X CRUSTACEAN PRODUCTION IN INDIA

By

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The crustaceans form a very important fishery in India. The average production of marine crustaceans based on the 10 years data from 1959 to 1968 was estimated at 84,734 tonnes and forms about 10.89% of the annual production of all fish, estimated at 777, 733 tonnes. The above estimate of crustacean landings does not include the production generated from the backwaters, paddy fields, lakes and estuaries. Although no reliable estimates of production from these sources are available, rough estimates of production from these sources are available. These estimates place the production from these sources at more than 50% of the marine production. The production of marine crustaceans from all sources in India would thus form more than 10% of the world production of crustaceans which in 1967 was estimated at 1350,000 tonnes. Thus the total crustacean landing not only form a sizable part of the total marine fish landing in India but it accounts for more than 10% of the world crustaceans production. This will indicate the importance of the crustaceans fishery in India. If the increasing demand for prawns from U.S.A. and other foreign countries is remembered, the importance of the Indian crustacean fishery will be understood better because out of an average annual production of 84,734 tonnes of crustaceans as much as 81,699 tonnes on an average consist of prawns. The prawn production in India form about 13% of the total world production of prawns and shrimps which in 1967 was estimated at 690,000 tonnes. If the substantial production from backwaters paddy fields, lakes and estuaries etc., are also taken into consideration, the percentage of Indian production to the world production of marine prawns will be about 18%.

The table I presents the production o marine crustaceans in India together with its composition into 3 broad groups from 1959 to 1968. It may be seen from the bottom row of the table, that pennaeid prawns with an average annual production of 47,538 tonnes form 56.10% of the average annual crustacean production in India. The next group in importance is the non-penaeid prawns whose average annual production is 34,161 tonnes

forming 40.32% of the average annual crustacean production. The two groups of prawns together form 96.42% of the average annual crustacean production, the balance 3.58% consisting of other crustaceans with an average annual production of 3,035 tonnes. It will be seen from the table I that for the country as a whole, the annual landings of penaeid prawns increased from 27,632 tonnes in 1959 to 63,389 tonnes in 1964; showed some decline in 1965 and again increased to 68,102 tonnes in 1968. Apart from minor fluctuations in a few years, the data show a definite rising trend for the annual landings of penaeid prawns. To find out the trend, a quadratic equation of the type $y = a + bt + ct^2$ (where Y is the annual production in thousand tonnes, and t is the year, the base year 1959 being taken as t=0) was fitted to the data by the method of least squares. The fitted equation was

$$Y = 29.6278 + 4.0913t - 0.0189t^2$$

The figure 51A shows the fitted equation to the observed data. It is pertinent to examine if the deviations from the fitted data are due to random fluctuations around the trend or there is some serial correlation. This was tested by Von Neuman's ratio given by $\sum \frac{\Delta u_i}{u_i^2}$ where $\Delta u_i = u_i - u_{i+1}$ and $u_i = \hat{y}_i - y_i$. It was seen that the fluctuations round the trend were random, and the fitted equation will best represent the trend in the annual production. The high positive b value indicated the rate of increase per year and negetive c value indicated the rate at which the above rate is being retarded.

By fitting a similar regression to the annual production of nonpenaeid prawns, we get the following equation.

$$Y = 34.0462 + 0.7518\,t - 0.1098\,t^2$$

From the figure 51 B, it will be seen that there is very little indication of trend in the annual production of non-penaeid prawns.The fluctuations are found to be random in nature.

The trend in the annual production of other crustaceans is shown in figure 52 A and is represented by the equation

$$Y = 19.7367 + 0.1384\,t + 0.3523t^2$$

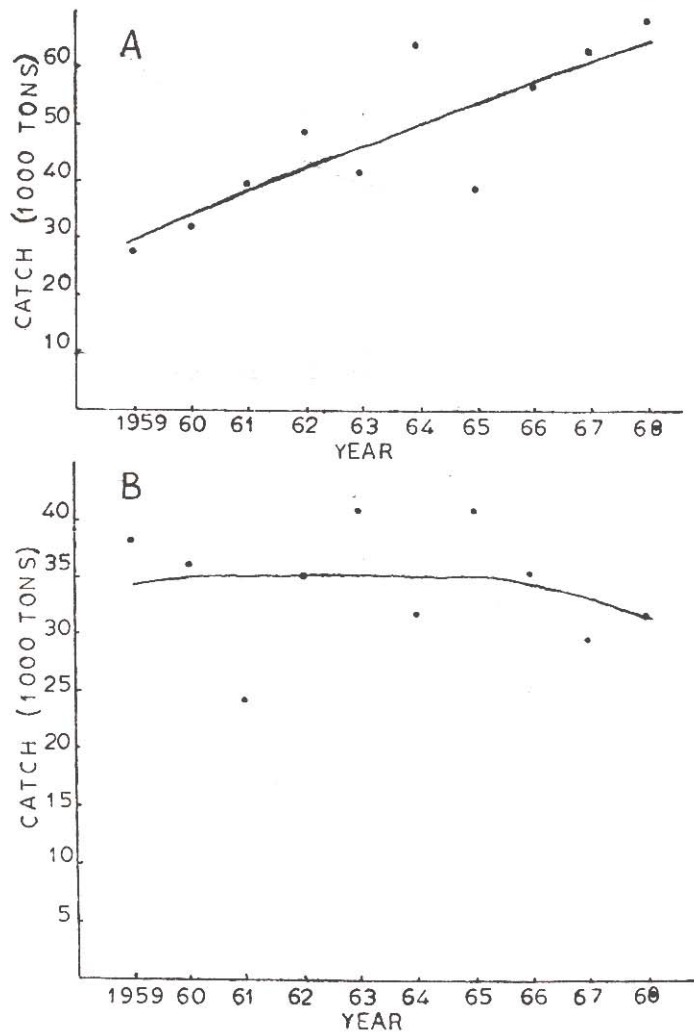where y is now expressed in units of 100 tonnes. From the trend it is

Fig. 51A   Trend $Y = 29.6278 + 4.0913t - 0.0189t^2$
in the annual production of penaeid
prawns in India.

B.   Trend $Y = 34.0462 + 0.7518t - 0.01098t^2$
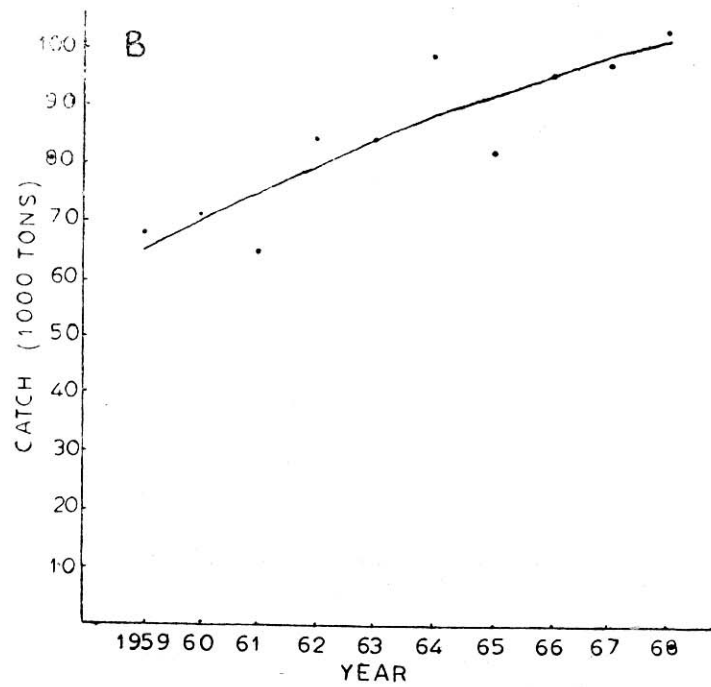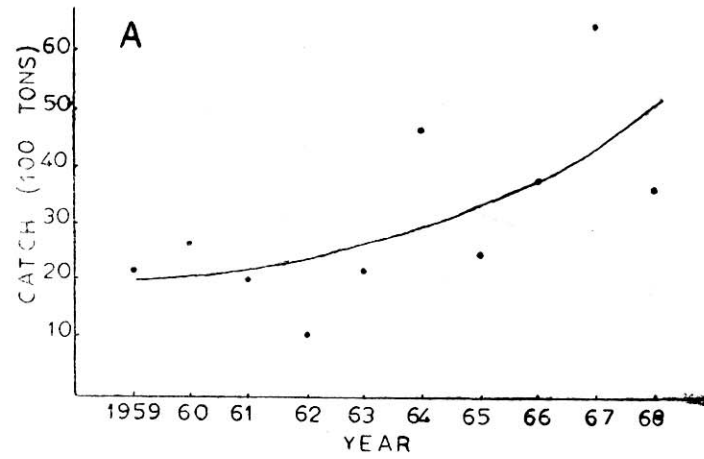in the annual production of non-penaeid
prawns in India.

Fig. 52A. Trend $Y = 19.7367 + 0.1304t + 0.3523t^2$ in the annual production of other crustaceans in India.

B. Trend $Y = 65.6357 + 4.9307t - 0.1061t^2$ in the annual production of all crustaceans in India.

seen that annual production dropped till 1961 from whence an upwards trend is noticed. Von Neuman's ratio test showed that the deviations of actual observations from the trend line were of random nature and as such the fitted equation will best represent the trend in the annual production of other crustaceans in India.

The figure 52B shows the trend in the annual production of all crustaceans in India. The equation of the trend is given by

$$Y = 65.6357 + 4.9307t - 0.1061t^2$$

The trend is similar to the one found in case of the annual production of penaeid prawns.

State-wise break up of annual landings

Crustaceans are landed in all the maritime States of India but the amount of landings differ from state to state. The table II shows the State-wise landings of crustaceans from 1959 to 1968 together with the average annual landings in each State and the percentage contribution of each State. It will be seen that the landings on the east coast of India form only about 16.45% of the total crustaceans landings, while the balance of 83.55% is landed on the west coast of India. Among the States, Maharashtra ranks first by contributing 47.82% of the total crustacean landings in India, followed by Kerala which contributes on an average 27.25% of the average annual production of crustaceans. The percentage contribution of other States are small and may be seen from the last column of table II. In fact the major crustacean fishery of India are today located in the two States of Maharashtra and Kerala. Hence, it will be only proper to examine the trend of crustacean landings in these two States.

Crustacean fishery in Maharashtra

The tables III to V show the State-wise landings of penaeid prawns, non-penaeid prawns and other crustaceans from 1959 to 1968. From these tables, it will be seen that the composition of the average annual crustacean production of 40,517 tonnes in Maharashtra may be broken up as follows.

	Tonnes	Percentage
Penaeid prawns	8, 969	22.13
Non-penaied prawns	31, 509	77.77
Other crustaceans	39	0.10
Total	40,517	100.00

Thus, in Maharashtra, penaeid prawns which are very important from the point of view of export earnings form only 22.13% of the total crustaceans landed in the State. The major portion of the crustaceans landings in the State consists of small non-penaeid prawns.

From table III, it will be seen that the landings of penaeid prawns in the State was only 5,746 tonnes in 1959, varied from 8 to 9 thousand tonnes during the next years, dropped down to the minimum of 5,02 tonnes in 1963, touched the maximum of 14,301 tonnes in 1964 and varied between 8 to 11 thousand tonnes during the next 3 years. Fitting a second degree quadratic equation to the annual landings of penaeid prawns expressed in thousand tonnes, we get the equation

$$Y = 6.6371 + 0.7904t - 0.0454t^2$$

If this represents the trend in the penaeid prawn landings, it will be seem from figure 53A that the production shows an increasing trend up to 1964 and thereafter there is a slow decline. The fluctuations around the trend line are again seen to the random and therefore the fitted line may be considerated to represent the trend best.

The landings of non-penaeid prawns in Maharashtra also showed fluctuations from 21,744 tonnes in 1961 to 37,482 tonnes in 1963. The fitted trend line is given by the equation

$$Y = 26.3900 + 3.0089t - 0.2993t^2$$

where y is expressed in 1000 tonnes. The figure 53B shows the fitted lines along with the actual landings in different years. The trend showed increase up to 1965 showing slow decline thereafter.

As there is no significant landings of other crustaceans in Maharashtra, it is not necessary to fit any trend line to the data.

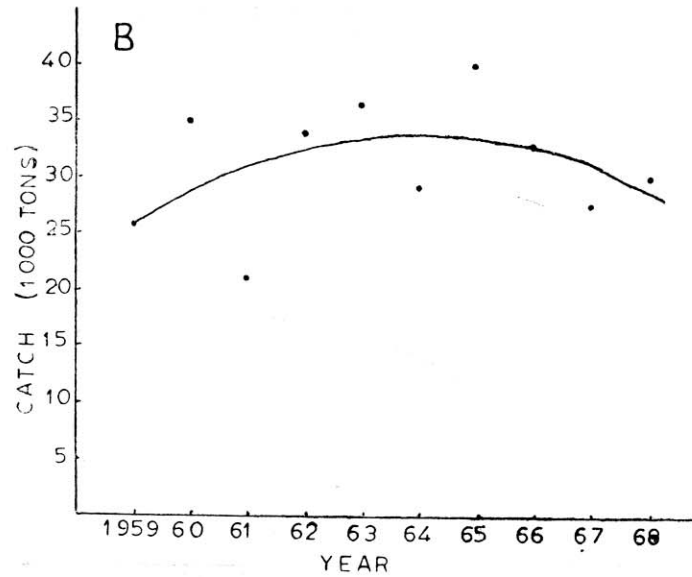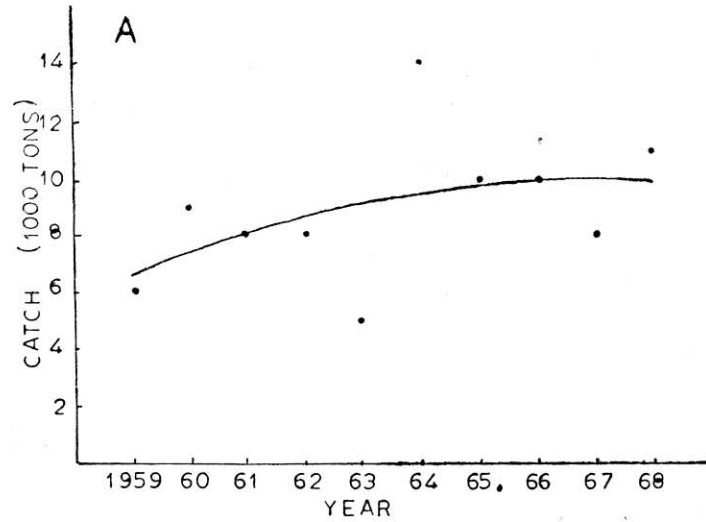Fig. 53A. Trend $Y = 6.6371 + 0.7904t - 0.0454t^2$ in the annual production of penaeid prawns in Maharashtra

B. Trend $Y = 26.3900 + 3.0089t - 0.2993t^2$ in the annual production of non-penaeid prawns in Maharashtra.
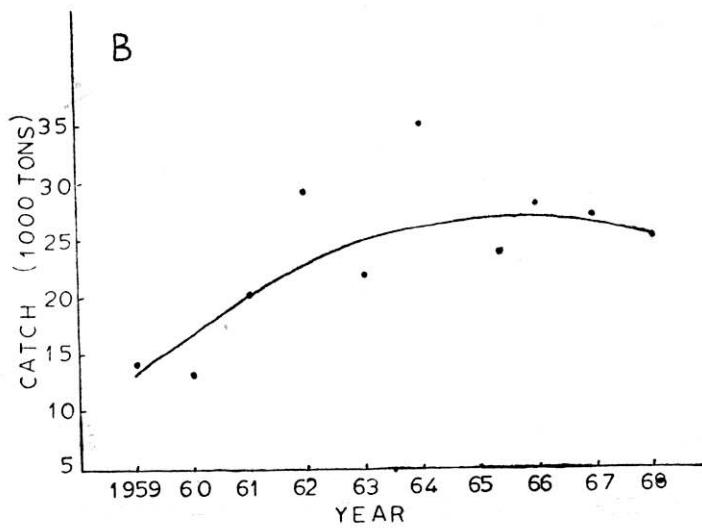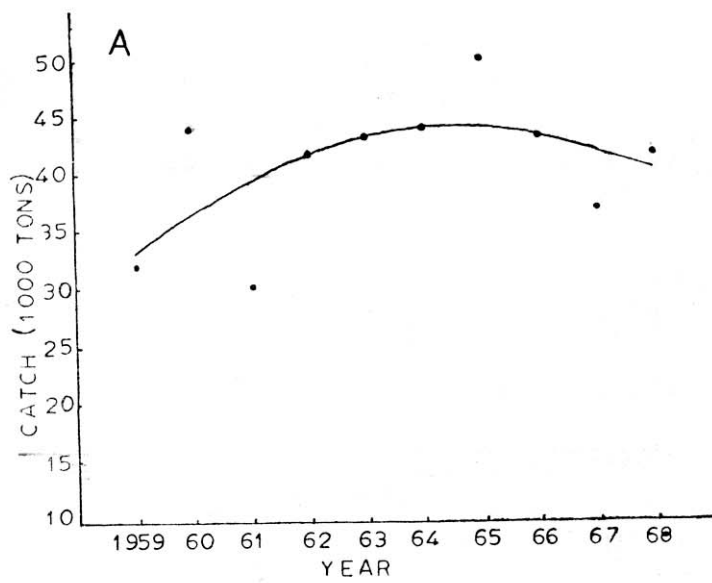
Fig. 54A. Trend $Y = 32.9923 + 3.8953t - 0.3446t^2$ in the annual production of all crustaceans in Maharashtra.

B. Trend $Y = 12.9728 + 4.3447t - 0.3447t^2$ in the annual production of penaeid prawns in Kerala.

For the total crustacean landings, the trend is given by

$$Y = 32.9923 + 3.8953t - 0.3446t^2$$

where y is in units of 1000 tonnes. The trend was increasing up to 1965 and then it showed a slow decline (fig. 54A).

Crustacean fisheries in Kerala

The composition of the average annual production of crustaceans is as follows.

	Tonnes	Percentage
Penaeid prawns	22, 828	98.87
Non-penaeid prawns	111	0.48
Other Crustaceans	150	0.65
Total	23. 089	100.00

The most remarkable feature of crustaceans landings in Kerala is that 98.87% of the same consists of valuable penaeid prawns. A second degree equation fitted to the data on the annual landings of the penaeid prawns is as follows.

$$Y = 12.9728 + 4.3447t - 0.3447t^2$$

The fitted line together with the actual annual landings are shown in figure 54B. It will be seen that there was a rising trend in the annual landings of penaeid prawns up to 1965 and thereafter the trend shows a slow decline.

The landings of non-penaeid prawns and other crustaceans in Kerala are so small that no attempts are made to fit trend lines to them.

Species composition of crustacean landings and distribution

It has been stated that the crustacean catch of India can be divided into 3 broad categories viz., (1) the penaeid prawns, (2) the non-penaeid prawns and (3) other crustaceans. The average annual catch of each category together with its percentage contribution may be seen from table I. The penaeid prawns are relatively large sized and are valuable

for export earnings. They are represented in the catch by a number of species but from the point of quantity landed all of them are not equally important nor are they distributed all along the coast line. The table VI presents the State-wise species composition of average annual penaeid prawns landings. The average annual landings of each species in the whole country are also shown. These figures have been worked out from the data available in the Fishery Survey Division of Central Marine Fisheries Research Institute.

It will be seen that among the penaeid prawns *Metapenaeus dobsoni* tops the list with an average annual landings of 16,072 tonnes forming 33.81% of the penaeid prawn landings and 18.97% of the crustacean landings in India. The species was landed in small quantities all along the east coast and also along the west coast south of Maharashtra. The major portion of the landings was in Kerala. Next in order landing was *Parapenaeopsis stylifera* with an average annual landings of 8,163 tonnes, forming 17.17% of the penaeid prawn landings and 9.63% of the crustacean landings, in India. The species was landed only along the west coast, the major landings being in Kerala and Maharashtra. *Penaeus indicus* with an average landings of 5,552 tonnes formed 11.68% of the penaeid landings and 6.55% of the crustaceans landings in India. It was landed all along the east coast and in Kerala and Mysore in the west coast. More than 91% of the landings came from Madras and Kerala.

Metapenaeus affinis accounted for 4,590 tonnes of landings forming 9.66% of penaeid prawn and 5.42% of crustacean landings in India. The species was landed all along the east and west coast though about 72% of the landings came from Maharashtra and Gujarat. Next in importance was *M. brevicornis* with an average landings of 3,273 tonnes and forming 6.89% of penaeid prawn and 3.86% of total crustacean landings in India. The species was landed mainly in West Bengal, Orissa, Andhra but small quantities were also landed in Maharashtra and Gujarat.

The other notable species in order of their landings were

	Landings (tonnes)	Percentage to penaeid prawn landings	Percentage to total crustaceans landings
M. monoceros	2, 093	4.40	2.47
Parapenaeopsis hardwickii	1, 720	3.62	2.03
Penaeus monodon	1, 321	2.78	1.56
Parapenaeopsis sculptis	1, 199	2.52	1.42
Solenocera indicus	638	1.34	0.75
Penaeus merguensis	637	1.34	0.75

Metapenaeus monoceros was landed in all the maritime States of India, though their landings in Kerala and Mysore were very small. *Parapenaeopsis hardwickii* and *P.sculptlis* and *Solenocera indicus* were obtained only in Maharashtra and Gujarat. *Penaeus monodon,* were landed all along the east coast and also in Kerala on the west coast. *Penaeus merguensis* was landed mainly in West Bengal, Orissa and Andhra. Besides the above, other species like *P. semisulcatus, P. penicillatus, Parapenaeopsis uncta* etc. also contributed small quantities towards the penaeid prawn landings.

The species compopsition of non-penaeid prawns and other crustaceans are shown in tables VII and VIII. Among non-penaeid prawns the most important in order of landing are as follows :-

	Landings (tonnes)	Percentage of non-penaeid prawns	Landings of total crustaceans
Acetes indicus	13, 514	39.56	15.75
Palaemon tenuipes	6, 111	17.89	7.81
Palaemon styliferus	3, 936	11.52	4.65
Hippolysmata ensirostris	2, 397	7.02	2.83

Acetes indicus was landed in Andhra, Madras, Kerala and Maharashta but more than 97% of landings was in Maharashtra. Both the species of *Palaemon* were landed in good quantites in Maharashtra and Gujarat. Similarly *Hippolysmata ensirostris* was landed only in Maharashta and Gujart.

Among other crustaceans, crabs belonging to the genera *Neptunus* and *Scylla* formed respectively 88.16% and 4.00% of the landings of other crustaceans. *Neptunus* landings were obtained all along the coast, though the bulk came from Andhra and Madras. The main landings of *Scylla* were at Madras. Lobster belonging to genus *Panulirus* was mainly landed in the south west coast of Madras and in Kerala.

TABLE I

Prawn and crustacean landings in India from 1959 to 1968

| Year | Landings in tonnes of | | | | All fish | P. C. of crustacean to all fish |
	Penaeid prawns	Non-penaeid prawns	Other crustacea	Total crustacea		
1959	27,632	37,805	2,093	67,530	584,587	11.55
1960	31,759	36,271	2,571	70,601	879,681	8.03
1961	39,083	23,685	2,038	64,806	683,569	9.48
1962	48,251	34,984	1,031	84,266	644,244	13.08
1963	41,071	40,522	2,061	83,654	655,484	12.76
1964	63,389	31,506	4,565	99,460	859,582	11.57
1965	38,085	41,415	2,392	81,892	832,772	9.83
1966	56,146	34,768	3,716	94,630	889,651	10.64
1967	61,865	29,064	6,291	97,220	850,171	11.44
1968	68,102	31,586	3,595	103,283	897,587	11.51
Average	47,538	34,161	3,035	84,734	777,733	10.89
p. c.	56.10	40.32	3.58	100.00		

TABLE II

Statewise landings of all crustaceans from 1959 to 1968

States	Landings in tones										Avarage annual landings	p. c.
	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968		
West Bengal & Orissa	631	806	1,616	2,205	3,793	2,317	2,133	1,887	7,744	10,872	3,400	4.01
Andhra	3,822	4,107	3,982	1,892	5,209	6,902	3,846	3,787	9,159	6,285	4,890	5.77
Madras	2,579	2,970	4,138	3,291	4,424	8,085	4,390	7,712	10,310	8,592	5,649	6.67
Kerala	14,864	12,781	20,541	29,240	22,044	35,292	14,541	28,936	27,310	25,521	23,089	27.25
Mysore	1,679	492	613	2,414	687	1,057	785	1,748	1,278	5,381	1,613	1.90
Maharashtra	31,565	43,931	29,956	41,804	42,528	43,643	50,266	43,311	36,547	41,621	40,517	47.82
Gujarat	12,254	5,307	3,215	2,350	3,669	2,162	4,455	4,616	4,083	3,721	4,583	5.41
Other areas	316	297	745	1,070	1,300	2*	1,476	2,643	789	1,290	9,913	1.17
	—	—	—	—	—	—	—	—	—	—	—	—
Total	67,530	70,601	64,806	84,266	83,654	99,460	81,892	94,630	97,220	103,283	84,734	100.00

TABLE III

State-wise annual landings of penaeid prawns from 1959 to 1968

(landings in tonnes)

States/years	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	Average	p. c.
West Bengal & Orissa	626	803	1,612	2,178	3,776	2,309	2,133	1,885	7,738	10,872	3,393	7.14
Andhra	1,836	1,591	2,797	1,305	3,476	5,229	3,507	2,999	6,886	5,784	3,541	7.45
Madras	1,634	1,872	1,819	2,526	3,265	3,958	2,189	5,136	6,365	5,044	3,382	7.11
Kerala	14,067	12,583	20,393	29,218	21,878	35,220	14,327	28,120	27,164	25,310	22,828	48.02
Mysore	1,601	420	545	2,379	647	1,040	778	1,696	1,260	5,364	1,573	3.31
Maharashtra	5,746	9,278	8,166	8,077	5,032	14,301	9,796	9,864	8,136	11,296	8,969	18.87
Gujarat	1,823	4,917	3,012	1,497	1,697	1,330	3,948	4,094	3,653	3,221	2,919	6.14
Other places	299	295	739	1,070	1,300	2	1,398	2,352	663	1,211	933	1.96
Total	27,632	31,759	39,083	48,251	41,071	63,389	38,085	56,146	61,865	68,102	47,538	100.00

TABLE IV

State-wise annual landings of other crustaceans from 1959 to 1968

(landings in tonnes)

States/years	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	average	p. c.
West Bengal & Orissa	1	3	4	-	-	8	-	2	6	-	2	0.06
Andhra	1,118	1,423	496	213	853	468	9	162	2,240	159	714	23.53
Madras	761	823	1,311	755	1,058	3,982	2,110	2,443	3,794	3,150	2,109	66.52
Kerala	117	175	105	22	90	72	130	557	58	176	150	4.94
Mysore	78	72	58	35	40	17	7	52	18	16	39	1.29
Maharashtra	16	48	46	2	14	18	58	135	35	14	39	1.29
Gujarat	-	25	13	4	6	-	-	74	14	1	14	0.46
Other places	2	2	5	-	-	-	78	291	126	79	58	1.91
Total	2,093	2,571	2,038	1,031	2,061	4,565	2,392	3,716	6,291	3,595	3,035	100.00

TABLE V

State-wise annual landings of non-penaeid prawns from 1959 to 1966

(Landings in tonnes)

States/years	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	average	p. c.
West Bengal & Orissa	4	-	-	27	17	-	-	-	-	-	5	0.01
Andhra	868	1,003	689	374	880	1,205	330	626	33	342	635	1.86
Madras	184	275	1,008	10	101	145	82	123	151	398	248	0.72
Kerala	500	23	43	-	76	-	84	259	88	35	111	0.33
Mysore	-	-	10	-	-	-	-	-	-	1	1	-
Maharashtra	25,803	34,605	21,744	33,725	37,482	29,324	40,412	33,312	28,376	30,311	31,509	92.24
Gujarat	10,431	365	190	848	1,966	832	507	448	416	499	1,650	4.83
Other places	15	-	1	-	-	-	-	-	-	-	2	0.01
Total	37,805	36,271	23,685	34,984	40,522	31,506	41,415	34,768	29,064	31,586	34,161	100.00

TABLE VI

Composition of average penaeid prawn landings

States	W. Bengal & Orissa	Andhra	Madras	Kerala	Mysore	Maharashtra	Gujarat	Other States	Total	p. c. to penaeid landings	p. c. to total crustacean landings
Penaeus semisulcatus	83	81	312	-	-	-	-	-	476	1.00	0.56
P. merguensis	285	341	-	-	11	-	-	-	637	1.34	0.75
P. indicus	179	189	1,529	3,578	77	-	-	-	5,552	11.68	6.55
P. monodon	355	355	499	112	-	-	-	-	1,321	2.78	1.56
P. penicillatus	-	-	-	-	-	-	86	-	86	0.18	0.10
Metapenaeus dobsoni	195	169	518	14,559	631	-	-	-	16,072	33.81	18.97
M. affinis	413	352	27	212	303	2,172	1,111	-	4,590	9.66	5.42
M. monoceros	442	459	492	12	8	497	183	-	2,093	4.40	2.47
M. brevicornis	1,441	1,595	-	-	-	54	183	-	3,273	6.89	3.86
Parapenaeopsis stylifera	-	-	-	4,306	524	2,466	867	-	8,163	17.17	9.63
P. sculptilis	-	-	-	-	-	1,016	183	-	1,199	2.52	1.42
P. hardwickii	-	-	-	-	-	1,720	-	-	1,720	3.62	2.03
P. uncta	-	-	-	-	-	-	123	-	123	0.26	0.15
Solenocera indicus	-	-	-	-	-	455	183	-	638	1.34	0.75
Unidentified	-	-	5	49	19	589	-	933	1,595	3.35	1.88
Total	3,393	3,541	3,382	22,828	1,573	8,969	2,919	933	47,538	100.00	56.10

TABLE VII

Composition of average non-penaeid prawn landings

States	W. Bengal & Orissa	Andhra	Madras	Kerala	Mysore	Maharashtra	Gujarat	Other States	Total	Percentage to non-penaeid landings	Percentage to total crustacean landings
Acetes indicus	-	-	240	111	-	13,163	-	-	13,514	39.56	15.95
Acetes spp.	-	635	-	-	-	-	365	-	1,000	2.93	1.18
Palaemon tenuipes	-	-	-	-	-	5,769	342	-	6,111	17.89	7.21
P. stylifers	-	-	-	-	-	3,594	342	-	3,936	11.52	4.65
Palaemon spp.	-	-	8	-	-	-	-	-	8	0.02	0.01
Hippolysmata ensirostris	-	-	-	-	-	1,796	601	-	2,397	7.02	2.83
Unidentified spp.	5	-	-	-	1	7,187	-	2	7,195	21.06	8.49
Total	5	635	248	111	1	31,509	1,650	2	34,161	100.00	40.3

TABLE VII

Composition of average landings of other crustaceans

States	W. Bengal & Orissa	Andhra	Madras	Kerala	Mysore	Maharashtra	Gujarat	Other States	Total	Percentage to non-penaeid landings	Percentage to total crustacean landings
Panilurus spp.	-	-	82	53	-	2	-	-	137	4.51	0.16
Neptunus sp.	-	708	1,817	97	17	32	-	-	2,671	88.01	3.15
Scylla spp.	-	6	120	-	1	-	-	-	127	4.18	0.15
Other	2	-	-	-	21	5	14	58	100	3.30	0.12
Total	2	714	2,019	150	39	39	14	58	3,035	100.00	3.58