FISHERIES OF THE WEST COAST OF INDIA

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FISHERY SURVEY AND STATISTICS

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The development of fisheries will help the country in meeting the deficiency in the much needed protein in our diet. The role of reliable and accurate statistics in framing plans or formulating policies for such development need not be overemphasised.

It is however necessary to know the various items of statistics that need be collected. The term, fisheries statistics, is a very comprehensive one and is somewhat different from the term agricultural statistics. Agricultural statistics can generally be divided into three groups, *viz.*, (*a*) statistics on potentialities for exploitation, (*b*) statistics of production, and (*c*) statistics on distribution. These statistics will generally describe the agricultural economy completely. Similar statistics on fisheries will likewise describe the economic side of the fishing industry which is engaged in commercial fishing. But there is still another aspect *viz.*, statistics to determine the magnitude and structure of the various fish populations which yield fish catches. Such statistics may be termed biological statistics and have to be clearly distinguished from the economic statistics of the fishery. The distinction will become clear if we take the analogy of the mine. While statistics of potentialities, production and distribution determine the status of the industry, data on the geological structure of the mine lead to an assessment of the total available resource. Similarly data on the biological characteristics of fish populations determine the optimum catch that could be derived from the fish populations without adversely affecting them.

Fishery statistics can, therefore be classified into two groups. The first group contains statistics on items which will describe the economic pattern of the fishing industry and will help in formulating plans for further economic expansion of the industry. Detailed information on the various items of statistics of the later group, *i.e.*, the biological statistics, will throw light on the relation between catch and fish populations and will therefore help in formulating plans for scientific and efficient management of fisheries. As has already been stated, the requirement of data on the economic side

of the fishing industry may be classified into the following broad divisions: (i) Potentialities for exploitation, (ii) Production and (iii) Utilization.

The statistics on potentialities for exploitation will include data on the following: the total available water-area for fishing, the extent of area exploited, the number of persons engaged in fishing and other allied activities, the number of equipments such as boats and nets available for fishing. A study of the personnel engaged in fishing in relation to the equipment they possess and the catches obtained by them will reveal the nature of the industry and will suggest methods for its development. As any development plan for the industry also envisages simultaneous improvement in the living conditions of fishermen, collection of data on socio-economic condition of fishermen will probably come under this head.

The statistics of production mainly relates to the total landings. But data on cured, dried and processed fish together with other by-products like shark-liver oil, fish meal, etc., will come under this head. The study of the production figures in relation to regional demands will suggest ways in which the production has got to be regulated.

The statistics of utilization, demand and supply will show how the production is being utilized. Statistics of cured, dried and processed food will show how much fish is being consumed fresh. Market data and prices in different regions will indicate the position of demand and supply. Statistics of capital investment at different stages of the industry will point to the structural pattern of the industry.

Before stating the requirements of data necessary under the head biological statistics, it will be relevant to put in a few words the nature of the problem for which these statistics will be required. Mere development of the means of production will not improve production if the fish is not there or if the inherent qualities of the fish populations are adversely affected by fishing. If P_1 and P_2 denote the total populations of a fish in the beginning and end of a year, the change in population is given by

$$P_2 - P_1 = (G + R - M) - C \qquad (1)$$

where G is the growth, R is the recruitment and M and C are mortality and catch respectively. If there is no catch, the change of population will be denoted by $(G + R - M)$, which may be termed the rate of natural increase. This rate of natural increase is obviously a function of the population and may be denoted by $F(P)$. If $C < F(P)$, the population will increase. But the increase in population will increase the degree of competition between fishes and will thus reduce the natural rate of increase, thereby bringing the

population back to the original level. If $C > F(P)$, the population will decrease temporarily but this will afford better opportunities to the individuals to grow, increase the survival rate of the new arrivals and reduce mortality, thus increasing the natural rate of increase and bringing up the population to the original level. Thus it is clear that the catch can be greater than $F(P)$. But if it is very much greater than $F(P)$ the population can never recover back to its original position. Thus the maximum catch which will not change the population will be termed as the optimum catch. Any catch more than this optimum catch will affect the population and therefore the future catch. Any catch lower than the optimum catch will be both economic and biological wastage. Thus an efficient and scientific management of fishery means determination of the level of this optimum catch and the stable population. Such determination is very complex. For, the fish populations are not only affected by commercial fishing but also by various environmental factors. All such environmental factors along with commercial fishing affect the natural rate of increase and therefore the fish populations. Correct determination of populations therefore will require comprehensive biological and hydrological data which will estimate the environmental factors. But to start with, we may treat the environmental factors as random variables and try to understand the relationship between the amount of fishing, the quantity and quality of catch and the quantity and quality of fish populations and the rate of natural increase of population.

We know that the commercial catch is proportional to the amount of fishing (E) and to the population, *i.e.*, $C = KEP$, where K is a constant and KE measures the instantaneous rate of mortality. From above, the catch per unit effort U is given by

$$U = C/E = KP \qquad (2)$$

If we get an estimate of K, and know U from observations, we get an estimate of the population during the year. Therefore if we know catch, from equation (1), we get an estimate of $F(P)$, the rate of natural increase. If we plot the estimates of U and $F(P)$ for several years, the resulting curve will have a mode. This mode represents the optimum catch.

Thus the essential data required for assessment of fish populations are: (i) commercial catch and its composition by species, (ii) amount of fishing effort for the catch of each species, and (iii) an estimate of the mortality rate of the populations, along with data on other biological and environmental factors for a fuller assessment of the fish population.

In conformity with the general aim, the interest of the Central Marine Fisheries Research Station was mainly directed towards the collection of

the second group of statistics, though some economic statistics such as village-wise statistics of boats and nets were also collected in course of the preparatory survey conducted for designing the main survey. When the Central Marine Fisheries Research Station started functioning in 1947, it was found that excepting for some rough estimates of catch as given in *Agricultural Report of Marketing of Fish*, no reliable statistics on an all-India basis were available for any of the items of statistics listed above. It was, however, imperative, in consonance with the objectives of the Institute to have accurate estimates of catch, effort, natural rate of increase, etc., from year to year to assess the condition of various fish populations.

It was therefore contemplated to devise a sampling technique which would give a fairly accurate estimate of the catch and the effort, from which estimates of natural rate of increase could be obtained. Accordingly in 1948, a preparatory survey was carried out on complete enumeration basis, in which village-wise data were collected on the number of fishermen, the number of fishing units of different types, the fishing seasons, the type of fish caught and general information on disposal of catches. A resurvey was again undertaken in 1955–56 to make the inventory of fishing villages up-to-date.

On the basis of information collected in the preparatory survey, the entire coast-line of India was divided into twelve zones, making each zone as homogeneous as possible from the point of fishering practices and fisheries. To start with, three representative fishing centres (villages) were selected in each zone. But from 1955–56, the number of centres was increased to six on the west coast zones, which are responsible for landing more than 75% of the total catch. In order to increase the accuracy of the estimates, the coast-line of India were redivided into twenty homogeneous zones from 1957. The number of fishing villages studied was also increased, so that about 10% of the total number of villages was covered.

Three selected fishing villages are put in charge of a field investigator who visits each village once in each fortnight, the duration of stay at a village during each visit being three days. During each day's stay at village, a certain fixed percentage (varying from 10 to 20% from zone to zone) of fishing units landing their catch are examined on the basis of systematic selection, and data on total catch, catch of different species of fish, man-power engaged, duration of fishing, etc., are collected. The numbers of different types of fishing units landing their catches are also recorded. The fishing unit mentioned above is a boat-net combination. It is taken as the ultimate sampling unit, as the quantity and quality of catch depend mainly on the type of gear used.

The data are analysed separately for each zone every month. For the first four years from 1950, only estimates of catch were obtained along with its composition. From 1954, estimates of effort and catch per unit-effort are also being obtained. It is hoped that ten to fifteen years' data on the above items would enable us to determine the status of the fish populations. A summary of the data collected during the eight years (1950–57) are given in Tables I and II.

TABLE I

Showing annual catch in metric tons, total effort in thousand man-hours and catch (in kilogramme) per man-hour

Year	Total Catch (metric tons)	Total Effort (1000 man-hours)	Catch (kg.) (per man-hour)
1950	580,021	..	..
1951	533,916	..	..
1952	528,346	..	..
1953	581,460	..	..
1954	588,257	317,272	1·85
1955	595,722	331,033	1·80
1956	718,702	334,887	2·14
1957	875,420	318,147	2·74

It will be seen that the minimum essential statistics on the *biological* side are now being collected regularly and on a planned basis. On the other hand, excepting for the catch statistics which are being collected in connection with the biological assessment of fish populations and some village-wise statistics of fishing population and fishing units which were collected during the two preparatory surveys, statistics on the *economic* side of the fishing industry have yet to be collected on an all-India basis, although some States have been collecting such statistics at the State-level. It is necessary that the area of collection of comprehensive economic statistics relating to fishing industry be extended to cover the whole of India. While an understanding of the relationship between catch and fish population will lead to better management of fisheries, economic statistics on various items of fishing

TABLE II

Showing the composition of the average annual catch for 1950–57

	Fish	Average catch in Metric tons	Per cent.
1.	Elasmobranchs	22,781	3·64
2.	Eels	2,755	0·44
3.	Catfishes	20,281	3·24
4.	*Chirocentrus*	4,515	0·72
5.	(*a*) Oil-sardine	47,583	7·61
	(*b*) Other sardines	42,391	6·78
	(*c*) *Hilsa*	1,050	0·17
	(*d*) *Anchoviella* and *Thrissocles*	32,076	5·13
	(*e*) Other clupeids	23,448	3·75
6.	Bombay-duck	60,011	9·60
7.	Flying-fish	1,844	0·29
8.	Perches	9,168	1·47
9.	Red mullet	2,691	0·43
10.	Polynemids	5,097	0·82
11.	Sciaenids	42,357	6·78
12.	Ribbonfish	31,519	5·04
13.	Carangids	17,327	2·77
14.	Silver-bellies	12,758	2·04
15.	*Lactarius*	5,458	0·87
16.	Pomfret	12,722	2·03
17.	Mackerel	62,414	9·98
18.	Seer fish	7,285	1·17
19.	Tunnies	2,460	0·39
20.	Sphyraena	1,286	0·21
21.	*Mugil*	237	0·04
22.	*Bregmaceros*	5,024	0·80
23.	Sole	7,938	1·27
24.	Prawns and Crustaceans	109,572	17·53
25.	Miscellaneous	31,182	4·99
	TOTAL ..	625,230	100·00

industries will be needed for framing an efficient plan for further economic expansion of the industry.