

A SURVEY OF THE SEA FISHERIES OF INDIA

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ABSTRACT

A preliminary account is given of the design and technique of the sampling method employed for estimating the landings of sea fish at some selected centres along the East and West coasts of India. Statistics of marine fishing villages, fishing populations, boats and nets are presented along with approximate percentages of the occurrence of important fishes and also the estimated monthly landings of fish during 1949 at some representative places.

India, with a long coast line of about 2,900 miles, has a vast fishable area but only a narrow stretch of water 5-7 miles from the shore is exploited. The degree of exploitation of the inshore waters has not been fully assessed. The fishing industry is diffuse and is in the hands of fishermen without education; besides, neither the implements of fishing nor the fishermen are licensed or registered. As a result, the industry, in spite of rich potential resources, is in the stage of a cottage industry. A detailed survey of the existing resources is an essential and urgent necessity for any scientific and administrative programme of development and exploitation of the industry. But in view of the peculiar circumstances prevailing in India, a complete or total enumeration of the data on all the aspects of the fisheries is not possible at present. Hence recourse has to be made to the sampling method, particularly with reference to the problem of estimation of landings. The present paper deals with the design and technique of the sampling method adopted in the pilot survey carried out by the Central Marine Fisheries Research Station, Mandapam. Though the programme is still in the early stage, it is presented here in view of the interest it may have to countries where fisheries are underdeveloped and complete enumeration for estimating production is not practicable.

RECRUITMENT AND TRAINING OF PERSONNEL

The first step in this work was obviously the training of a batch of suitable persons who could carry out this survey. The persons carrying out the survey must possess not only adequate knowledge of

fishery science but should also know the language of the area in which they are to work, since they have to deal with illiterate fishermen. And in a multilingual country such as India, this places a special burden. Twelve graduates representing the various languages in the different zones where they have ultimately to work were recruited, and it was subsequently thought that it would be better for them to undergo a course of six months' intensive training in fisheries. This was necessary because not all the persons chosen were graduates in Zoology, although the majority were persons who had completed a course of training under the all-India Fisheries training scheme. The training subsequently given at the Bombay Sub-station mainly consisted of—

(1) *On the biological side*—Identification of fish, dissection of fish for study of stomach contents, conditions of gonads and parasites; study of plankton along with determination of salinity and specific gravity of sea water, and

(2) *On the Survey side*—the study of different kinds of craft and tackle existing in India, their advantages and drawbacks, the economic status of the fishing populations in relation to existing fishery conditions, necessity of survey, how statistical surveys can be carried out, importance of the preliminary field data and how to present them for detailed analysis.

PRELIMINARY SURVEY

The entire coast-line of India was divided into 12 somewhat unequal zones after taking into consideration the geographical conditions and the regional language. In each zone, approximately 250 miles long, one survey assistant conversant with the local language, was posted with instructions to conduct a preliminary rapid survey of the fishery conditions in the respective zone. In this survey, the assistants acquainted themselves with all the marine fishing villages in their respective zones and collected, village by village as far as possible, the complete statistics of fishing population, boats and nets, with some information on the socio-economic condition of fishermen. They also gathered information regarding

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the availability of different species of fish and the seasons of their occurrence. These data were subsequently checked and confirmed by a survey during the off-season in the following year and are tabulated in appendix I.

INTENSIVE STUDY

More intensive survey of fisheries with the ultimate object of assessing the resources of sea-fisheries of India was next taken up. The resources available at the disposal of the Central Marine Fisheries Research Station did not permit either total enumeration or even a full-scale random sample survey for the entire coast-line of India. The survey for estimating the total landings is therefore confined initially to a few important centres on both coasts of India but in course of time it should be possible to extend the present machinery to cover the entire coast-line of India.

Five standard forms for collection of information on inventory and production were prepared and given to the survey assistants for recording detailed information. On the inventory side, statistics were collected on a complete enumeration basis. The forms III, IV and V are designed to collect complete statistics on boats, nets and marine fishing villages. The collection of production statistics is based on the sampling method for which forms I and IV are prescribed. Form I is meant for examination of sample boat-net combinations with reference to the following items: the type of boat-net combination, the number of crew, the distance from the shore where fishing took place, the total weight of the fish landed and the separate weight for different species of important fishes. Form VI shows the number of working boat-net combinations of different types at each place of observation. It also shows the number of days when there was no fishing during the month.

Each survey assistant was asked to visit all the centres in his zone twice a month, once in each fortnight, the duration of stay at a centre each time depending on the total number of centres selected in the zone. In the case of a three-centre zone, the duration of stay at each centre was four to five days in a fortnight and thus data for eight to ten days was collected during the whole month. Based on the data of these days, a monthly estimate of landings was made for each place.

After preliminary trials, the unit of sampling was chosen to be a boat-net combination. Thus a catamaran with hooks and lines and a catamaran with gill net are considered to be two different types of sampling units. It may be noted here that the

quantity and quality of catch depend not on the boat but mainly on the type of the net used. Hence the selection of a boat as sampling unit is not quite satisfactory, when various types of tackle are operated simultaneously in one place.

On every day of visit to a fishing village, the survey assistant is to determine at once from local enquiry, the approximate number of different boat-net combinations that have gone out fishing. Subsequently he also checks this number and records the exact number in form VI. From this the sample size for each boat-net combination for the day is determined in accordance with the proportion of all boats (10%) to be examined. As the boats are not numbered, the randomness of the sample is assured by choosing every tenth boat that returns from fishing.

METHOD OF ESTIMATE

In broad out-line the method of estimation is based on the situation for a three-centre zone where observations have been made for about 8-10 days at each centre in a month. These observations are sorted out according to the different boat-net combinations used and the average catch in respect of each boat-net combination used is worked out. From form VI, the number of different boat-net combinations working at the place for those 8-10 days is obtained, from which is calculated the average number of different boat-net combinations working at a place per day. These figures, when multiplied by the corresponding average figures of landings from different boat-net combinations, give the daily estimated landings by each of the different combinations in use at the place and when added together give the estimate of daily landings. This, multiplied by the number of total fishing days in a month gives the total monthly landings.

From preliminary analysis it is found that the percentage error of the estimated landings at different places does not exceed ten per cent. Besides, for each boat-net combination, the weight of different species of fish are tabulated separately for all these samples for the 8-10 days under observation and the percentage of each to the total weight of all fish obtained is calculated. This gives an indication of the degree of availability of different species of fish in a month and, on this basis, approximate percentages of important fish have been given zone by zone in Appendix II.

ESTIMATED FISH LANDINGS

Appendix III shows the estimated monthly landings of fish in tons at some representative places

along both coasts of India during 1949. As the work was begun in January, 1949, systematic statistics could not be collected at some places in the first month or two.

It will be seen that there is much variation in these figures from month to month and the period of good fishing at some places does not synchronise with such periods at other places. The main reasons for these variations appear to be the south-west and north-east monsoons and the appearance and disappearance of large groups of shoaling fishes.

DIFFICULTIES IN COURSE OF SURVEY

The main difficulties encountered in the course of the work may now be examined.

(1) *Lack of co-operation from the fishermen*—The fishermen have such deep-rooted prejudices and superstition that the survey assistants in the beginning faced a considerable reluctance to give correct information. By moving among them constantly and by explaining to them the motives of the survey, the assistants have won their confidence to some extent. Even now they have to face intense opposition in some places. This attitude of the fishermen arises from their fear that their century-old right to exploit the sea may be curbed by the imposition of taxes and that the survey assistants are secretly assessing their capacities for paying such a tax.

(2) *Transport difficulties*—In many zones, the fishing villages have very inadequate means of communication. The assistant may have to wade through mud, sand and paddy fields to reach a fishing village. At the village, they may have neither shelter nor food. They may therefore have to carry provisions with them over long distances. These physical hardships combined with local opposition in certain cases are a serious strain on the survey assistants who must work single handed.

(3) *Financial difficulties*—For any planned method of collecting statistics even by the sampling technique, many people are required, and this requires a substantial allotment of funds. It is necessary that the cost of collection of statistics should be met by the fishing industry but the men engaged in fishing are entirely against the idea. Only twelve survey assistants were recruited to collect the statistics, each having for observation a coast-line of about 250 miles, on an average. Collection of statistics is therefore confined to two or

three fishing centres in each zone for the present. It is obvious that this is not an ideal arrangement.

(4) *Leave etc.*—Since only one survey assistant is available to collect data within each zone, and since there are no spare hands to replace them, gaps and discontinuity in the routine collection of data are bound to occur when for reasons of health or otherwise the assistant is forced to be away from duty. Attempts are now being made to avoid such discontinuities in the data by sparing the services of other workers at the respective centres in places where establishments of the Central Marine Fisheries Research Station exist. A further extension along the same lines will be the help of State fishery organizations in making the data relating to the different zones complete.

SUMMARY

As a first step in collecting comprehensive statistics of the Indian fishing industry a preliminary survey has been made along the entire coast-line of India, carried out for a period of about six months, and collecting information about fishing population, boats, nets etc. on total enumeration basis.

Based on these data a sampling technique was evolved to estimate the total production of marine fisheries. The design of sampling is a multi-stage one, with a few centres selected from each zone in the first stage and a certain percentage of the boat-net combinations from these centres being taken in the ultimate stage.

The method of estimation is briefly described and a statement of estimated monthly landings of fish at important centres along both coasts of India during 1949 is given, supplemented by computed figures of landings for the whole of India. In addition, approximate percentages of some important fishes, zone by zone, are also furnished. The difficulties met with during the course of this investigation are briefly discussed.

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APPENDIX I

Showing the statistics of marine fishing villages, fishing population, boats, nets and computed landings of fish

Zones	Number of fishing villages	Total fisher-men population	Types of boats			Types of nets					Computed landings of fish in tons in 1949
			Cata-marans	Boats	Canoes	Shore seines or in-shore drag nets ^s	Fixed or stationary nets	Bag nets or boat seines	Drift and gill nets	Other miscellaneous types	
1. West Bengal and Orissa	127	33,640	2,391	792	..	1,257	3,092	4,079	4,341	2,224	18,842
2. Andhra coast (from south of Gopalpur to north of Vishakapatnam)	139	83,404	9,034	850	..	887	..	4,617	20,763	..	54,273
3. Andhra coast (from Vishakapatnam to Masulipatnam)	145	28,885	5,995	5,442	..	560	13,530	3,027	11,635	1,036	24,429
4. Andhra coast (south of Masulipatnam to north of Pulicat lake)	108	8,870	2,578	474	..	217	..	1,452	2,697	..	1,308
5. Coromandel coast (Pulicat lake to Cuddalore)	123	51,329	7,874	543	336	535	..	4,700	473	..	12,685
6. Coromandel coast (south of Cuddalore to Devipattanam)	55	9,138	2,086	353	..	..	833	927	5,029	650	11,850
7. Palk Bay and Gulf of Mannar (south of Devipattanam to North of Cape Comorin)	55	35,268	1,502	482	228	1,282	..	853	10,283	..	2,600
8. Travancore, Cochin and South Malabar (Cape Comorin to Ponnani. R.)	45	1,59,248	982	..	13,387	..	..	12,948	5,712	3,094	48,659
9. Malabar and South Kanara (north of Ponnani. R. to Mangalore)	108	85,115	..	36	6,468	7	..	6,205	3,875	5,063	85,512
10. Kanara, Karwar and Konkan coast (north of Mangalore to south of Ratnagiri)	145	85,057	..	2,670	4,349	2,119	11,109	763	41,840	13,628	72,840
11. Bombay and Gujarat (Ratnagiri to Broach)	183	1,61,945	..	3,949	562	..	..	33,315	75,501	35,768	48,447
12. Kathiawar coast (north of Broach) .. .. .	..	..	..	..	..	..	..	..	..	..	..
Total	1,231	7,41,899	32,442	15,571	25,330	6,864	28,564	72,886	1,82,169	61,463	3,81,442

APPENDIX II

Showing the occurrence and distribution of important fish with their percentage, zone by zone

Zones	Important fish with approximate percentage
1. West Bengal and Orissa.	Sardines 40% and Anchovy 30%.
2. Andhra coast (from south of Gopalpur to north of Vishakapatnam)	Sardines 25%, White baits 20% and Ribbon-fish 20%.
3. Andhra coast (from Vishakapatnam to Masulipatnam)	Anchovy 30%, White baits 25%, Ribbon-fish 10%, Pellona 10% and Sharks 5%.
4. Andhra coast (south of Masulipatnam to north of Pulicat lake)	No important fisheries.
5. Coromandel coast (Pulicat lake to Cuddalore)	Anchovy 25%, Ribbon-fish 20%, Silver bellies 10%, Big-jawed Jumper 5% and Flying-fish 5%.
6. Coromandel coast (south of Cuddalore to Devipattanam)	Rays 15%, Jew-fish 10%, Cat-fish 10%, Flying-fish 5% and Ribbon-fish 5%.
7. Palk Bay and Gulf of Mannar (south of Devipattanam to North of Cape Comorin)	Perches 50% and Sardines 20%.
8. Travancore, Cochin and South Malabar (Cape Comorin to Ponnani. R.) ..	Sardines 25%, Mackerel 15%, White baits 15%, Big-jawed Jumper 12%, Tunnies 10%, Silver bellies 7% and Prawns 5%.
9. Malabar and South Kanara (north of Ponnani. R. to Mangalore)	Mackerel 20%, Sardines 20%, Prawns 20%, Sharks 15% and Soles 7%.
10. Kanara, Karwar and Konkan coast (north of Mangalore to South of Ratnagiri)	Mackerels 45% and Sardines 15%.
11. Bombay and Gujarat (Ratnagiri to Broach)	Prawns 20%, Bombay-duck 20%, Ribbon-fish 15%, Indian Cod (<i>Bregmaceros maccllelandi</i>) 10%, Jew-fish 5% and Indian Salmon 5%.

APPENDIX III

Estimated monthly landings of fish in British tons (2,240 lbs) at some representative places during 1949

	Jan.	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.
East-Coast—												
1. Puri	—	114.3	481.6	862.9	4.14	x	x	x	x	x	2.14	11.56
2. Gopalpur	—	49.9	195.0	5.03	4.00	x	x	x	x	x	20.24	10.13
3. Bimlipatam	—	390.1	952.6	341.3	94.27	72.87	44.91	12.66	42.7	175.92	49.66	209.73
4. Lawson's Bay	—	72.3	484.9	942.6	88.17	142.15	124.57	142.54	129.44	89.19	243.60	194.63
5. Vishakapatnam	—	—	96.86	132.00	26.52	31.84	28.74	7.43	47.79	11.73	10.64	—
6. Pudumadaka	—	145.2	43.5	177.06	77.44	12.32	27.51	29.84	29.60	1.40	22.79	58.62
7. Uppada	—	44.8	281.9	154.75	182.68	114.25	90.88	213.78	81.43	58.24	54.00	72.21
8. Kakinada	—	82.8	341.8	221.88	314.83	31.55	5.91	36.66	52.24	72.14	27.47	52.83
9. Sathankuppam	—	1.35	8.3	1.63	0.74	6.04	3.60	7.32	x	x	x	10.94
10. Mypaud	—	12.68	—	—	—	1.92	0.37	0.51	x	x	x	21.50
11. Kothapatnam	—	1.2	3.67	11.62	26.64	17.38	1.31	6.19	x	x	x	2.07
12. Ennore	—	10.5	6.20	2.00	5.77	1.07	2.33	2.13	9.50	10.46	15.91	2.29
13. Triplicane (Madras)	—	30.3	7.60	1.90	4.07	1.38	2.52	23.36	25.59	8.95	19.96	6.26
14. Sadras	—	12.00	2.70	5.20	3.62	7.81	1.23	3.52	3.04	3.14	8.17	4.33
15. Cuddalore	—	22.0	10.30	22.00	8.07	101.10	2.60	10.71	18.12	9.60	123.27	5.02
16. Tranqueber	—	—	43.40	97.28	51.16	229.65	23.01	28.16	61.26	43.84	50.09	27.12
17. Akkaraipettai (Negapatnam)	—	—	59.60	29.28	—	60.71	25.01	47.62	151.61	—	39.42	23.71
18. Adirampattam	—	—	50.4	15.83	17.64	11.17	16.34	11.17	14.18	9.96	4.08	9.42
19. Nambuthalai (Tondi)	—	—	16.6	11.21	29.34	98.01	19.80	55.71	86.99	29.34	22.54	—
20. Tuticorin	—	—	10.44	9.1	15.14	13.47	22.94	17.58	32.81	18.28	20.56	23.83
21. Idindakarai	—	—	14.7	14.1	—	—	—	6.92	14.76	61.39	36.33	38.18
West Coast—												
22. Vizhingam	—	—	65.40	90.83	75.74	106.77	—	128.14	281.68	507.03	319.87	37.94
23. Wadi	—	—	—	87.66	11.11	19.39	—	96.16	138.12	51.00	58.96	10.44
24. Narakkal	—	—	19.35	50.53	—	173.42	—	49.44	42.80	70.08	12.35	155.89
25. Malipuram	—	—	70.39	—	35.75	—	100.09	82.11	100.05	59.75	14.47	150.89
26. Tanur	—	157.8	302.53	174.51	282.53	75.00	230.31	319.87	385.63	2521.50	432.82	663.45
27. Calicut	—	127.2	91.82	52.98	122.35	288.70	150.56	351.49	426.51	1126.41	552.50	301.30
28. Quilandy	—	528.5	185.70	154.42	412.42	59.85	395.43	290.11	356.60	309.25	—	262.62
29. Karwar	—	—	2.06	0.35	x	x	x	x	x	24.31	364.63	1348.73
30. Vengurla	—	—	13.22	5.5	x	x	x	x	x	38.23	—	30.97
31. Malwan	—	—	26.42	15.43	x	x	x	x	x	—	—	58.66
32. Ratnagiri	—	—	76.17	—	131.2	x	x	x	x	10.54	219.86	239.84
33. Paj	—	—	220.79	231.07	208.4	x	x	x	x	9.51	58.47	433.39
34. Versova (Bombay)	—	—	281.06	416.33	—	x	x	x	x	731.94	1535.84	824.61

X—denotes that there was practically no fishing or very little fishing.

— denotes that there was fishing but statistics not available for estimating the landings.