fishing pressure is ever on the increase and probably we are almost reaching the optimum level of exploitation in these most intensively fished areas. The effect of any further increase in fishing effort on the potential prawn resources in the region needs careful watching. In conclusion it may be said that our scientific investigations should be directed towards stabilizing the prawn yields in this region and cautioning the industry before it

is late to regulate fishing effort. Besides initiating commercial exploitation of the recently discovered prawn grounds in the deeper waters of the shelf and the slope, a surer approach to step up production is the intensification of fishing effort in grounds other than those around Cochin, viz., those in the central and northern regions on the west coast and around the estuaries and the vicinities of backwaters along the east coast. There is also the need, as stated earlier, for conducting exploratory surveys for locating new prawn beds. The status of the prawn fishing industry is eminently high at present and the projects for expansion in future are yet brighter for we are coming to know more and more about the distribution and magnitude of the currently exploited as well as the untapped resources, against an increasing knowledge of the biology of species supporting the fisheries.

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APPENDIX

Export of Shrimp and Shrimp Products from India during 1960-1968

Year		Frozen Prawns	Canned Prawns	Dried prawns	Other prawn Products*	Total
1960	Q	1,211,165	319,510	-	-	1,530,675
	V	5,866,123	1,784,047	-	-	7,650,170
1961	Q	1,462,656	621,773	-	-	2,084,429
	V	7,366,872	4,222,907	-	-	11,589,779
1962	Q	2,238,190	969,923	-	-	3,208,113
	V	10,820,276	6,558,924	-	-	17,379,200
1963	Q	3,966,899	1,231,274	2,808,675	255,015	8,261,863
	V	21,203,766	7,575,594	9,324,698	84,363	38,104,058
1964	Q	5,870,031	1,073,927	3,008,650	511,870	10,464,478
	V	31,518,242	6,991,927	8,996,764	128,573	47,635,506
1965	Q	7,028,121	1,148,002	1,702,270	104,896	9,983,289
	V	41,421,834	9,505,799	5,446,894	69,728	56,444,255
1966	Q	8,783,545	1,523,327	1,463,142	83,269	11,853,283
	V	88,791,851	18,656,606	5,270,682	65,983	112,785,122
1967	Q	11,173,489	2,200,383	1,540,089	127,156	15,041,117
	V	129,808,364	31,243,273	8,961,115	128,573	170,141,325
1968	Q	14,397,425	2,237,923	1,410,759	13,647	18,059,754
	V	156,340,498	26,156,195	7,258,581	84,971	189,840,245

Q – Quantity (in kg); V – Value (in Rupees).

Source: Marine Products Export Promotion Council, Ernakulam.

* Prawn powder and prawn pickles.