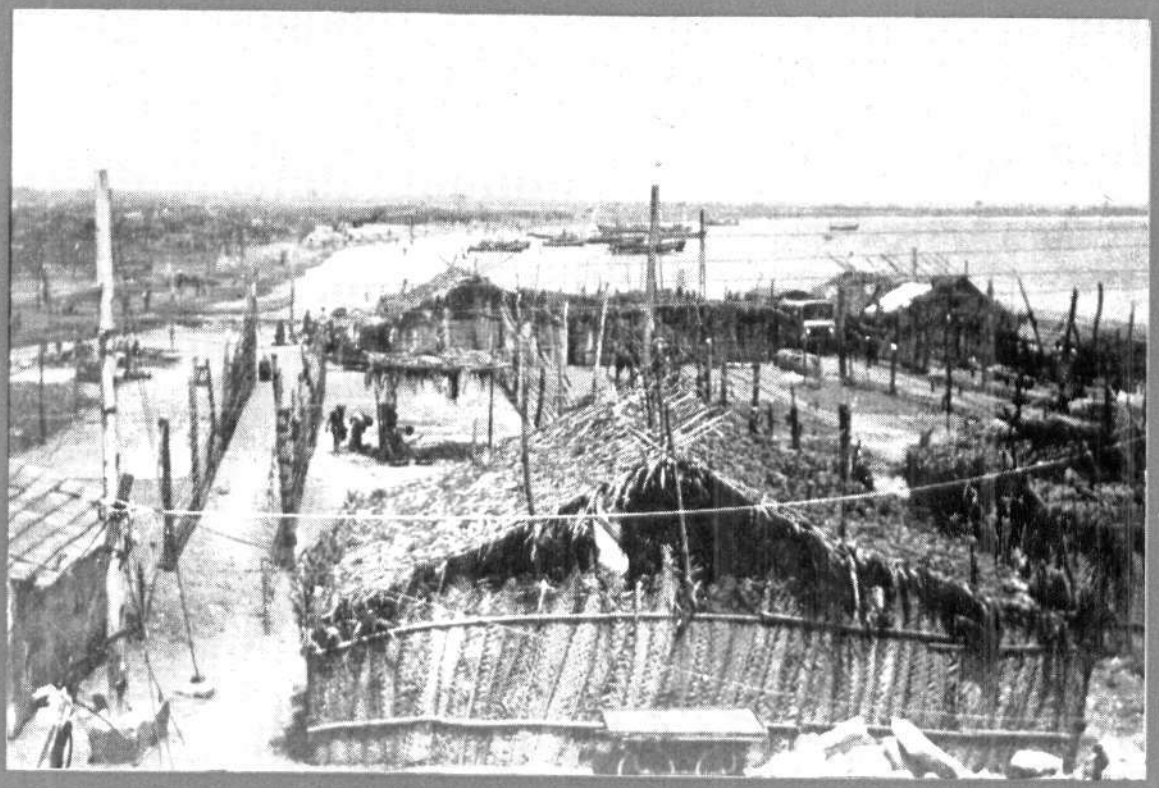
MARINE FISHERIES INFORMATION SERVICE



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THE MARINE FISHERIES INFORMATION SERVICE: Technical and Extension Series envisages the rapid dissemination of information on marine and brackish water fishery resources and allied data available with the National Marine Living Resources Data Centre (NMLRDC) and the Research Divisions of the Institute, results of proven researches for transfer of technology to the fish farmers and industry and of other relevant information needed for Research and Development efforts in the marine fisheries sector.

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Front cover photo:
Temporary hutment of fishermen at a fish landing centre along the Gujarat coast.

Back cover photo:
A view of the fisheries harbour at Mangrol, Saurashtra, Gujarat

A STUDY ON THE SOCIO-ECONOMIC CONDITIONS OF FISHERMEN IN SOME SELECTED VILLAGES OF MAHARASHTRA AND GUJARAT COASTS

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Introduction

Maharashtra and Gujarat states together have a coastal length of about 2,300 km which is about 1/3rd of India's coastal line. As many as 500 marine fishing villages with almost same number of marine fish landing centres are located in this region. About 4 lakhs of fishermen population are dependent on fishing, wholly or partially, all along this coast. As much as 30% of marine fish catch in the country is contributed by these two states. About 70% of marine fish catch in Gujarat and 85% in Maharashtra are contributed by mechanised boats which operate mainly trawl-nets, gill-nets and bag-nets. Bombay duck, sciaenids, pomfret, penaeid and non-penaeid prawns, clupeoids, perches, silverbar, seerfish, polynemids, ribbonfish, catfish, sharks and tunnies form major catch in this region.

The recent technological innovations in marine fishing have not shown much impact on the living conditions of fishermen and they are still socially and economically backward. Economic uplift of the fishermen mainly depends on the growth and development of fisheries sector. Hence, location oriented and resource based developmental schemes are required to be implemented for each region which would help in area planning for socio-economic improvement of fishermen. To assess the socio-economic status of fishermen, the Central Marine Fisheries Research Institute, Cochin, carried out a study on the income, consumption and employment pattern and the credit facilities available to them in some of the fishing villages of Maharashtra and Gujarat.

Work programme

General village information in first stage, were collected from 14 fishing villages of Maharashtra and 18 fishing villages of Gujarat covering three coastal districts in each state. Subsequently in the second stage, three villages of Maharashtra namely, Ekdara, Alibag Koliwada (both in Raigad District) and Mahim Koliwada (Greater Bombay District) and four villages of Gujarat namely, Umbergaon (Valsad District), Bhimpore (Surat District), Sutrapada Bunder and Mangrol Bunder (both in Junagadh District) were selected for indepth study taking into consideration the size of village, type of craft and gear used, socio-economic status and other factors of fishery (Fig. 1). Information regarding catch, income, craft and gear, indebtedness, employment etc. relating to all the fishermen families in each village were collected by interviewing heads of families through a schedule specially designed for this study. Enumerators were selected from the same

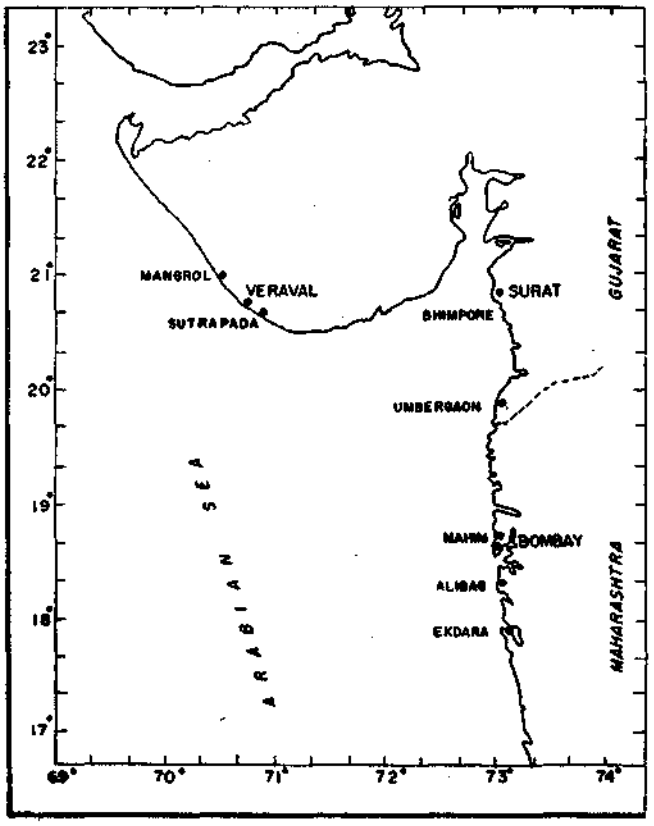

Fig. 1. Villages selected in Maharashtra and Gujarat for the study.

villages and properly trained to ensure accuracy in data collection. Scientific and technical staff of the Institute associated with the project supervised the work of enumerators during the course of data collection.

The definitions of terminologies used in collection and interpretation of data are given below:

1. *Fishermen family:* Family having atleast one member engaged in fishing or fishery allied activities

2. *Family:* Members sharing meals from one kitchen

3. *Children:* All males and females below 12 years of age

4. *Main occupation:* An occupation contributing 50% or more of the income of an individual/ family

5. *Subsidiary occupation:* An occupation contributing less than 50% income of an individual/ family

6. *Fishery allied activities:* Activities include fish trading, processing/curing, transporting, loading/ unloading, net splicing/repairing, boat building/ repairing and other activities related to fishery

7. *Catch share:* Share of a family in fish catch obtained from operating owned/partially owned/ leased-in boat/gear or from operating others boat/gear

8. *Net fishery income:* Income of a family earned by its members from fishing and fishery allied activities after deducting operational cost

9. *Types of houses:*

   a) *Hut:* A dwelling with mud walls or an enclosure made of *'thattis'* and having thatched roof

   b) *Kutcha house:* A dwelling with brick/stone walls and having thatched roof

   c) *Pucca house:* A dwelling with brick/stone walls and having tiled roof

   d) *Concrete house:* A dwelling with brick/stone walls and having concrete roof

10. *Education:*

    a) *Primary:* 5th standard pass
    b) *Middle:* 8th standard pass
    c) *Higher secondary:* 12th standard pass
    d) *Graduate and above:* Degree holder

11. *OBM boat:* Boat fitted with outboard motor

12. *G. F. C. C. A:* Gujarat Fisheries Central Co-operative Association Ltd.

Details of socio-economic survey

For comparative analysis within the village, all the fishermen families were stratified on the basis of ownership of means of production. One year period starting from July '81 to June '82 was taken as reference period for the study. Results based on the analysis of data collected at the household and village levels are presented below.

1. Ekdara (Maharashtra)

This village is about half-a-km away from Murud town (taluk headquarter) and is mainly inhabited by *'Mahadev Koli'*, a tribal community. There is no *pucca* road inside the village. Infrastructural facilities related to fishery such as cold storage, ice plant and curing yards are available in Murud only. Jetty facility is not available at this centre. A fishermen co-operative society is functioning satisfactorily. It provides fishing implements, and helps fishermen in getting loan from banks and government agencies. The main occupation of the villagers is fishing and fishery related activities and number of carpenters, tailors, labourers and businessmen are limited. About twenty persons are employed in private or public sector. Rice and fish are staple food items in this village. The percentages of hut, *kutcha* and *pucca* houses are 39, 24 and 37 respectively (Fig. 2). There is no concrete house in this village. The percentage of *pucca* houses is more among boat owners.

Fishermen population of this village during 1981–'82 was 1,119 which comprised 328 adult males, 330 adult females and 461 children (Table 1). Average number of persons per family was 8.0. The families with less than 5, 5–9 and 10 or more members were 24%, 62% and 14% respectively. Further analysis showed that percentage of working population was 49.7%. Among the working population, 41.6% was found as active fishermen, 51.6% engaged in fishery

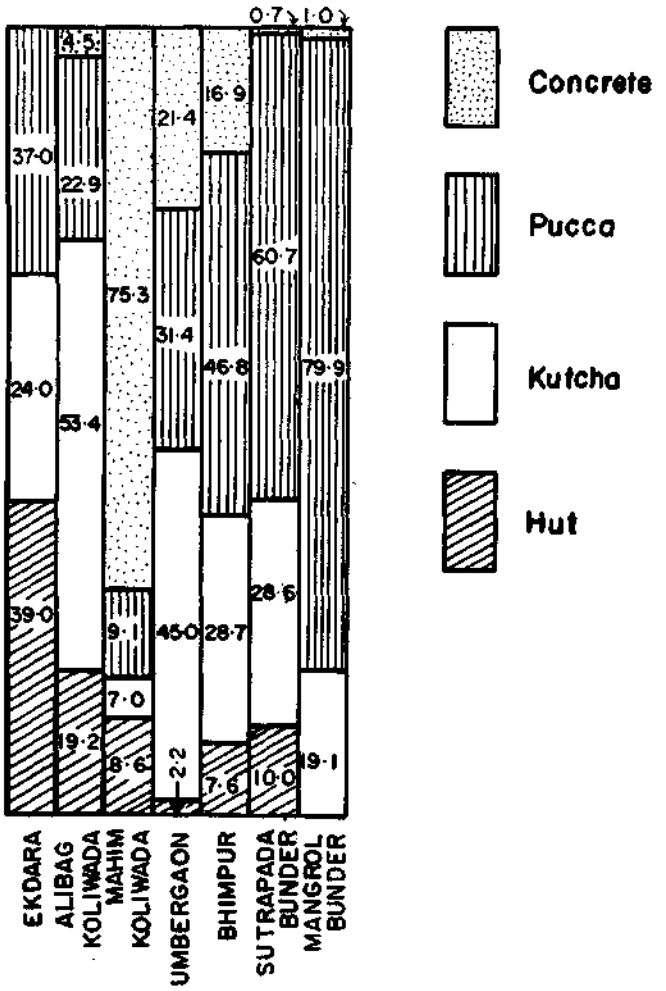

Fig. 2. Type of houses (%).

allied activities and 6.8% employed in non-fishery activities. Occupation-wise breakup, as given in Table 2, showed that 81% of respondents has fishery as the only occupation, 13% fishery as main and non-fishery as subsidiary occupation and remaining 6% non-fishery as main occupation. Literacy among the respondents showed that majority was constituted of illiterates (60%). Persons with primary, middle, higher secondary and graduate and above qualifications were 31%, 4%, 4% and 1% respectively. About 80% of the heads of families were members of fishermen co-operative society in Ekdara (Fig. 3).

About 20 mechanised and 15 non-mechanised boats are operating at this centre in addition to few boats under construction. Mechanised boats are generally fitted with Ruston, Kirloskar or Ashok Leyland inboard engines of 2–4 cylinders. Few small boats, locally known as *'tonny'* assist big boats in loading/unloading of catch and transportation of goods. Surface and bottom-set gill-nets (locally called *'tarti'* and

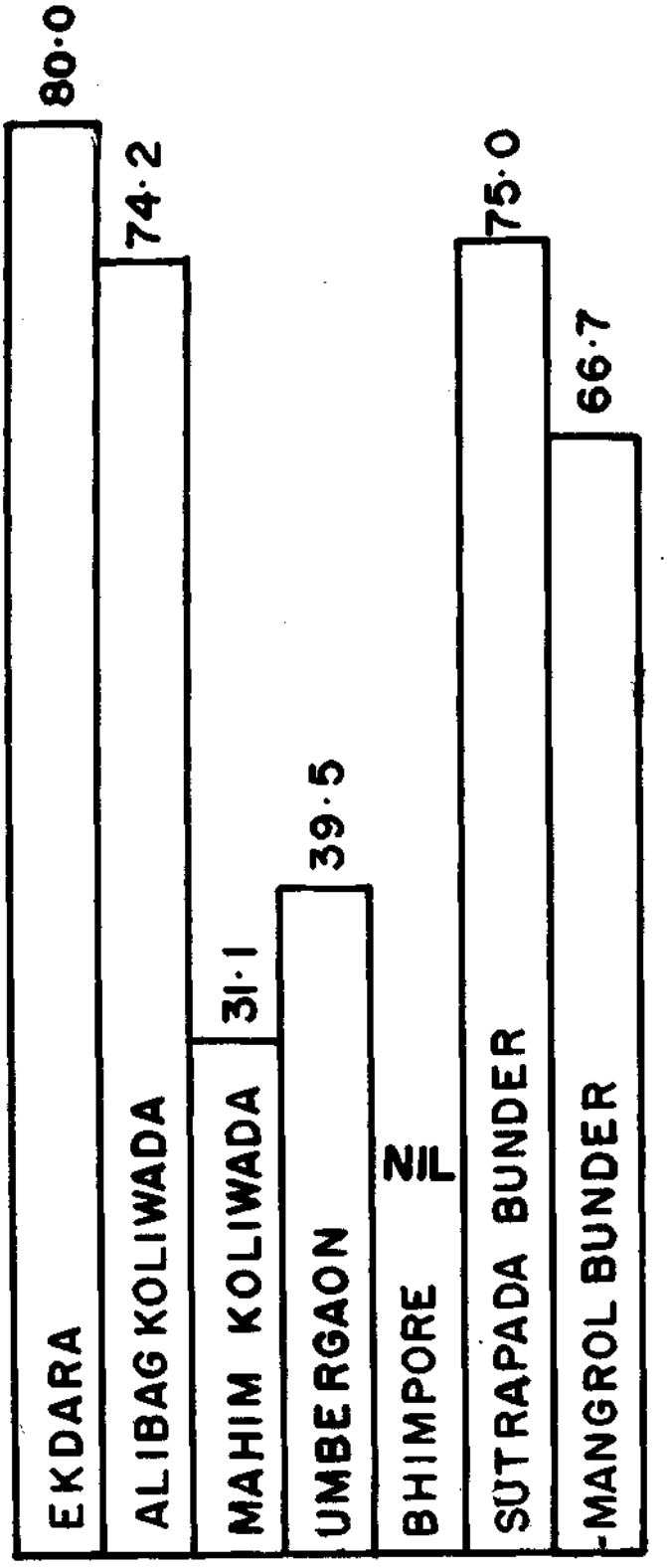

Fig. 3. Membership in fishermen co-operative societies (%).

'budi' respectively) and bag-nets, known as *'dol'*, are the main gears operated at this centre. Fishing grounds being rocky, there are frequent cases of engine and net

Table 1. *Fishermen population and occupational status in selected villages of Maharashtra and Gujarat coasts* 1981–'82

Villages	Population				Average family size	Working population (%)	Distribution of working population (%)		
	Males	Females	Children	Total			Active fishermen	Fish. allied activities	Non-fishery occupations
Maharashtra									
Ekdara	328	330	461	1,119	8.0	49.7	41.6	51.6	6.8
Alibag Koliwada	630	636	892	2,158	8.1	56.1	38.0	55.7	6.3
Mahim Koliwada	1,042	1,034	1,388	3,464	6.9	52.8	21.2	58.1	20.7
Gujarat									
Umbergaon	590	583	866	2,039	7.3	54.0	31.7	54.6	13.7
Bhimpore	545	541	693	1,779	7.5	58.0	28.5	51.7	19.8
Sutrapada Bunder	580	579	935	2,094	7.7	46.7	51.5	45.1	3.4
Mangrol Bunder	1,433	1,416	1,814	4,663	7.4	48.4	47.8	51.6	0.6

Table 2. *Education and occupation of heads of the families*

Villages	Education %				Occupation %				
	Primary	Middle	Higher secondary	Graduates & above	Nil	Only fishery	Fishery main others subsidiary	Non-fishery main fishery subsidiary	No. of families
Maharashtra									
Ekdara	31.0	4.0	4.0	1.0	60.0	81.0	13.0	6.0	140
Alibag Koliwada	32.3	6.4	4.9	0.8	55.6	69.6	21.3	9.1	266
Mahim Koliwada	35.2	21.2	12.0	0.6	31.1	32.8	29.3	37.9	503
Total/Average	33.7	14.2	8.7	0.7	42.7	51.0	24.4	24.6	909 (100)
Gujarat									
Umbergaon	29.2	20.1	11.3	1.5	37.9	62.1	20.4	17.5	280
Bhimpore	37.3	22.8	8.0	0.4	31.5	46.5	28.7	24.8	237
Sutrapada Bunder	31.2	6.2	0.8	0.4	61.4	90.5	5.4	4.1	272
Mangrol Bunder	34.1	6.0	1.6	0.2	58.1	91.3	3.7	5.0	633
Total/Average	33.1	11.1	4.9	0.5	50.4	77.9	11.5	10.6	1,422 (100)

damages. During monsoon season there is hardly any fish landing. Dol-net operation is not carried out during neap tides (from 6th to 9th lunar-day), locally known as *'bhang'*. Ice is used only on mechanised boats which go on fishing trips of four to five days. The strength of the crew on mechanised boats ranges from six to nine, whereas on non-mechanised boats it ranges from two to four. Mechanised boats with gill nets operate upto 10 m in the sea. Total number of families (140) were divided into five groups *viz.* families owning/sharing mechanised boats (35), both mechanised and non-mechanised boats (6), non-mechanised boats alone (13), only gears (68) and those engaged in fishery allied activities (18). As can be seen from Figure 4, 37% of families has full ownership and 63% partial ownership of boats. In case of gears, 81% of families has full ownership, 13% partial ownership and 6% leased-in.

Major catch of this centre constitutes pomfret, perches, croakers, penaeid and non-penaeid prawns, silverbar, catfish, sharks, clupeoids and seer fish. The

catch is sold to the private traders through Fishermen Co-operative Society which in turn charges 5% commission from the traders and 1% from the fishermen. Some of the mechanised boats take the catch to Bombay for sale. As shown in Table 3A, the annual fish catch shares of families owning/sharing mechanised boats, both mechanised and non-mechanised boats, non-mechanised boats alone and only gears were found to be 25,067, 29,303, 8,936 and 4,694 kg respectively. Among these categories, the average annual fishing days were found minimum in case of non-mechanised group (198 days) and maximum in case of the group owning only gears (206 days). There was not much variation in fishing days among different categories. The average annual net fishery income per fishermen family was calculated at Rs. 5,313 in this village. Maximum fishery income (Rs. 11,873/annum) was found for the families owing/sharing both mechanised and non-mechanised boats and minimum (Rs. 3,362/annum) for families engaged in fishery allied activities. Analysis of indebtedness showed that for those availed loan (79%), average outstanding loan was Rs. 2,868 per family during the reference year. Families engaged in fishery allied activities availed minimum amount of loan (Rs. 484) among the five categories. Maximum outstanding loan was found for the families owning/sharing both mechanised and non-mechanised boats (Rs. 8,560) followed by those owning/sharing only mechanised boats (Rs. 5,420). Further analysis showed that about 21% of fishermen families did not avail loan from any source (Table 4) and the rest had availed loan from Fishermen Co-operative Society (40.4%), government (10.4%), banks (10.0%) and private agencies (21.8%).

2. Alibag Koliwada (Maharashtra)

This fishing village is located at southwest end of Alibag town and dominated by 'Mahadev Koli,' a tribal community. The village has got electric and water connections. The distance of landing centre from the village is about a km whereas fish market is located inside the village. Fish drying yards are provided by Customs Department on rent/lease of Rs. 10–15 per year to the fishermen. Neither jetty facility nor boat building yard is available at this centre. Ice plant and cold storage facilities are available at about 2 km in the town. Diesel and kerosene oil are provided through Fishermen Co-operative Society. About 10 families have marginal land holding for farming. There are 10 carpenters, one barber and four tailors. Baskets, ropes and mats are made in more than 20% of the houses. Couple of provision shops, hotels and tea stalls are also available in the village. More than 100 persons are employed in government, semi-government and private organisations. Rice and coconut are the major crops grown in this area and rice and fish are main food items of villagers. The analysis of type of houses showed that the percentages of hut, *kutcha, pucca* and concrete houses were 19.2%, 53.4%, 22.9% and 4.5% respectively (Fig.2).

Fishermen population (2,158) of the village consists of 630 adult males, 636 adult females and 892 children (Table 1). The average size of family was 8.1 in Alibag Koliwada during the reference year. Further analysis of family strength showed that 15.8% of families had less than five members, 52.6% between five and nine and 31.6% had 10 or more members per family. Working population was found to be 56.1%, of which 38% was found as active fishermen, 55.7% engaged in fishery allied activities and 6.3% in non-fishery activities. Of total respondents, 69.6% reported fishery as their only occupation, 21.3% fishery main and non-fishery as subsidiary occupation and 9.1% non-fishery main and fishery as subsidiary occupation. Literacy among the respondents was 32.3% primary, 6.4% middle, 4.9% higher secondary and 0.8% graduates (Table 2). Of the 266 heads of fishermen families interviewed, 74.2% was found members of Fishermen Co-operative Society (Fig. 3).

About 70 mechanised and 20 non-mechanised boats are operating at this centre. Bag-nets, surface and bottom set gill-nets and few trawl-nets are used for fishing. Dol-nets are operated in 3-5 m of water while gill-nets and trawl-nets operated in 6–12 m. Labour for crew is generally arranged from outside the village and contracted for entire fishing season of eight to nine months a year. Annual wage ranges from Rs. 4,000–6,000 per labourer excluding meals, bidi, pan *etc.* Bag-net is the main gear of this centre operated by five to six persons. Total number of fishermen families (266) were divided into five categories *viz.* families owning/sharing mechanised boats (76), both mechanised and non-mechanised boats (11), non-mechanised boats alone (22), only gears (73) and those engaged in fishery allied activities (84). Ownership of means of production showed that 26.2% of boat operating families had full ownership, 69.8% partial ownership and 4.0% leased-in of boats whereas most of the gears (99%) were found either with single family ownership or partial ownership (Fig. 4).

About 70% of catch at this centre comprises non-penaeid prawns (locally called *'Jawla'*) and remaining (30%) includes penaeid prawns, croakers, ribbon fish, cat fish, Indian-cod and clupeoids. Non-penaeid prawns caught is sun dried and sold through Fishermen

Co-operative Society to the private companies located at Bombay, Mahad, Dasgaon, Belgam and Ratnagiri on contract basis. The society works as commission agent between companies and the fishermen, and charges 5% and 3% commission respectively from them. The society issues advances from time to time to fishermen upto 50% of value of the catch sold through it. About 85% of boat/net operating families sells their catch through the society.

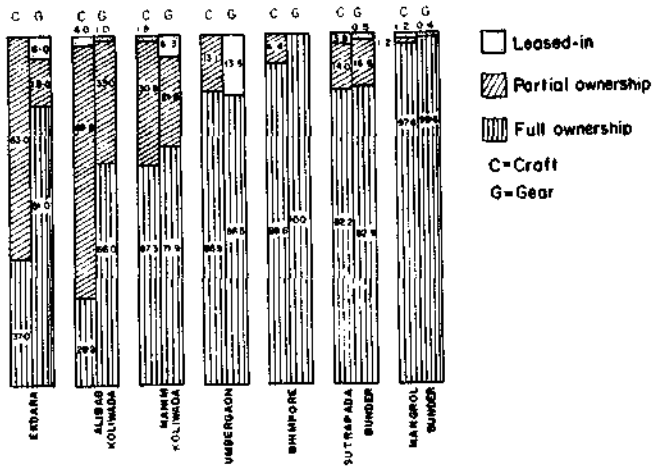

Fig. 4. Ownership of means of production (%).

As shown in Table 3A, the average annual share in fish catch for the families owning/sharing mechanised boats, both mechanised and non-mechanised boats, non-mechanised boats alone and only gears was 37,584, 41,380, 11,990 and 6,255 kg per family for 216, 203, 200 and 192 fishing days respectively per annum. Minimum fish catch was observed in July–September quarter and maximum in October–December quarter for all the categories. On analysis of income per family for different categories it was found that families owning/sharing both mechanised and non-mechanised boats had maximum net fishery income (Rs. 13,016/annum) and those engaged in fishery allied activities had minimum income (Rs. 3,443/annum). The average annual net fishery income per family in Alibag Koliwada was calculated at Rs. 6,118. Among all the categories, maximum outstanding loan was found for the families owning/sharing both mechanised and non-mechanised boats (Rs. 12,182) and minimum for those engaged in fishery allied activities (Rs. 512). Average debt was worked out to be Rs. 4,057 per indebted family. Only 15% of the families did not avail loan during the study year, whereas 45.3% availed loan from Fishermen Co-operative Society, 16.0% from government agencies, 7.0% from banks and 16.7% from private agencies like fish merchants, boat owners, friends, relatives *etc.* The Fishermen Co-operative Society is helping fishermen in getting loan from government and banks, providing diesel/kersosene and fishing implements and working as agent between fishermen and fish traders.

3. Mahim Koliwada (Maharashtra)

Mahim Koliwada belongs to Greater-Bombay District of Maharashtra and is about 10 km from main city (Bombay). Fish market, bus stand and railway station are within the radius of 2 km from landing centre. The village is electrified and has many facilities of township. Regarding fishery infrastructure, it is observed that no jetty, boat building yard, curing yard or cold storage/freezing plant is available. A Fishermen Co-operative Society is functioning in the village which provides diesel, kerosene oil and fishing implements to the member fishermen at subsidised rate. About 500 persons are employed in public and private sector and the number of self employed persons like doctors, engineers, carpenters and tailors are about 50. Rice and fish are among major items of food. Of the total of 503 fishermen families, 75.3% occupies small concrete houses constructed by Maharashtra Housing Board and allotted to the fishermen whereas the remaining occupies huts (8.6%), *kutcha* (7.0%) and *pucca* (9.1%) houses (Fig. 2).

Total fishermen population was 3,464 including 1,042 adult males, 1,034 adult females and 1,388 children (Table 1). Average number of persons per family was 6.9. Further analysis showed that percentages of families having less than 5, 5-9 and 10 or more members per family were 17.1, 68.6 and 14.3 respectively. Working class constituted about 53% of the population. Among the working population, 21.2% were active fishermen, 58.1% engaged in fishery allied activities and 20.7% in non-fishery activities. As given in Table 2, 32.8% of respondents had fishery as the only occupation, 29.3% fishery main and non-fishery as subsidiary occupation and 37.9% non-fishery main and fishery as subsidiary occupation. About 62% of heads of families engaged in fishery allied activities reported non-fishery as the main occupation whereas 92% of heads of families owning/sharing boats reported fishery as their main occupation. Literacy among the respondents was 35.2% primary, 21.1% middle, 12.0% higher secondary and 0.6% graduates and above. The literacy was comparatively more among the respondents engaged in fishery allied activities and it was justified by the fact that most of them were employed in government, semi-government or private organisations

Table 3a. *Annual fishing days, share in fish catch, income and indebtendness per family in the fishing villages of Maharashtra coast* 1981–'82

Villages & Categories	No. of fishing days	Catch Quantity (kg)	Catch Value (Rs.)	Fishery income (Rs.)	Indebtedness (Rs.)	Families availed loan (%)	No. of families
Ekdara							
Families owning/sharing:							
a) Mechanised boats	203	25,067	52,642	8,588	5,420	77	35
b) Mech. & non-mech. boats	198	29,303	59,363	11,873	8,560	100	6
c) Non-mech. boats	198	8,936	18,996	4,397	3,154	85	13
d) Gears	206	4,694	9,876	3,741	1,228	79	68
Families engaged in fishery allied activities	—	—	—	3,362	484	67	18
Total/Average				5,313	2,768	79	140
Alibag Koliwada							
Families owning/sharing:							
a) Mechanised boats	216	37,584	58,141	10,610	7,844	95	76
b) Mech. & non-mech. boats	203	41,380	65,079	13,016	12,182	91	11
c) Non-mechanised boats	200	11,990	19,424	4,655	3,042	91	22
d) Gears	192	6,255	10,175	3,923	2,141	89	73
Families engaged in fishery allied activities	—	—	—	3,443	512	70	84
Total/Average				6,118	4,057	85	266
Mahim Koliwada							
Families owning/sharing:							
a) Mechanised boats	208	21,086	61,150	9,976	6,630	93	46
b) Mech. & non-mech. boats	208	23,357	66,336	11,667	11,500	100	12
c) Non-mechanised boats	206	7,172	19,082	5,125	2,250	64	28
d) Gears	216	3,403	9,369	4,240	742	45	44
Families engaged in fishery allied activities	—	—	—	3,674	216	33	373
Total/Average				4,572	2,338	43	503

whereas ladies and old persons in the family were engaged in fish trading, net splicing/repairing *etc.* About 31% of the respondents was found members of Fishermen Co-operative Society (Fig. 3). Percentage of the society's membership was comparatively more in case of boat owners (80%).

About 50 mechanised boats including few trawlers and 30 non-mechanised boats operate at this centre. Sufrace and bottom-set gill-net, stake-net, trawl-net and cast-net are commonly used for fishing. Boats varying from 7-12 m in length, 1.5–2.5 m in width and 0.75–1.75 m in depth are fitted with 2–4 cylinder Kirloskar or Ruston engines. In mechanised boats, 5–8 persons go as crew for gill-net operation. Small non-mechanised boats are operated by 2–3 persons. The number of families owning/sharing only mechanised boats, both mechanised and non-mechanised boats, non-mechanised boats alone and only gears were 46, 12, 28 and 44 respectively whereas 373 families were found engaged in fishery allied activities (Table 3A). Ownership of craft and gear (Fig. 4) showed that majority of boats (67.3%) was found with single family ownership followed by partial ownership (30.8%)

Table 3b. *Annual fishing days, share in fish catch, income and indebtedness per family in the fishing villages of Gujarat coast* 1981–'82

Villages & Categories	No. of fishing days	Catch Quantity (kg)	Catch Value (Rs.)	Fishery income (Rs.)	Indebtedness (Rs.)	Families availed loan (%)	No. of families
Umbergaon							
Families owning/sharing:							
a) Mechanised boats	205	24,024	88,802	12,690	9,953	87	68
b) Mech. & non-mech. boats	210	27,631	97,534	15,240	13,655	88	8
c) Non-mech. boats	232	6,960	18,263	7,632	3,429	88	42
d) Gears	219	3,285	8,872	4,862	1,423	66	72
Families engaged in fishery allied activities	—	—	—	3,800	495	83	90
Total/Average				7,134	4,061	80	280
Bhimpore							
Families owning/sharing:							
a) Non-mech. boats	247	11,068	27,027	7,084	1,061	49	35
b) Gears	244	5,114	9,869	4,336	497	45	153
Families engaged in fishery allied activities	—	—	—	3,482	388	71	49
Total/Average				4,565	544	51	237
Sutrapada Bunder							
Families owning/sharing:							
a) OBM boats	214	13,640	35,962	9,204	3,432	83	132
b) Non-mech. boats	218	6,460	17,975	5,038	2,976	75	24
c) Gears	210	2,940	7,702	3,914	1,136	80	25
Families engaged in fishery allied activities				3,378	574	55	91
Total/Average				6,401	2,436	73	272
Mangrol Bunder							
Families owning/sharing:							
a) Trawlers	210	29,108	1,15,020	16,332	13,031	97	150
b) IBM boats	231	21,346	74,002	11,057	9,660	80	5
c) OBM boats	226	12,052	37,436	9,293	4,864	80	95
d) Mech. & non-mech. boats	227	23,972	76,109	12,276	10,784	81	16
e) Non-mech. boats	228	6,961	18,794	5,266	2,975	86	7
f) Gears	217	4,340	11,718	4,621	1,233	86	215
Families engaged in fishery allied activities	—	—	—	3,904	462	47	145
Total/Average				8,184	5,479	79	633

and leased-in (1.9%). In case of gears, full ownership, partial ownership and leased-in was 71.9%, 21.9% and 6.2% respectively. Full ownership was more for non-mechanised boats (85.7%) than mechanised boats (61.1%) because of lesser capital investment in former.

Pomfret, seer fish, ghol, *Hilsa*, ribbonfish, silver-bar, catfish, sharks and clupeoids form major catch at this centre. Bulk of the catch is sold in Crauford and Malad (both in Bombay) markets to the private fish traders and the rest in local market generally by fisher-women. A portion of catch is sun dried/salted. Trucks, autorikshaws and headloads are common mode of fish transportation.

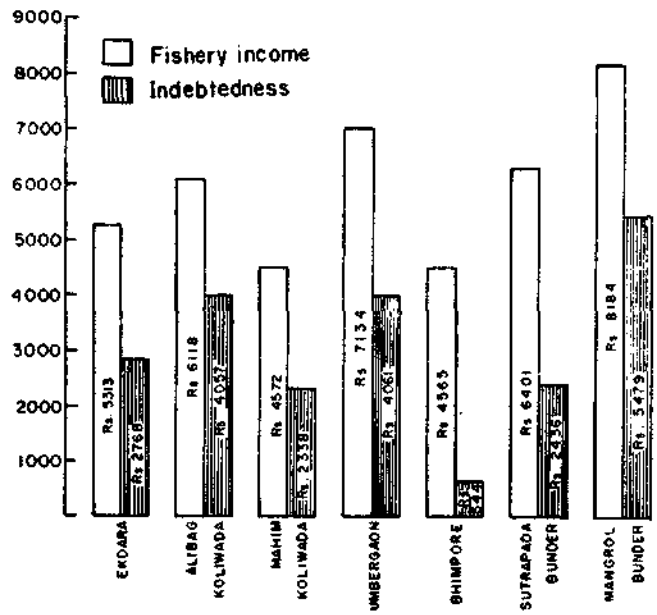

Fig. 5. Fishery income and indebtedness (Rs.).

Table 3A shows that for 208, 208, 206 and 216 annual fishing days, fish catch share for the families owning/sharing only mechanised boats, both mechanised and non-mechanised boats, non-mechanised boats alone and only gears was calculated at 21,086, 23,357, 7,172 and 3,403 kg per family respectively. Annual net fishery income varied from Rs. 3,674 for the families engaged in fishery allied activities to Rs. 11,667 for the families owning/sharing both mechanised and non-mechanised boats. The average annual fishery income in Mahim Koliwada was calculated at Rs. 4,572 per family. Like fishery income, maximum outstanding loan of Rs. 11,500 per family was found for the families owning/sharing both mechanised and non-mechanised boats and minimum of Rs. 216 per family for those engaged in fishery allied activities. The outstanding loan per indebted family in Mahim Koliwada was noted as Rs. 2,338 during the study year. Fishermen families availed loan from different agencies like Fishermen Co-operative Society (7.0%), government (5.4%), banks (5.6%) and fish traders/friends/relatives (35.0%) whereas remaining families (47.0%) did not avail any loan.

Fishermen reported increasing pollution in the coastal water due to release of effluents from industrial units which affect the fish catch of this region.

4. Umbergaon (Gujarat)

Fishing is the main occupation of 'Machhi', a Hindu backward community in this village. It is one of the advanced fishing villages of Gujarat based on infrastructure available. It is a medium size fishing village and tahsil headquarter, spreading over an area of about 2 km^2. The village is electrified and has a small fish market. Water connection and jetty facilities are not available whereas boat building yard, service station, ice plant, cold storage, diesel bunk and kerosene oil agency are available inside the village. Fishermen have a well functioning co-operative society which provides fishing implements and diesel at subsidised rates. Ice factory and boat building yard are working under the management of the society. About 15% of total families (280) have small land holdings for cultivation whereas 20 families have trade and 40 families are engaged in artisanal activities. As many as 300 persons are employed in public and private organisations and 15 self employed as engineers, doctors etc. Rice and fish are the main food items of consumption. As shown in Figure 2, fishermen dwellings constitute huts (2.2%) *kutcha* (45%), *Pucca* (31.4%) and concrete houses (21.4%). No family owning mechanised boat was found to occupy hut.

Total population of fishermen in this village was 2,039 (Table 1) including adult males (590) adult females (583) and children (866). About 20% of families has 10 or more members per family. Families having less than 5 and 5-9 members per family were 15.4% and 65% respectively. Average family size was 7.3 during the reference period. Working population was found to be 54%. Percentage of working population was observed maximum among the families owning/sharing only gears (58.6%) and minimum among those owning/sharing mechanised boats alone (46.6%). Among the working population 31.7% was found as active fishermen, 54.6% engaged in fishery allied activities and 13.7% in non-fishery activities. Occupation analysis further showed that 62.1% of the respondents had

fishery as the only occupation, 20.4% fishery main and non-fishery as subsidiary occupation and 17.5% fishery subsidiary and non-fishery as main occupation (Table 2). Literacy among respondents was 29.2% primary, 20.1% middle, 11.3% higher secondary and 1.5% graduates and above. About 40% of the respondents was members of Fishermen Co-operative Society (Fig. 3). As many as 90% of heads of families under mechanised group were members of the society.

About 75 mechanised boats and 40 non-mechanised boats operate at this centre. Gill-nets, trawl-nets and bag-nets are main gears used for fishing. Big gill-netters go on trips of 15-20 days for 'ghol', 'dara' and shark fishing, whereas trawlers go for 4–6 days mainly for prawn and cephalopod fishing. Generally, from October to January there is bag-net operation (locally known as 'dol') in 3–6 m of water and the same boats are used as gill-netters during other months. Trawlers operating from Bombay base, land at New Ferry Wharf. In monsoon, fishing is carried out in creek with drag-nets, cast-nets and stake-nets. Crew consisting of 6–9 persons operate trawl-nets and gill-nets but stake-net ('gholwa') is operated by 1–2 persons. Wage of crew ranges from Rs. 3,000 to Rs. 5,000 per labourer per annum excluding meals, pan, beedi *etc.* As shown in Table 3b, number of families owning/sharing only mechanised boats, both mechanised and non-mechanised boats, non-mechanised boats alone and only gears were 68, 8, 42 and 72 respectively whereas 90 families were found engaged in fishery allied activities. Figure 4 shows that boats were either with single family ownership (86.9%) or partial ownership (13.1%) and no boat was leased-in/out in this village. Percentage of single family ownership in case of non-mechanised boats was comparatively more. Similarly, there was no leased-in/out of gears and all were either fully owned (86.5%) or partially owned (13.5%). The sharing system of means of production which was prevalent earlier is being discouraged these days. New boats under construction were reported with single family ownership.

Fish catch at this centre mainly comprises prawns, cephalopods, sharks, pomfret, seer fish, bombay duck, threadfin, croakers, polynemids, cat fish, and ribbon fish. Quality fish are sold to private fish traders of Nargol, Maroli and Umbargaon and no catch is sold through Fishermen Co-operative Society. Sun-dried and salted fish are taken to Bombay for sale. A portion of the catch is sold in local retail market and nearby localities by fisherwomen.

As shown in Table 3B, among all the categories, the maximum fishing days were found for non-mechanised group (232 days/annum) and minimum for mechanised group (205 days/annum). Unlike this, share in fish catch per family was maximum for the families owning/sharing both mechanised and non-mechanised boats (27,631 kg/annum) and minimum for those owning/sharing only gears (3,285 kg/annum). Further, net fishery income per family was maximum for the families owning/sharing both mechanised and non-mechanised boats (Rs. 15,240/annum) and minimum for those engaged in fishery allied activities (Rs. 3,800/ annum).

Table 4. *Percentage of the families availed loan from different agencies in selected villages of Maharashtra and Gujarat* 1981–'82

Villages	Percentage of families availed loan from:				Percentage of families not availed loan
	Fish. Co-op. Society	Government	Bank	Private agencies	
Maharashtra					
Ekdara	40.4	10.4	10.0	21.8	21.4
Alibag Koliwada	45.3	16.0	7.0	16.7	15.0
Mahim Koliwada	7.0	5.4	5.6	35.0	47.0
Gujarat					
Umbergaon	4.3	6.0	13.5	56.6	19.6
Bhimpore	—	—	—	51.1	48.9
Sutrapada Bunder	20.6*	—	12.0	40.2	27.2
Mangrol Bunder	—	8.6	10.7	59.4	21.3

*GFCCA provides loan to fishermen in the form of advances through fishermen co-operative society.

Average net fishery income per family was calculated at Rs. 7,134/annum in this village during the reference period. Like income, maximum indebtedness was found for the families owning/sharing both mechanised and non-mechanised boats (Rs. 13,655/family) and minimum for those engaged in fishery allied activities (Rs. 495/family). Average outstanding loan per indebted family was Rs. 4,061 (Table 3B). About 80% of the fishermen families are indebted in this village. Percentages of families who availed loan from Fishermen Co-operative Society, government, banks and private agencies were 4.3, 6.0, 13.5 and 56.6 respectively (Table 4). About 20% of families did not avail loan from any of the agencies.

5. Bhimpore (Gujarat)

Bhimpore is 18 km from Surat and is a backward fishing village. It is situated between Mindhola and Tapi rivers at joining point. The fishing is carried by 'Machhi' / 'Khalasi' who come under economically backward communities in Gujarat according to Bakshi Commission. The village is electrified but water connection is still not provided. A small fish market exists in the village. Jetty facility is available but no boat building yard/service station, curing yard, ice plant, cold storage or petrol/diesel bunk are available. There are 237 fishermen families in the village. About 5% of the families owns small land holdings for farming. About 15 families have provision shops excluding one textile shop. Artisans include tailors (10), carpenters (5) and barbers (5). More than 200 persons from fishermen families are working in public or private owned shipping companies, mills and factories. Rice and fish are main food items of consumption. The percentages of fishermen families residing in huts, *kutcha, pucca* and concrete houses are 7.6, 28.7, 46.8 and 16.9 respectively (Fig. 2).

The total fishermen population during the reference year was 1,779 (Table 1) including adult males (545), adult females (541) and children (693). The average size of fishermen family was 7.5. Percentages of families with less than 5, 5–9 and 10 or more members per family are 8, 70 and 22 respectively. Working population is 58%, the highest being 60.6% in case of the families owning/sharing only gears and lowest 56.8% for those engaged in fishery allied activities. Active fishermen formed 28.5% of working population whereas 51.7% engaged in fishery allied activities. About 20% of working population is employed in non-fishery occupations in this village. Among the total of 237 heads of families interviewed, the literacy level was 37.3% (primary), 22.8% (middle), 8.0 % (higher secondary) and 0.4% (graduate and above) (Table 2). A Fishermen Co-operative Society which registered 168 members is disfunct now.

About 30 non-mechanised boats, locally known as 'Sidwala' are in operation at this centre. Drag-net, bag-net, wall-net, stake-net ('gholwa'), gill-net, hooks and line and traps are common gears used for fishing in this village. Fishing by operating small drag-nets in shallow water without boat, locally known as 'Pagadia' fishing, is very common at this centre. Since, no mechanised boat is operating at this centre, the fishermen families (237) were grouped into three categories *viz.* families owning/sharing non-mechanised boats (35), only gears (153) and those engaged in fishery allied activities (49). Results regarding the ownership of means of production revealed that 88.6% of boats was with single family ownership and 11.4% with partial ownership (Fig. 4). No leased-in/out of boat was found in Bhimpore. Similarly, all the gears were found with single family ownership and no gear was with partial ownership or leased-in/out.

At this centre, bombay-duck, prawns, mullet, mud-skipper, cat fish, *Hilsa* and croakers form the major catch. Most of the catch is taken to Surat by bus or autorikshaw and sold to private fish traders. Small portion of catch is sold in local retail market and nearby localities by fisherwomen.

Annual share in fish catch (Table 3B) for families owning/sharing non-mechanised boats and only gears was worked out to be 11,068 kg and 5,114 kg per family for 247 and 244 fishing days respectively. Unlike other centres, there is substantial *Hilsa* landing in monsoon season. Mud-skipper (Gobidae) fishing by means of noose-loop traps locally called 'Phans' or 'Pahi' is a unique method of this centre. Income analysis showed that among the three categories, maximum net fishery income per family was found for the families owning/sharing boats (Rs. 7,084/annum) and minimum for those engaged in fishery allied activities (Rs. 3,482/annum). Average outstanding loan per indebted family was Rs. 544 with maximum of Rs. 1,061 for families owning/sharing boats and minimum of Rs. 388 for those engaged in fishery allied activities. About 51% of total families availed loan from private agencies like money lenders, fish traders, friends, relatives *etc.* whereas 48.9% did not avail any loan (Table 4). Moreover, fishermen are not interested to avail loan either from government or banks for investment on mechanisation because the fish catch was badly affected

due to construction of Ukai dam on Tapi river and increasing pollution in Mindhola river by discharge of effluents from chemical and fertilizer plants and textile mills located in this region.

6. Sutrapada Bunder (Gujarat)

Sutrapada Bunder is about 19 km from Veraval and is connected with coastal highway. The fishing is the occupation of 'Koli Kharwa', a backward Hindu community. All the fishermen have settled near landing centre and the village is known as Sutrapada Bunder which is about 1 km away from main Sutrapada village. About 272 families are engaged in fishing and fishery allied activities. The village is electrified but water connection is not available. It has limited infrastructure facilities. Fish market, boat building yard, curing/processing yards, ice factory, petrol/diesel bunk, cold storage *etc.* are available only at Veraval. Kerosene is supplied through the Fishermen Co-operative Society. This village is covered under World Bank Project for development of fishery infrastructure like link road, jetty, auction hall, water supply, ice factory *etc.* There are five petty shops and four hotels including tea stalls. Besides three weavers and one carpenter, about 20 persons are employed in government, semi-government and private organisations and two persons are self employed. Rice, fish, wheat and *bajra* are main food items of the villagers. The percentages of huts, *kutcha*, *pucca* and concrete houses are 10.0, 38.6, 50.7 and 0.7 respectively (Fig. 2).

Fishermen population totalled 2,094 (Table 1) comprising 580 adult males, 579 adult females and 935 children. Members per family averaged 7.7. Percentages of families with less than 5, 5–9 and 10 or more members were 21.7, 57 and 21.3 respectively. About 47% was working population. Among the working population, 51.5% was active fishermen, 45.1% engaged in fishery allied activities and 3.4% in non-fishery activities. Of active fishermen, 87.8% was found operating OBM boats and 12.2% non-mechanised boats. Occupation analysis showed that 90.5% of the respondents had fishery as the only occupation, 5.4% fishery main and non-fishery as subsidiary occupation and 4.1% non-fishery main and fishery as subsidiary occupation (Table 2). Majority of respondents was illiterate (61.4%). The respondents with primary, middle higher secondary and graduate qualifications were 31.2% 6.2%, 0.8% and 0.4% respectively. As many as 400 fishermen are members of Fishermen Co-operative Society which provides fishing implements to the fishermen.

About 100 OBM boats, excluding 5 FRP (Ferrocement/fibreglass reinforced plastic) boats and 20 non-machanised boats operate at this centre. Most of the boats are fitted with 6–9 H.P. OBM and run on kerosene oil. Gears used at this centre include surface and bottom-set gill-nets, cast-net, hooks and line and drag-net. Fishermen families were divided into four groups *viz*, families owning/sharing OBM boats (132), non-mechanised boats (24), only gears (25) and those engaged in fishery allied activities (91). There was no IBM (inboard motor) boat in this village. Ownership of means of production showed that 82.2% of boats was with single family ownership, 14.0% partial ownership and 3.8% leased-in (Figure 4). Regarding ownership of gears it was found that 82.9% of gears was with full ownership, 16.6% partial ownership and 0.5% leased-in.

Main catch of this centre constitutes pomfret, seerfish, croakers, *Hilsa* and other clupeoids, catfish, ribbonfish, perches and silverbar. About 22% families sells the fish catch to GFCCA through Fishermen Co-operative Society at the rate fixed/contracted for 15 days to one month by GFCCA with the concurrence of fishermen's representatives. Few families (15–20 boats owners) sell their catch at Veraval to private fish traders and remaining boats sell to private traders in the village. Autorikshaw is the main mode of fish transportation. Most of the catch is sold in fresh form. A small portion of salted and sun dried shark and cat fish is purchased by traders coming from Bombay.

Annual catch share with number of fishing days for different categories is presented in Table 3B. Maximum annual share in fish catch among these categories was found for the families owning/sharing OBM boats (13,640 kg per family) and minimum for those owning/sharing only gears (2,940 kg per family). Annual fishing days were maximum for the families owning non-mechanised boats (218 days) and minimum for those operating only gears (210 days). Further, net fishery income among these categories was also found maximum for the families owning/sharing OBM boats (Rs. 9,204/annum) and minimum for those engaged in fishery allied activities (Rs. 3,378/annum). Average annual fishery income was calculated at Rs. 6,401 per family. Average outstanding loan for the families owning/sharing OBM boats, non-mechanised boats, only gears and those engaged in fishery allied activities was Rs. 3,432, 2,976, 1,136 and 574 respectively. Outstanding loan for indebted families averaged to Rs. 2,436. About 27% of the families did not avail loan from any

source. Percentages of families who availed loan from Fishermen Co-operative Society (from GFCCA advance), banks and private agencies were 20.6, 12.0 and 40.2 respectively (Table 4).

7. Mangrol Bunder (Gujarat)

Mangrol Bunder is an advanced fishing village of Junagadh District. 'Kharwa', a dominating community in the village, is engaged in fishing and fishery allied activities. Mangrol Bunder, which is 3 km from main Mangrol town, is connected by *pucca* road. It has got electric and water connections. Facilities connected with fishery like jetty, boat building yard (under Gujarat Fisheries Development Corporation), service station, curing yards, ice plant, cold storage, petrol/diesel bunk etc. are available within the radius of 3 km from landing centre. Fishermen Co-operative Society provides fishing implements. This village is covered under World Bank Project for providing infrastructure for fishery development. There are 10 retail shops and seven hotels including tea stalls. Most of the artisanal activities are carried out by persons coming from nearby town. A few persons from the village work in government or private organisations. *Bajra,* rice and fish form staple food of the villagers. At Mangrol Bunder, there is no hut and the percentages of *kutcha, pucca* and concrete houses are 19.1, 79.9 and 1.0 respectively (Fig. 2).

Total population (4,663) of this village consists of adult males (1,433), adult females (1,416) and children (1,814). Average family size was 7.4 (Table 1). Families with less than 5, 5–9 and 10 or more members were 22.8%, 67.1% and 10.1% respectively. Working population was 48.4% in this village. Among the working population, 47.8% was active fishermen, 51.6% engaged in fishery allied activities and 0.6% employed in non-fishery occupations. Among the active fishermen, 69.5% was found going on trawlers, 28.5% on OBM boats and 2% on non-mechanised boats. Occupation analysis showed that 91.3% respondents had fishery as the only occupation, 3.7% fishery main and non-fishery as subsidiary occupation and 5.0% non-fishery main and fishery as subsidiary occupation (Table 2). Education level of respondents was of the order of 34.1% (primary), 6.0% (middle) and 1.8% (higher secondary and above). About 67% of the respondents was members of Fishermen Co-operative Society at Mangrol Bunder (Fig. 3).

About 280 boats including 150 trawlers and 95 OBM boats operate at this centre. Trawl-nets and gill-nets are main gears used for fishing. Gill-nets are operated in 8–11m of water whereas trawl-nets operate upto 8 m. In monsoon old gill-nets are used to trap lobsters. Trawlers make fishing trips of 4–6 days and gill-netters 3–4 days, whereas OBM boats go on daily trips. A crew consisting of 6–9 persons operate trawlers and gill-netters whereas OBM boats are operated by 3–4 persons. Most of the gill-netters and trawlers are 40 footers fitted with 4–6 cylinder Ruston or Ashok Leyland engines. Crew members are contracted for fishing season of 8–9 months a year and wage ranges from Rs. 3,000–4,000 per labourer, excluding personal expenditure. Number of families owning/sharing trawlers, IBM boats, OBM boats, both mechanised and non-mechanised boats, non-mechanised boats alone and only gears were 150, 5, 95, 16, 7 and 215 respectively whereas number of families engaged in fishery allied activities was 145. Ownership of means of production showed that 97.6% of boats was with single family ownership and 1.2% each with partial ownership and leased-in/out (Fig. 4). Almost all the gears (99.6%) were found with single family ownership.

Catch at Mangrol centre comprises pomfret, croakers, cephalopods, *Hilsa* and other clupeoids, seer fish, shark, catfish, silverbar, prawns, lobster and sciaenids. Most of the catch is sold to private fish traders. Small portion of catch is sold in retail market by fisherwomen. Head load and autorikshaw are main mode of fish transportation.

Catch particulars (Table 3B) showed that among the six categories, highest share in annual fish catch per family was observed for the families owning/sharing trawlers (29,108 kg) for 210 fishing days followed by those owning/sharing both mechanised and non-mechanised boats (23,972 kg) for 227 fishing days. Quantity of catch share per family was observed minimum for the families owning/sharing only gears (4,340 kgs/annum) for 217 annual fishing days. Annual fishing days ranged from 210 to 231 among different categories. Net fishery income was found maximum for the families owning/sharing trawlers (Rs. 16,332/annum) followed by those owning/sharing both mechanised and non-mechanised boats (Rs. 12,276/annum). Among all the categories, minimum fishery income was observed for the families engaged in fishery allied activities (Rs. 3,904/annum). The average income per family at Mangrol Bunder was calculated at Rs. 8,184/annum. Income and indebtedness have got similar pattern for fishermen families under different categories. Maximum outstanding loan was found for the families

Fig. 6. Unloading of catch at Navabunder.

Fig. 7. Sorting out of catch at Navabunder.

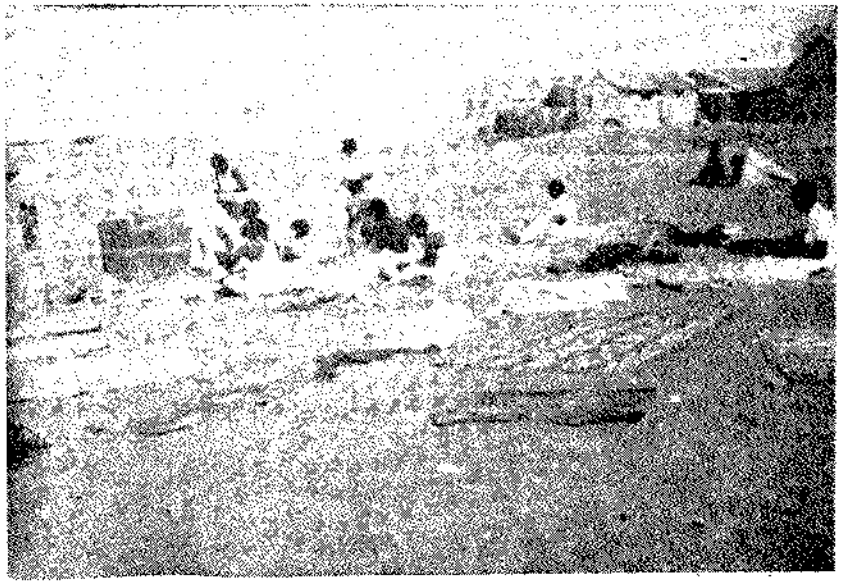

Fig. 8. Net repairing at Sutrapada.

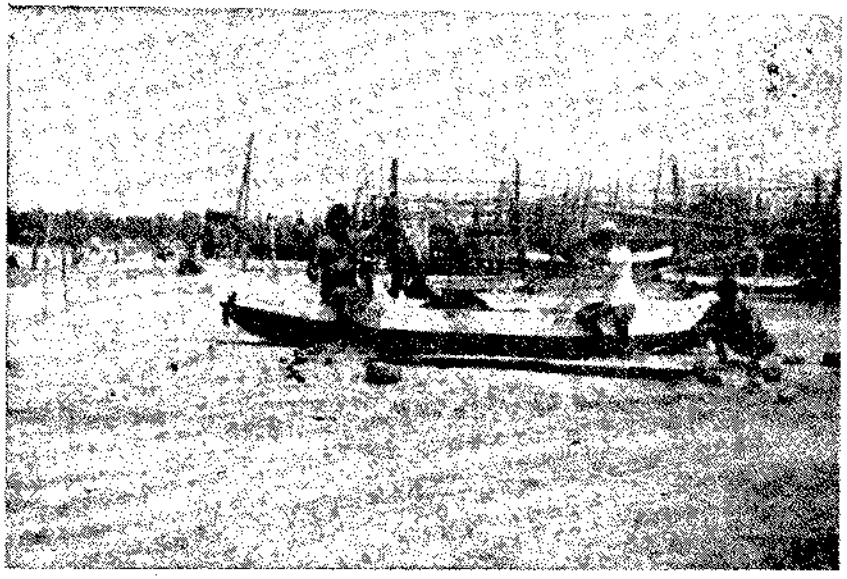

Fig. 9. Net repairing at Madh. In the background are the fish drying stands.

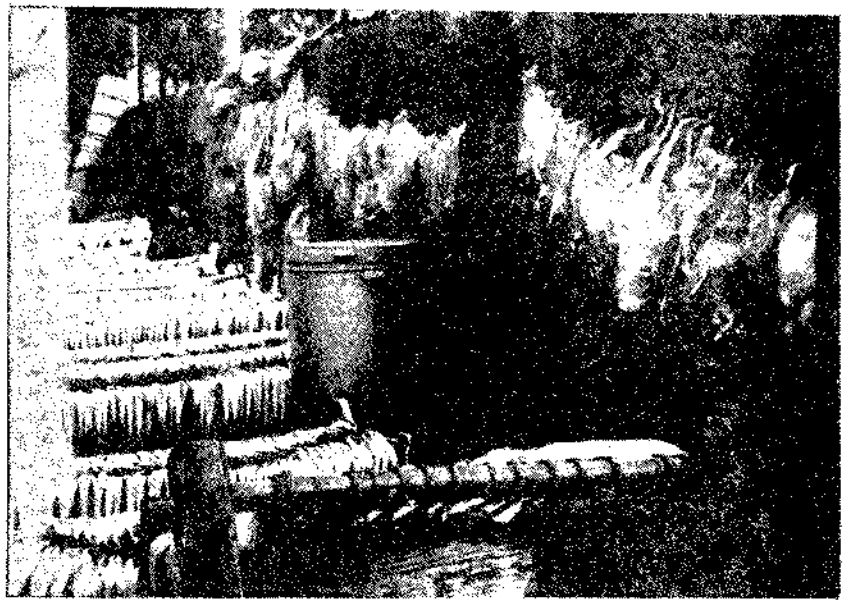

Fig. 10. Fish maws of cat fish, wam, ghol etc. are being sundried on the raised platform at umbergaon.

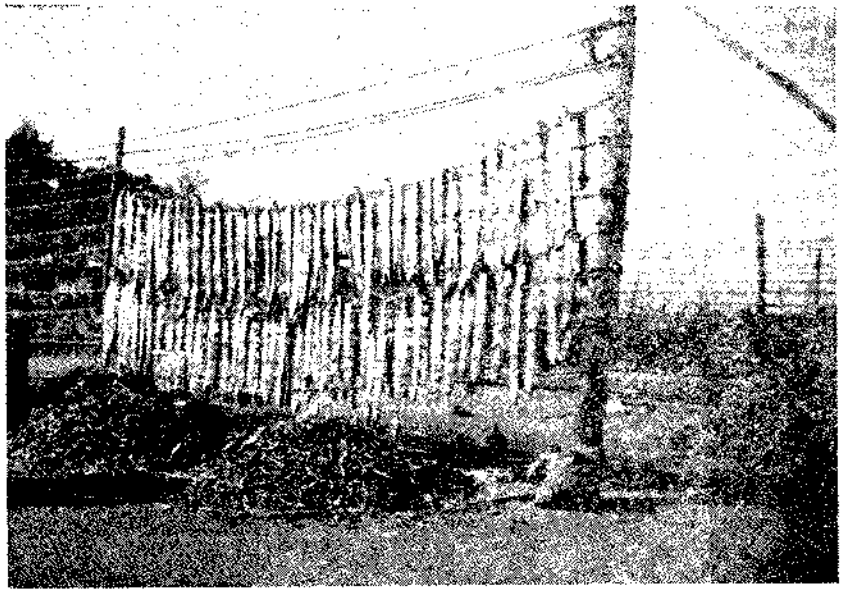

Fig. 11. Sundrying of ribbon fish at Navabunder.

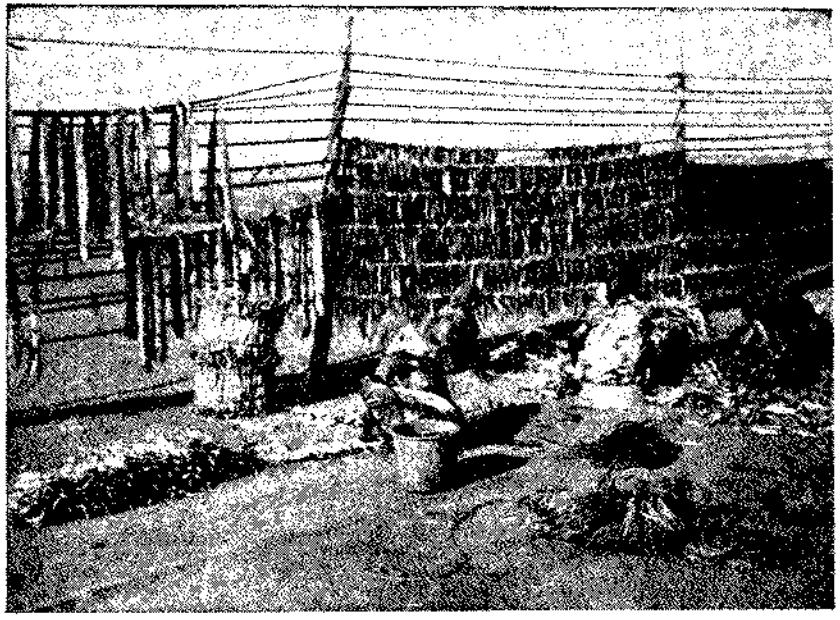

Fig. 12. Fishermen arranging dry fish in bundles at Navabunder.

Fig. 13. Sorting of dry fish at Navabunder.

Fig. 14. Fisherwomen with dry fish bundles on head are going to fetch water. A scene at Navabunder.

Fig. 15. Fisherwomen with fish baskets on head enter the state transport bus at Bhimpore.

Fig. 16. Dry fish ready for disposal at Navabunder.

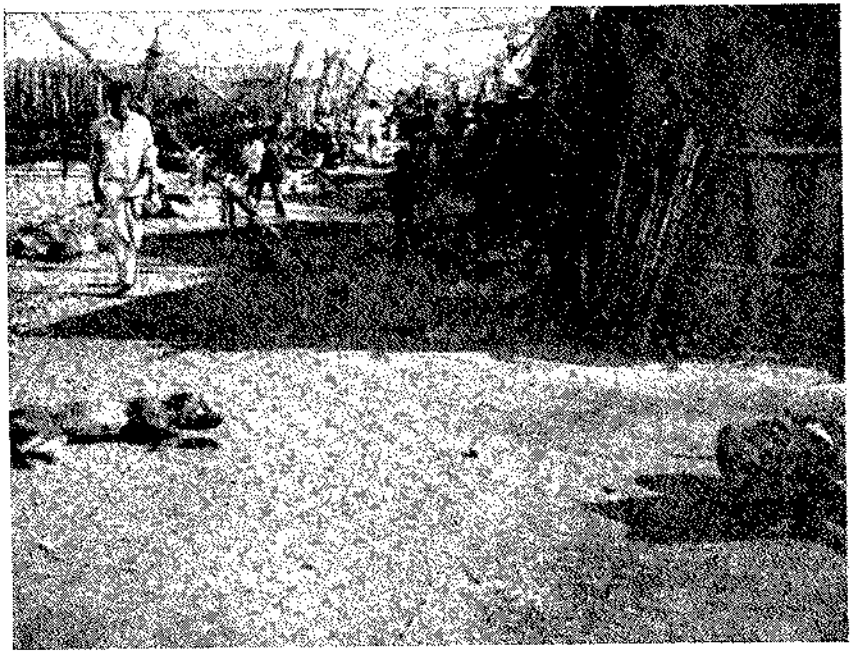

Fig. 17. Temporary dwelling of labourers near fish drying yards at Navabunder.

owning/sharing trawlers (Rs. 13,031) and minimum for those engaged in fishery allied activities (Rs. 462). The average debt was worked out to be Rs. 5,479 per indebted family. As shown in Table 4, about 21% of families did not avail loan whereas majority availed loan from private agencies (59.4%). The percentages of families who availed loan from banks and government were 10.7% and 8.6% respectively. Fishermen Co-operative Society does not provide loan but helps fishermen in getting loan from government and banks.

Comparison within the state and between the states

Maharashtra villages: Looking at the general condition of the villages and the fishery infrastructure available, Alibag Koliwada ranks first among the selected villages of Maharashtra. Family size is comparatively smaller in Mahim Koliwada. Percentage of working population is highest in Alibag Koliwada whereas percentage of those employed in non-fishery occupations and literacy level is highest in Mahim Koliwada. Dependence on fishing, as main occupation, is found more in Ekdara. Mechanised fishing is mroe prevalent at Alibag Koliwada than other centres which is specialised in seining for non-penaeid prawns *(Jawla)* by bagnet ('dol'). Non-penaeid prawns in bag-net and silverbar in gill-net at Ekdara centre and pomfret and seer fish by gill-net in Mahim Koliwada are among the important catches. Not much difference was observed in ownership status of means of production in these villages. Maximum variation in annual fishing days is observed among different categories in Alibag Koliwada. Fish catch and income of families under different categories are also higher in Alibag Koliwada. The average indebtedness as well as percentage of indebted families are comparatively low in Mahim Koliwada. Percentage of families availing loan from fishermen co-operative societies is the highest in Alibag Koliwada whereas percentage of those availed loan from private agencies is more in Mahim Koliwada.

Gujarat villages: Based on the mechanisation level and fishery infrastructure available, Umbergaon and Mangrol Bunder are categorised as advanced, Sutrapada Bunder as medium and Bhimpore as backward fishing villages. There is hardly any difference in family size among these villages. Percentage of workers in the total population is the highest in Bhimpore and lowest in Sutrapada Bunder whereas percentage of population employed in non-fishery occupations is the lowest in Mangrol Bunder and the highest in Bhimpore. Percentage of active fishermen in working population is the highest in Sutrapada Bunder followed by Mangrol Bunder and the lowest in Bhimpore. Highest level of literacy is observed in Bhimpore followed by Umbergaon and lowest in Sutrapada Bunder. Highest dependence on fishery is noted in Mangrol Bunder and Sutrapada Bunder and lowest in Bhimpore. Mangrol Bunder has several mechanised fishing boats whereas Bhimpore has no mechanised boat. Main craft at Sutrapada Bunder is OBM boat operating gill-nets. In Umbergaon, gill-nets, trawl-nets and bag-nets are main gears used for fishing. Prawn, bombay duck, pomfret and shark are important catch components at Umbergaon centre. Pomfret and seer fish at Sutrapada Bunder; prawn, seer fish and pomfret at Mangrol and bombay duck and *Hilsa* at Bhimpore form major catch in general. The ownership of means of production shows almost similar trend in all the selected villages of Gujarat. Number of annual fishing days on mechanised boats are comparatively more at Mangrol Bunder. For non-mechanised boats, fishing days are maximum in Bhimpore because there is substantial landing of *Hilsa* in monsoon season. In Umbergaon, bag-net ('dol') is generally operated during October-January and the same boats are used as gill-netters in rest of the fishing season. Between Mangrol Bunder and Sutrapada Bunder, no significant variation is observed in fish catch and income for the families owning/sharing OBM boats. Among the four selected villages, the highest income is found for the families owning/sharing trawlers in Mangrol Bunder followed by those operating both mechanised and non-mechanised boats at Umbergaon. The weighted average fishery income and indebtedness are found highest in Mangrol Bunder and lowest in Bhimpore. Percentage of families availing loan is comparatively more in Umbergaon. Among all the four villages, percentage of families availing loan through fishermen co-operative societies is the highest in Sutrapada Bunder. Majority of the families in Mangrol Bunder and Umbergaon are getting loan from private agencies.

Maharashtra vs Gujarat villages

Socio-economic conditions of Gujarat fishermen are comparatively better than those of Maharashtra. Fishing is mostly carried out by tribal communities in Maharashtra whereas in Gujarat it is an occupation of 'Kharwa'/'Machhi' communities which come under OBC. No significant difference between the states, is observed regarding family size, literacy and dependence on fishing. Standard of fishermen's dwellings in Gujarat is better than Maharashtra. Contrary to

this, functioning and coverage of activities of fishermen co-operative societies in Maharashtra is better than Gujarat in general. There is not much difference in the level of mechanisation in the villages of both the states. There is no mechanised boat in Bhimpore and no IBM (inboard motor) boat in Sutrapada Bunder. Further, it is observed that OBM boats are more popular in Gujarat. There is similarity in trawl-net and gill-net operations but method of bag-net ('dol') operation differs in both the states. Owing to the availability of fish resources the non-penaeid prawns in Maharashtra and bombay-duck in Gujarat are the mainstay of bagnet ('dol') catches. Single family ownership of means of production is more in Gujarat than Maharashtra. Category-wise annual fishery income and fishing days in the villages of Gujarat is more than those of Maharashtra. Indebtedness pattern in both the states shows that heavier the investment in means of production, more the amount of loan availed. Except Mahim Koliwada in Maharashtra and Bhimpore in Gujarat where number of indebted families and amount of out-standing loan are comparatively low, all other villages have majority of families (73–85 per cent) under debt. Further, percentage of families availing loan from fishermen co-operative societies is comparatively more in the villages of Maharashtra and those availing loan from private agencies (mainly fish traders) is more in Gujarat.

Acknowledgements

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TRENDS IN THE YIELD OF EXPLOITED SCIAENID FISHERY RESOURCES ALONG THE INDIAN COASTS*

Introduction

The fishes of the family Sciaenidae collectively called sciaenids and populalry known as croakers or jew fishes constitute one of the commercially important ground fishes contributing to a sizeable share in the marine fish landings of India. Thirty species of the family Sciaenidae under 14 genera have been reported from the Indian seas. Though some species like the 'ghol' *Protonibea diacanthus, Otolithoides biauritus* etc. attain 100-120 cm in length, majority of them are in the length range of 20–35 cm or even less.

The initial attempts to discuss briefly about the catch trends of sciaenids along the Indian coasts during the periods, 1950–'62 and 1956–'65 were made by Nair and Banerji (1966) and Rao (1975) respectively. Subsequent accounts by Bensam (1973), Dharmaraja and Philipose (1975) and Rao (1976) pertained mainly to the east coast of India.

*Prepared by P. K. Mahadevan Pillai and S. K. Dharmaraja, C.M.F.R.I., Cochin.

In the present account a descriptive analysis is made on the recent trends in the yield of exploited sciaenid fishery resources along the coasts of India during the period, 1966–'84. The all-India statewise catch trends in the order of abundance during the period, 1966–'82 are summarised below.

All-India sciaenid landings

The total all-India sciaenid landings fluctuated from 26,580 tonnes in 1967 to 1,14,533 tonnes in 1975 with an average of 72,202 tonnes (Table 1). The percentage of sciaenid catch to total catch also varied from 2.98 in 1967 to 8.07 in 1975 (Fig. 1A).

Statewise landings of sciaenids

Gujarat

This state ranked first in the sciaenid landings among the maritime states of India with an estimated average

catch of 22,342 tonnes during the 19 year period from 1966 to 1984, the state's average catch being about 31% of the total all—India average catch. The maximum catch of 45,781 tonnes was recorded in 1975. Though a lesser catch trend was noticed during 1967–'72 period, the subsequent years witnessed higher catches (Table 1). The percentage contribution of sciaenids in relation to total landings in the state indicated a maximum of about 33% in 1973 (Fig. 1B). The increased catch obtained during 1973–'84 period enabled the state to achieve the first place in the sciaenid landings of the country.

The census conducted by CMFRI in 1980 *(Mar. Fish. Infor. Serv., T & E Ser., No.* **30,** 1981) indicates that there are 1,209 trawlers, 1,547 gill-netters and 650 'dol' netters in Gujarat which land appreciable quantities of sciaenids.

Maharashtra

With an estimated average catch of 15,098 tonnes during the period and contributing to about 7% of the state's fish production, Maharashtra occupies second place in the sciaenid landings (21%). The production trends indicate higher catches during 1973–'84 period with a maximum of 21,366 tonnes recorded in 1979 (Table 1).

The percentage contribution of sciaenids to the total catch fluctuated between 5% in 1972 and 9% in 1974 (Fig. 1C). Along the Bombay–Sourashtra coast sciaenids constitute 25.38% in the commercial catches. This indicates the role of mechanised trawlers in enhancing the landings of sciaenids. According to a recent study 87% of the marine fish catch in this state is landed by mechanised boats which bring substantial quantities of sciaenids.

Kerala

Kerala occupies the fifth place (9.9%) among the maritime states in the catch of sciaenids at all-India level with an estimated average landing of 7,146 tonnes (Table 1). The landings during the period 1966–'84 showed a highly fluctuating trend with a maximum of 16,811 tonnes in 1975 and a minimum of

Table 1. *Statewise landings of sciaenids in India during* 1966–'84 *(in tonnes)*

Year	West Bengal & Orissa	Andhra Pradesh	Tamil-nadu	Pondi-cherry	Kerala	Karna-taka	Goa	Maha-rashtra	Gujarat	Total
1966	440	3,144	5,679	810	4,921	1,508	131	7,856	11,543	36,032
1967	496	3,232	8,414	498	4,310	492	146	7,581	1,411	26,580
1968	1,795	2,557	9,836	709	3,630	821	320	7,141	1,496	28,305
1969	1,274	6,874	8,586	895	3,195	1,187	86	10,733	2,211	35,041
1970	2,617	4,091	10,045	481	5,792	1,885	97	12,906	3,989	41,903
1971	2,727	5,954	5,495	391	4,145	1,313	106	13,339	3,443	36,903
1972	2,479	7,277	6,221	546	6,137	2,114	280	11,299	3,806	40,159
1973	1,323	7,576	10,607	626	11,723	1,013	171	14,319	40,324	87,682
1974	1,671	12,358	9,943	250	9,220	3,208	883	17,453	24,275	79,261
1975	4,474	11,682	10,096	212	16,811	1,853	3,048	20,576	45,781	1,14,533
1976	4,399	10,891	10,562	434	6,955	3,216	2,640	19,781	28,698	87,576
1977	1,131	10,182	13,756	258	11,965	2,762	2,779	17,086	39,968	99,887
1978	6,970	5,597	14,239	374	13,045	1,728	3,256	17,202	33,968	96,379
1979	6,266	8,825	18,948	306	5,237	2,348	1,492	21,366	28,230	93,018
1980	3,222	9,496	19,547	320	6,164	3,500	1,530	13,956	31,625	89,360
1981	2,403	7,046	13,140	330	3,145	2,295	1,610	17,475	35,242	82,686
1982	4,785	8,779	22,029	561	3,581	2,326	2,298	15,926	26,962	87,247
1983	14,123	11,554	13,143	454	6,112	4,067	2,697	18,278	29,647	1,00,075
1984	19,885	8,047	12,707	741	9,686	2,005	1,677	22,588	31,887	1,09,223
Average	4,341	7,640	11,736	484	7,146	2,086	1,329	15,098	22,342	72,202
Percentage	6.01	10.58	16.26	0.67	9.90	2.89	1.84	20.91	30.94	

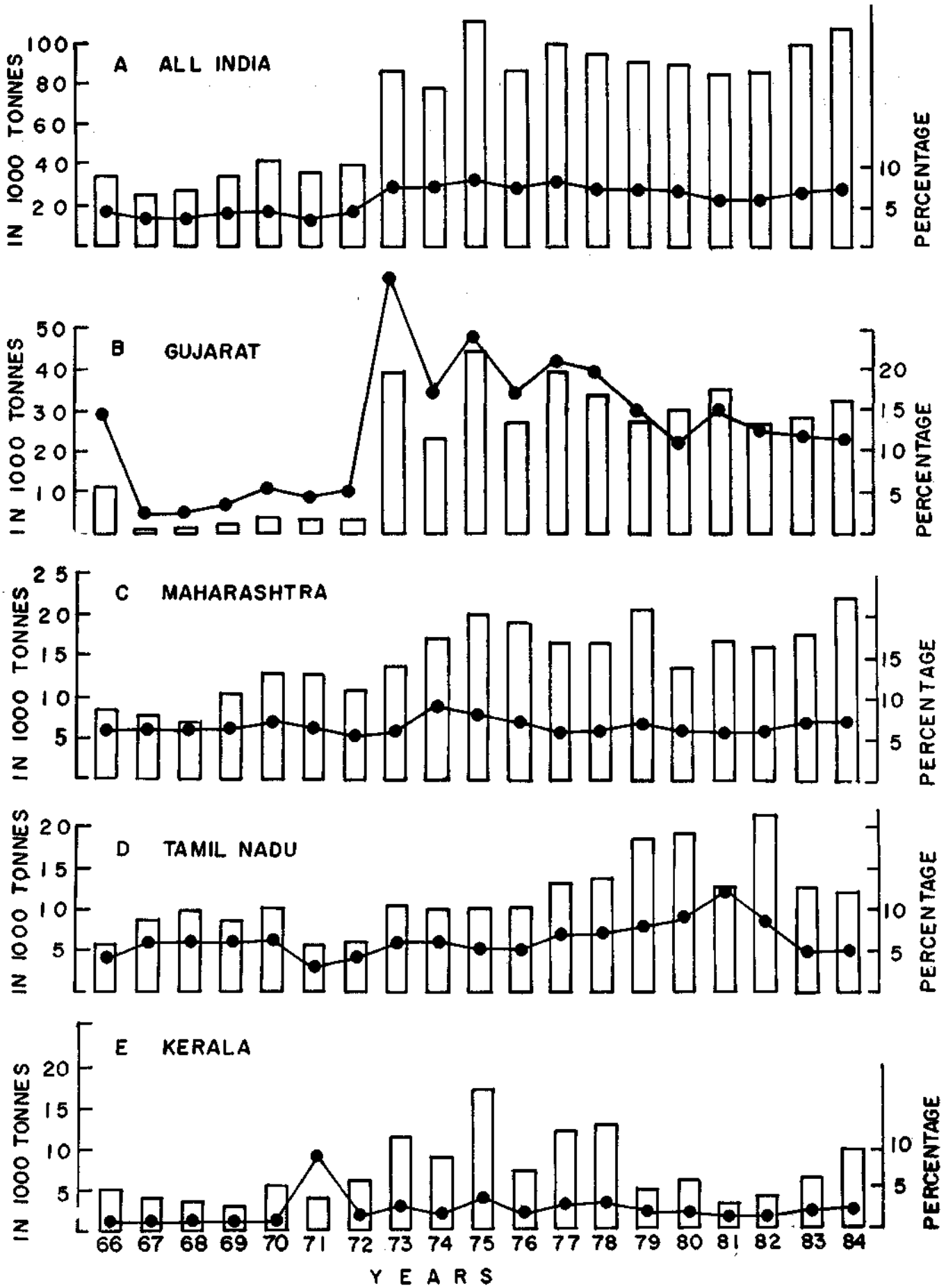

Fig. 1. Landings of sciaenids in the states of Gujarat, Maharashtra, Tamilnadu, Kerala and all-India and the percentage contribution to total landings during the period, 1966–'84.

3,145 tonnes in 1981, the corresponding percentages being 4 and 1 respectively (Fig. 1E).

Tamilnadu

This state ranks third in the landings of sciaenids at all-India level and first along the east coast of India with an average of 11,736 tonnes contributing to 16.26% of the all-India average catch (Table 1). The maximum landings were seen in 1982 (22,029 tonnes) and the minimum (5,495 tonnes) in 1971, the corresponding percentages to the total catch being about 9 and 3 respectively (Fig. 1D). The landings of sciaenids showed an increasing trend from 1975 to 1980 while a fluctuating trend was seen during other years.

Andhra Pradesh

With an average catch of 7,640 tonnes, this state ranks fourth (10.58%) in the landings of sciaenids, the minimum and maximum landings being 2,557 tonnes in 1968 and 12,358 tonnes in 1974 respectively (Table 1 and Fig. 2A). The percentage of sciaenid catch to the total catch in the state varied from 3 in 1968 to 10 in 1977 and 1978. The study has shown that while the catch from the mechanised boats along the Andhra coast increased in 1983 it registered a decrease in 1984.

West Bengal and Orissa

These two states jointly recorded an average catch of 4,341 tonnes of sciaenids during the period (Table 1) accounting for sixth place (6.01%). A maximum landing of 19,885 tonnes was recorded in 1984 showing an all time record. The landings during 1966–'84 showed a highly fluctuating trend, the last two years recording significantly higher catches. The percentage of the catch of scieanids to the total catch in these states varied from 3 in 1967 to 23 in 1984 (Fig. 2B).

Karnataka

This state could claim only seventh place (2.89%) in the landings of sciaenids among the maritime states of India and fourth along the west coast with an average catch of 2,086 tonnes (Table 1). The landings experienced considerable fluctuations year to year during the period 1966-'84. Except in 1974, 1976 and 1980 the catch was less than 3,000 tonnes (Fig. 2C). It is also noticed that excepting two years (1968 and 1974) the percentage contribution of sciaenids to the total catch in the state never exceeded 3% level.

Goa

An estimated average catch of 1,329 tonnes of sciaenids was noticed during the period, 1966-'84 the minimum and maximum landings being in 1969 and 1978 respectively (Table 1). Although the percentage contribution to the total catch was less than 1% prior to 1973, increased landings were noticed in the subsequent years (Fig. 2B). This increase in the catch can be attributed to the corresponding increase in the number of operations of mechanised boats in this Union Territory (*Mar. Fish. Infor. Serv., T. & E Ser., No.* **3**, 1978 and *No.* **30**, 1981).

Pondicherry

The catch particulars available for this Union Territory indicate an average landing of 484 tonnes during the period, 1966–'84. The fluctuating catch trend varied from 212 tonnes in 1975 to 895 tonnes in 1969 (Table 1). The percentage contribution to the state's total catch which was of the order of 8 in 1968 and 1969 sharply declined to 3 in 1974–'75 and 1979–'80 periods.

Discussion

The sciaenids form an important group of fishes in the marine fish landings in India. Earlier investigations by Nair and Banerji (1966) and Rao (1973) indicated 5.45% and 3.64% of the sciaenid landings to total fish landings during 1950–'62 and 1956–'63 periods respectively. The present study reveals an average catch of about 72,200 tonnes during the period, 1966–'84 forming 6% of the all-India total marine fish catch. Catch trends during the period reveal highest catch in 1975 with 1.15 lakh tonnes. In general, the sciaenid landings indicated maximum yield from 1973 onwards which can be attributed mainly to the operations of more number of mechanised boats along the Indian coasts. Since then, the mechanised boats have gradually increased and at present an estimated number of 19,000 mechanised boats are in operation along the Indian coasts (*Mar. Fish. Infor. Serv., T&E Ser., No.* **30**, 1981). Although trawling is almost exclusively carried out for prawns on account of their export value, sciaenids are also caught along with other demersal fishes. The percentage contribution of sciaenids to the total catch from 1973 did not show variation although 1975 recorded a maximum of 8%.

West (1973) estimated that out of 117×10^3 tons of demersal fish potential in the shelf srea off north east

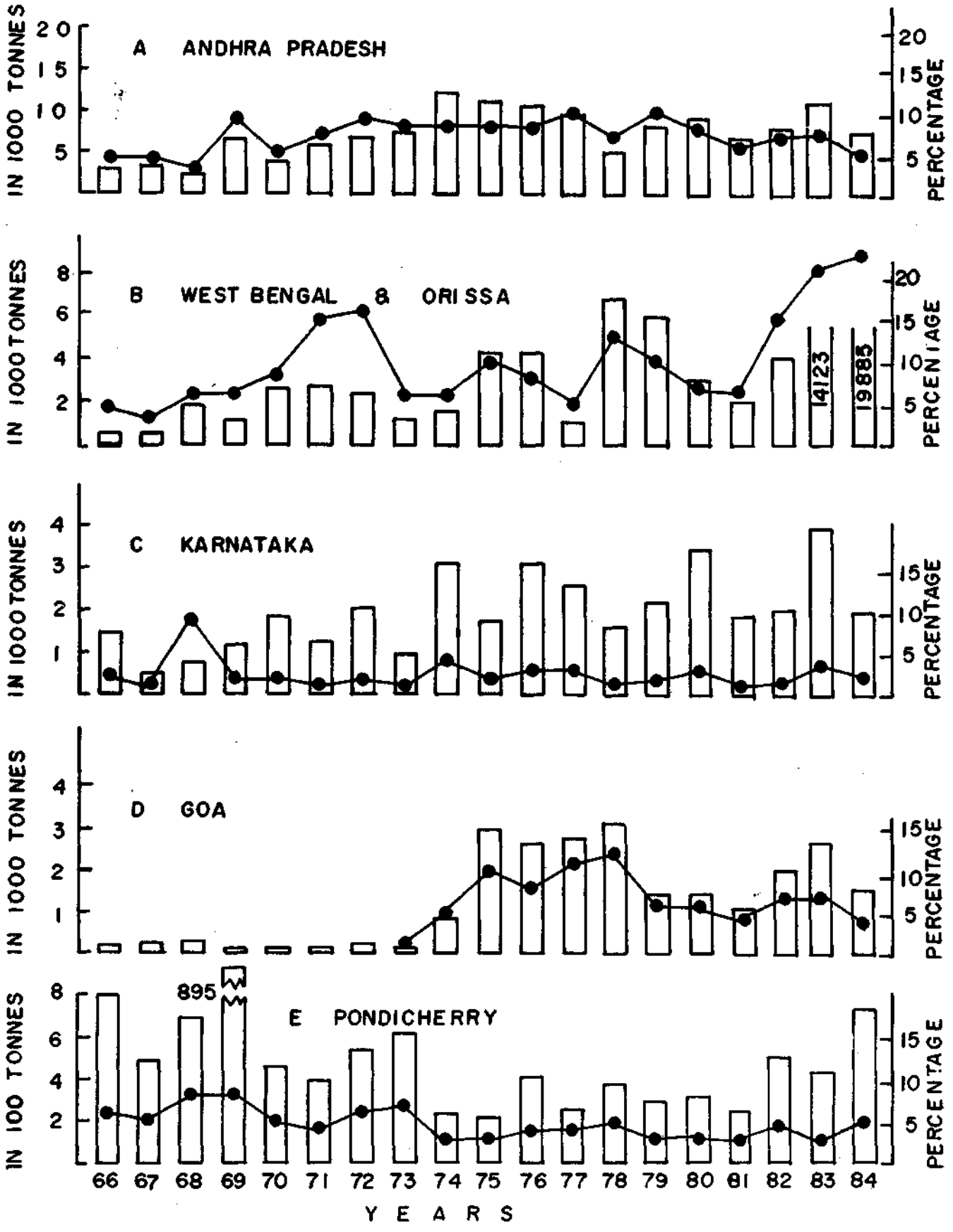

Fig. 2. Landings of sciaenids in the states of Andhra Pradesh, West Bengal & Orissa, Karnataka and union territories of Goa and Pondicherry and the percentage contribution to total landings during the period, 1966–'84.

coast of India, 16.7 x 10^3 tons were constituted by sciaenids thereby indicating the potential stock of this fishery along this coast. Comparatively better grounds for sciaenids have been recorded towards the north, while exploitable areas are present in the southern zone also mainly at 17°40′ N and in zone north of 19°40′N.

Acknowledgement

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MECHANISATION OF TRADITIONAL CRAFTS WITH OUTBOARD MOTORS AT VIZHINJAM*

Introduction

Vizhinjam, 16 km south of Trivandrum in Kerala State, is an important fish landing centre where, because of a bay protected by breakwaters, fishing goes on even during the monsoon period. Good marketing outlets are available at nearby places such as Balaramapuram, Trivandrum and adjacent towns. The fishery is artisanal, employing catamaran, dugout canoe and plank-built boat. At present eleven types of traditional gears are employed in this area, the major ones being boat seine, drift net and hooks and line *(Mar. Fish. Infor. Serv.,T & E Ser.*, 38: 1982). Mechanisation came late to Vizhinjam, while in the nearby places like Sakthikulangara and Kolachal mechanised fishing had been well established even years back. Vizhinjam fishermen were rather cautiously avoiding mechanisation since they feared that favouring mechanised fishing may invite big business men into the field which may affect the traditional fishing adversely. They also shared the early fears of the traditional fishermen that mechanised trawling scared away the fish shoals from inshore waters. However, in recent years a few mechanised boats have started operating from Vizhinjam employing the traditional drift net. But only few fishermen could afford the needed high capital investment and operational costs.

By about September, 1982, five traditional crafts fitted with 'Yamaha' outboard motors started operating from this area. The increased propulsion provided by the motor enabled the fishermen to reach distant fishing grounds, unexploited by the traditional crafts, and to bring better catches. Due to the high profit obtained by the fishermen and low capital and operational costs for the outboard motor when compared to those of mechanised boats, the mechanisation of traditional crafts with outboard motor became acceptable to the fishermen. Now in the course of one and a half years the total number of outboard motors at this centre increased to about sixty. This trend is bound to rise, in view of the prospect of the fishing harbour under construction and the additional attendant facilities, which would be an added incentive for further modernisation of the fishing fleet and fuller utilization of these facilities. Hence the present study on the mechanisation of traditional crafts with outboard motor and its prospects at Vizhinjam is an essential and timely step in assessing the impact of mechanisation on the traditional fishery.

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Fishing methods

The outboard motor fitted on the traditional crafts at Vizhinjam is Yamaha kerosene outboard motor (Model 8 B.K, 7 H.P.). Eventhough both catamaran and plank-built boats could be fitted with an outboard motor, plank-built boats are preferred because they provide more space for the gear and the catch. Though other gears are also operated from these motorised crafts, hooks and line is the principal gear operated throughout the year. Hence the data, collected from only those units, both mechanised and non-mechanised, which operated hooks and line during 1983, were considered for this study.

Fishermen, in the mechanised craft leave the shore for fishing at about 0500 hrs and return any time between 1300 and 1800 hrs, depending on the distance to the fishing grounds and the quantity of the catch obtained. Mechanised crafts generally go about 20–25 km off Vizhinjam to areas of 60–80 m depth, whereas the non-mechanised traditional crafts are confined to about 10 km from the shore and a depth range of 40–50 m. The number of actual fishing days in a month ranged from 20 to 25 for both the types of units.

Fish catch

The month-wise effort (that is the number of trips by each type of craft) and catch (kg) of hooks and line operated by non-mechanised and mechanised crafts are given in Table 1. It could be seen that both types of crafts operated all through the year and both brought in the major part of the yearly landings (55 to 80%) during July to October. The month-wise trend of the catch per trip in non-mechanised and mechanised crafts is presented in Fig. 1. It is observed that the catch per trip of powered crafts is higher during all the months.

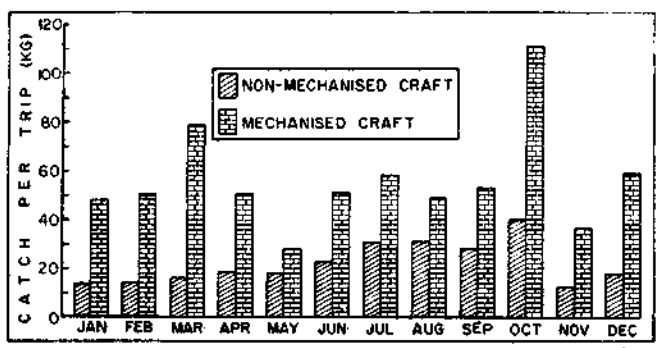

Fig. 1. Month-wise trend of catch per trip in the non-mechanised and mechanised traditional crafts.

Table 1. *Month-wise effort and catch of hooks and line operated by non-mechanised and mechanised crafts during* 1983

Months	Non-mechanised crafts		Mechanised crafts	
	Effort (trips)	Catch (kg)	Effort (trips)	Catch (kg)
Jan.	6,647	90,022	100	4,862
Feb.	5,705	81,810	158	8,017
Mar.	6,716	1,10,469	62	4,925
Apr.	7,200	1,34,777	73	3,681
May	6,433	1,15,990	16	457
Jun.	6,066	1,39,040	153	7,859
Jul.	6,898	2,12,189	853	49,793
Aug.	9,035	2,80,709	1,174	58,397
Sep.	6,533	1,84,862	1,010	53,434
Oct.	7,828	3,13,469	899	99,932
Nov.	5,175	63,533	386	14,180
Dec.	4,822	84,713	155	9,172
Total	79,058	18,11,583	5,039	3,14,709

Species composition

The annual catch, catch per trip (kg) and percentage composition of dominant groups of fish landed by hooks and line operated from non-mechanised and mechanised crafts are given in Table 2. About 25 major groups of fish supported the fishery by non-mechanised units. The carangid fishery ranked foremost, with annual landings of 817.5 tonnes, forming 45% of the total fish landings by hooks and line. *Decapterus dayi* was the most dominant carangid species accounting for 73.6% followed by *Selar crumenophthalmus* (6.6%), *Selar mate* (2.8%) and other carangids (16.8%). The next important group in the order of abundance was *Nemipterus* spp. with an annual landing of 214.3 tonnes which formed 11.8% of the total catch. Tunas made up the third major group forming 141.9 tonnes which constituted 7.8% of the total landings. Among tunas, *Auxis rochei* formed 48.8%, *Euthynnus affinis* 28.4%, *Sarda orientalis* 16.5% and other tunas 6.3%. The next important group was mackerel with an annual landing of 79.6 tonnes forming 4.4% of the total catch. Among the rest were cat fish (4%), *Dussumieria* spp. (3.4%), Balistids (2.4%), cuttle fish (2.3%), squids (2.2%), *Histiophorus* spp. and *Saurida* spp. (2.1%).

In the hooks and line fishery by mechanised crafts about 19 major groups of fishes constituted the catch (Table 2). As in the case of the traditional crafts,

Table 2. *Annual catch, catch per trip and percentage composition of dominant groups of fish landed by hooks and line operated from non-mechanised and mechanised crafts during* 1983

Fish groups	Non-mechanised crafts			Mechanised crafts		
	Annual catch (kg)	Catch per trip (kg)	%	Annual catch (kg)	Catch per trip (kg)	%
Sharks	30,243	0.38	1.67	5,665	1.12	1.80
Rays	18,568	0.23	1.02	—	—	—
Dussumieria spp.	61,570	0.78	3.40	13,094	2.60	4.16
Decapterus spp.	6,01,933	7.61	33.23	1,63,542	32.46	51.97
Selar mate	23,007	0.29	1.27	2,804	0.56	0.89
S. crumenophthalmus	54,851	0.69	3.03	—	—	—
Other carangids	1,37,749	1.74	7.60	11,826	2.35	3.76
Mackerel	79,579	1.01	4.39	5,762	1.14	1.83
Euthynnus affinis	40,312	0.51	2.22	11,638	2.31	3.70
Auxis rochei	69,295	0.88	3.83	12,390	2.46	3.94
Auxis thazard	—	—	—	3,013	0.96	0.59
Thunnus albacares	—	—	—	3,269	0.65	1.04
Sarda orientalis	23,429	0.30	1.29	—	—	—
Other tunas	8,908	0.11	0.49	991	0.20	0.31
Histiophorus spp.	36,960	0.47	2.04	—	—	—
Elacate niger	23,088	0.29	1.27	—	—	—
Tylosurus spp.	18,526	0.23	1.02	—	—	—
Coryphaena spp.	22,410	0.28	1.24	—	—	—
Cat fish	72,443	0.92	4.00	8,840	1.75	2.80
Saurida spp.	37,611	0.48	2.08	6,475	1.28	2.06
Lethrinus spp.	13,875	0.18	0.77	5,757	1.14	1.83
Lutianus spp.	25,413	0.32	1.40	7,490	1.49	2.38
Epinephelus spp.	—	—	—	7,275	1.44	2.31
Nemipterus spp.	2,14,318	2.71	11.83	36,103	7.16	11.47
Therapon spp.	20,334	0.26	1.12	—	—	—
Balistids	43,993	0.56	2.43	—	—	—
Sepia spp.	42,351	0.54	2.34	1,859	0.37	0.59
Loligo	39,662	0.50	2.19	—	—	—
Miscellaneous	51,155	0.65	2.82	6,916	1.37	2.20
Total	18,11,583	22.91		3,14,709	62.50	

carangids ranked first among the different fisheries by this gear. The annual carangid landing was 172.2 tonnes forming 56.6% of the total fish landings. *Decapterus dayi* was the most dominant species accounting for 91.8%, *Selar mate* (1.6%) and other carangids (6.7%). The group next in abundance was *Nemipterus* spp. with an annual landing of 36.1 tonnes forming 11.5% of the total landings. Tunas formed the third important group with an annual landing of 31.3 tonnes which formed 10% of the total catch. Among tunas *Auxis rochei* constituted 39.6% followed by *Euthynnus affinis* (37.2%), *Thunnus albacares* (10.4%), *Auxis thazard*

(9.6%) and other tunas (3.2%). Perches were the fourth important group with an annual landing of 20.5 tonnes forming 6.6% of the total catch. *Lutianus* spp. constituted 36.5% of the perch catch followed by *Epinephelus* spp. (35.4%) and *Lethrinus* spp. (28.1%). Other important groups in the order of abundance were *Dussumieria* spp. (4.2%), cat fish (2.8%) and *Saurida* spp. (2.1%).

From the Table 2, it can be seen that the variety of species which constituted the fishery of non-mechanised units was more when compared to that of the mechanised units. Eventhough the quality fishes like carangids, tunas and perches formed the abundant groups in both the types of units, the catch per trip for these groups in mechanised crafts was much higher than that of the non-mechanised crafts (Fig. 2). The yellowfin tuna *(Thunnus albacares)* and perches of the group *Epinephelus* were obtained only from mechanised crafts.

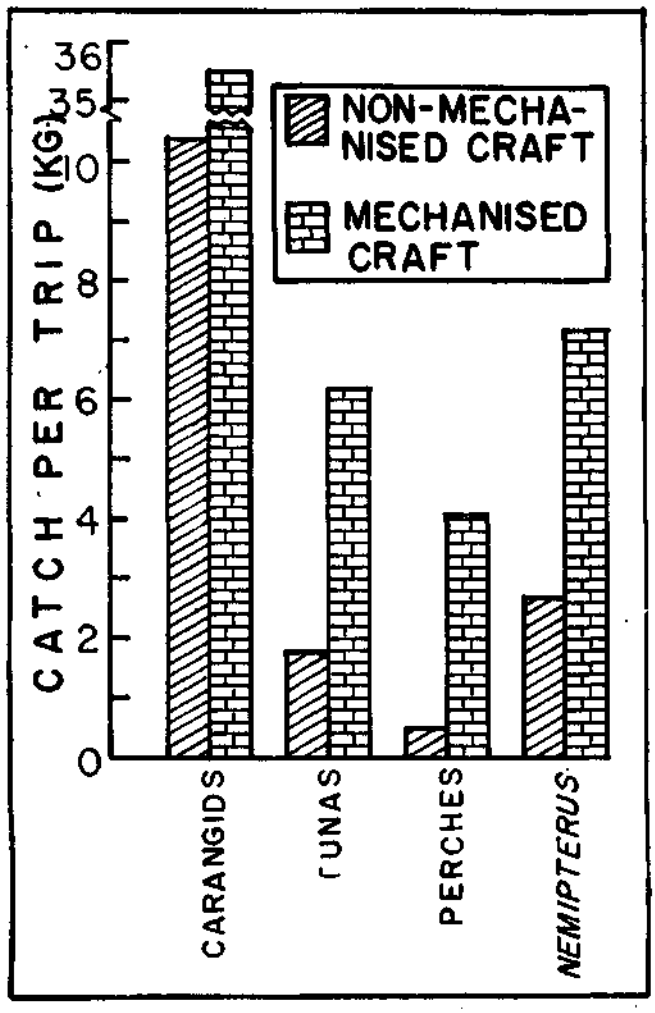

Fig. 2. Average catch per trip of four major groups of fishes landed by non-mechanised and mechanised traditional crafts.

Socio-economic aspects

A comparative idea of the operational and maintenance costs of both the types of crafts and the problems associated with these is necessary for understanding certain socio-economic aspects of the fishermen engaged in hooks and line fishing at Vizhinjam. The fuel requirements for the outboard motor per trip is 20 to 25 litres of kerosene and 1.5 to 2 litres of petrol. The average operational expenditure which includes the cost of fuel, maintenance of the motor and cost of bait would be about Rs. 100. The gross income from a mechanised craft ranges from Rs. 250 to 1,500 per trip with an average income of Rs. 600. The net income per trip would be Rs. 500. The number of crew in a mechanised unit is usually four. The profit will be divided among the owner and crew of the unit in such a way that the owner gets two shares and crew get one share each. If the owner himself is one among the crew, which is the usual practice, he gets three shares. Thus on an average the owner gets Rs. 250 and the crew Rs. 83.3 each per trip. On the otherhand the gross income by the non-mechanised crafts ranged from Rs. 60 to 200 per trip with an average income of Rs. 100. The number of crew in a non-mechanised unit is two. The income is divided into three equal shares and the owner of the unit gets two shares (Rs. 67), if he is also one among the crew as is the usual practice in Vizhinjam, and the other crew Rs. 33. Thus the profit obtained per trip by the owner of the unit from a motorised craft is about 3.7 times higher and that of the crew 2.5 times higher than their counterparts in non-mechanised crafts. The better returns of mechanised crafts is mainly because of the high price fetched by the quality fishes. The profit may naturally be high when it operates 'konchu vala' and special hooks for squids and cuttle fishes.

Now the idea of reaching extended and unexploited fishing grounds with less physical labour and the resultant increased catch obtained, has made the fishermen to take to motorisation. But they point out some difficulties they are faced with, like the high capital involved in the initial stage, nonavailability of bank loans, inadequate supply of kerosene at subsidised rate and lack of local facilities for repairs and procurement of spares. So they demand help in these respects from the government side.

General remarks

The introduction of nearly sixty outboard motors within the short period of one and a half years at Vizhinjam clearly indicates the fishermen's growing conviction

Fig. 3. Outboard motor being fitted to a catamaran.

Fig. 4. Catamaran fitted with outboard motor being launched for a fishing trip.

Fig. 5. Plank-built canoe suitably modified and fitted with outboard motor.

Fig. 6. Hooks and line catch ready for auction.

about the advantages of mechanisation. Also, the nearshore fishing grounds being fully exploited, any increased fishing has to be in the unexploited grounds farther off. The results of the data analysed indicated a higher catch per trip for motorised crafts. It is also observed that three major fisheries; tunas, carangids and perches could be further developed at Vizhinjam by the extensive exploitation of the distant fishing ground currently being fished by the motorised traditional crafts.

The present state of mechanisation has not led to any clash between the fishermen of mechanised and non-mechanised units. This is mainly because the mechanisation was adopted by the traditional fishermen themselves and it is used only for easy accessibility to areas beyond the fishing grounds of non-mechanised units.

As mentioned earlier, the development of the fisheries harbour at Vizhinjam, would be an added impetus to mechanisation. As is now realised, no mechanisation of fishing activity can be successful neglecting the traditional fishermen. Hence the present attitude of the traditional fishermen showing an inclination towards mechanisation is no doubt a positive trend and fisheries developmental activities in this area could be enhanced by accelerating this trend by means of incentives from government as well as fisheries welfare agencies for the procurement of outboard motors and for provisions of auxiliary facilities.

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WATER POLLUTION AND FISH MORTALITY IN ENNORE ESTUARY, MADRAS*

Mass mortality of fishes and aquatic organisms occur in Ennore estuary (13°14′N 80°20′E) from time to time due to water pollution. One such instance was observed from 5-9-1983 to 8-10-1983. Dead fishes were found floating and spread out for about 2 km distance in the region between Ennore Thermal Power Station and Ennore Railway Bridge (Fig. 1). The fish kill was particularly extensive on 30-9-1983. A brief account of this incident with analysis of relevant parameters to find out probable causes is given here.

Pollution problems are encountered in Ennore estuary as it receives industrial effluents and domestic sewage mostly in untreated condition. These affect water quality and living organisms. Major industries like Kothari Chemicals, Alkali Chemicals, Madras Refineries, Madras Fertilizers, Petrochemical industries, many other private industries and Government installation such as Ennore Thermal Power Station are located around Ennore estuary. It has been estimated that about 4,49,000 litres/day of industrial effluents carrying heavy metals are let out into this estuary by these industrial establishments. Another source of pollution that poses danger to fishes and other aquatic life is the flow of domestic sewage, and about 4 million litres/day are discharged into this estuary (Tamil Nadu Water Supply and Sewerage Board, Report 1980).

Eventhough the bar mouth of this estuary is kept open throughout the year by dredging operations by Ennore Thermal Power Station for maintaining free flow of sea water into this estuary, a large number of fish, prawn and other organisms die every year in this estuary due to water contamination. The physico-chemical characteristics of the water such as temperature, salinity, dissolved oxygen, pH and water transparency were examined besides heavy metal concentrations and their consequent impact on the mortality of fishes in the vicinity of industrial and sewage waste discharge points. Representative samples of dead fishes were collected from various stations of the estuary such as Ennore Thermal Power Station, Buckingham Canal discharge point, railway bridge, travellers bungalow and bar mouth of the estuary. The percentage intensity of dead fishes was high (70%) at the Buckingham canal discharge point.

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The dead fishes collected, with their size range are as follows (Fig. 2): *Liza macrolepis* (85–265 mm), *Liza cunnesius* (65–100 mm), *Liza tade* (60–85 mm), *Rhynchorhamphus marginatus* (80–95 mm), *Etroplus suratensis* (50–70 mm), *Tilapia mossambica* (95–105 mm), *Leiognathus fasciatus* (55–90 mm), *Tetrodon immaculatus* (40–50 mm), *Triacanthus brevirostris* (65–70 mm), *Tachysurus jella* (40–45 mm), *Tachysurus dussumieri* (40–50 mm), *Platycephalus serratus* (110–205 mm), *Platycephalus biomaculatus* (110–190 mm), *Ambasis commersoni* (60–75 mm), *Anguilla bicolar* (700–900 mm) and *Scylla serrata* (50–60 mm).

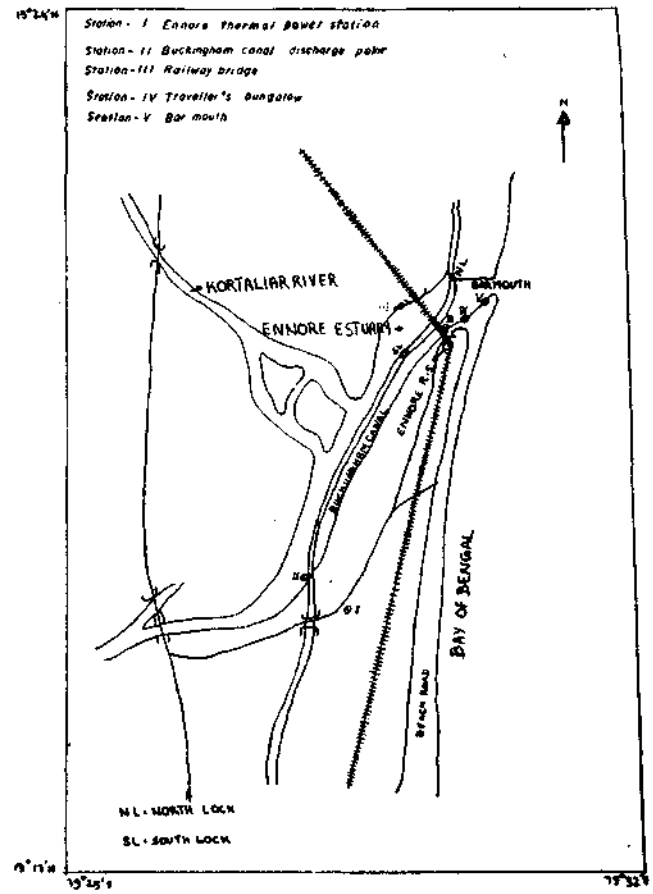
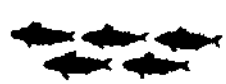


Fig. 1. Map showing location of sampling stations in Ennore estuary, Madras.

The analysis of various samples showed that temperature of water ranged from 30.0 to 33.6°C, salinity between 24.30 and 37.63‰ and dissolved oxygen content from 4.28 to 5.44 ml/l. The pH ranged from 7.67 to 8.11. The secchi-disc depth used as a measure of transparency of the water ranged from 31 to 62 cm. Further, the distribution and concentration of various heavy metals of the water in Buckingham Canal discharge point where the percentage intensity

Fig. 2. Fish mortatity in Ennore eastuary, Madras.

of fish mortality was high (70%) were analysed. They are ranked as follows: Mg > Na > K > Al > Pb > Fe > Cd > Zn > Sb (51.2, 20.0, 9.8, 7.8, 0.9, 0.3, 0.2, 0.04 and 0.01 ppm respectively). The concentrations of heavy metals like Mg, Al, Pb, Zn and Cd were found to be higher when compared to natural concentrations in sea water. The possibility of the presence of increased levels of these heavy metals in the water can be surmised, as many industries release effluents, and Buckingham Canal discharges domestic sewage wastes. The mass mortality of fishes occurred whenever the vents were opened to release the water from the Buckingham canal into the estuary. This is usually done during monsoon period to relieve the pressure on the bunds of Buckingham canal. As a result, the organic debris and some heavy metals in the water at the bottom would be churned up; an activity that usually takes place, which is indicative of excessive pollution. Thus based on the present investigation, it may be stated that the presence of some metallic elements, with their synergistic effects would have poisoned the water resultung in the mass mortality of fishes and prawns and dislocation of the most bottom fauna from their habitat in this estuary. The role played by the low oxygenated water brought by the process of churning in the Buckingham canal during monsoon season cannot be overlooked.



ON THE OCCURRENCE OF *DROMIA DEHAANI* RATHBURN IN TRAWLER CATCHES OFF BOMBAY COAST*

Dromia dehaani Rathburn, a crab ('Red kekada' in Maratti) has been reported from both the coasts of India but only in small numbers. Its landing in fairly large quantities by trawlers at New Ferry Wharf, Bombay, seems to be of great significance mainly because of two reasons, (1) its unusual large scale landings and the subsequent awareness among the public have made it an edible resource and (2) the presence of berried females with large number of eggs pointed to the possibility of its occurrence in deeper regions as a potential resource.

The crab is rather large with carapace broader than long. The four antero-lateral teeth are sub-equal but distance between 3rd and 4th is much greater than those between first and second, and second and third. The surface immediately behind front is smooth and even. Tips of chelipeds are distinctly pinkish in colour.

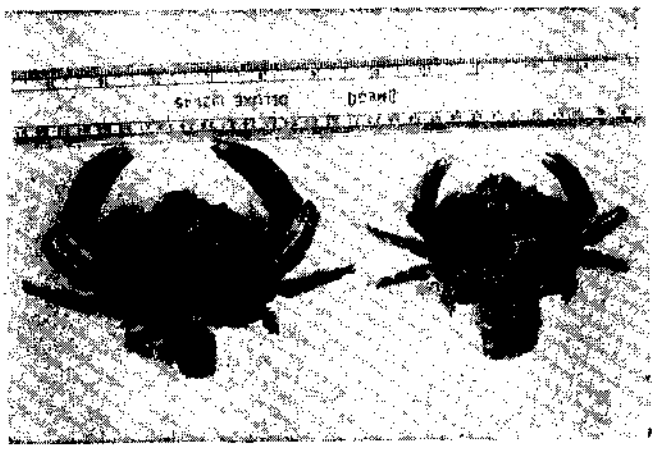


Fig. 1. *Dromia dehaani*- dorsal view of male and female.

The trawlers which brought the crabs were operated off Harnai–Murud coast at a depth range of 40–60m. The estimated landings amounted to 30 kg per day from 10 units. A representative sample was collected from the centre and was analysed. Biological observations made are as follows.

Name of species	Sl. No.	Carapace length (mm)	Carapace width (mm)	Weight (g)	Sex
Dromia dehaani	1.	46	52	35	F (berried)
	2.	48	53	50	F
	3.	57	65	80	F
	4.	55	64	95	F
	5.	60	72	145	M

The specimens were large in size, the biggest being a male with a weight of 145 g and stout chelipeds (Fig. 1). The average weight was estimated at 81 g. Two of the four females were in berried condition with numerous small eggs. The number of eggs carried by females was estimated to be about a lakh.

This resource is relatively new and so does not command good price as in the case of large sized portunid crabs. However, they were sold at a rate of Rs. 0.50–1.00 per specimen based on the size of the crab. It is quite probable that this species may command better prices in future due to consumer acceptance. The edible nature of this species is reported for the first time in Bombay. Good landing of this species can be expected in future when deeper regions are explored by trawlers.

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SEA EROSION AT BAITKHOL (KARWAR) AND ITS EFFECT ON INDIGENOUS FISHING*

In the wee hours of 4th June 1984, the sleepy town of Karwar was experiencing light showers, and the Karwar Bay was slightly rough as to be expected during the pre-monsoon period. As the hours passed by, menacing waves started furiously lashing against the Baitkhol and Karwar shores. By 0900 hrs waves as high as 2 m started pounding the NH 17 subjecting it to a severe test. However, the anger of the sea was centred between the Karwar Research Centre of CMFRI in the south and the Marine Engineer's Office in the north, a stretch of length extending about 0.3 km. Within no time the waves not only smashed the parapet wall bordering the western side of the road but also inundated the area which caused breaches in small patches at several points. In this process, many small huts of fishermen on the other side of the road were destroyed. There

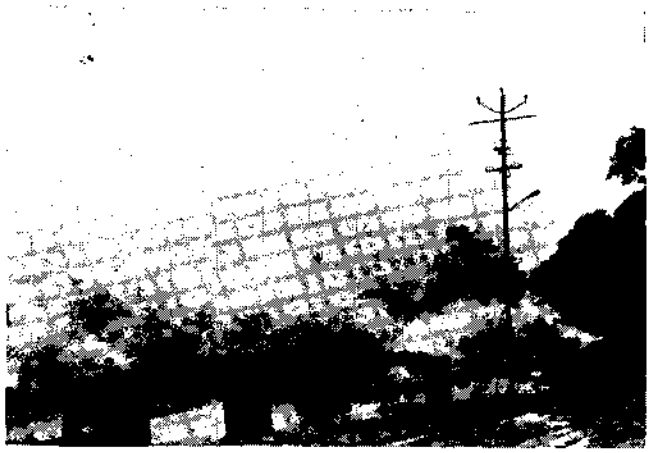

Fig. 1. The Karwar Bay in fury.

was an imminent danger of Karwar being cut off from the southern part of the country. This situation prevailed for the next four days during which period the northern part of the Baitkhol shore from where the indigenous crafts used to operate during the monsoon period was completely eroded. However, the local authorities took immediate steps in dumping boulders along the shore to prevent further erosion and damage to the NH. The situation was brought under control

Fig. 2. Nothing forms an obstacle for a furious sea.

by middle of the month. The unprecedented roughness of sea might have been due to the non-construction of breakwater walls before taking up the dredging operations in the Karwar Bay as a part of the developmental work of Karwar port.

In this connection it may be mentioned that the Baitkhol shore was famous for *rampan* operations in the yester years. Of late, this area was used for operations of *yendi* (small shore-seine) and dragnets, especially during the monsoon season. Because of the erosion of the fish landing area, the fishing operations were completely stopped thus affecting the earnings of fishermen. However, by the middle of August, a good stretch of sand dune of about 200 m long was emerged to south of the former shore.

*Prepared by M. H. Dhulkhed, Karwar Research Centre of C. M. F. R. I., Karwar.

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