MARINE FISH LANDINGS IN INDIA — ESTIMATES AND PRECISION

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Abstract

The reliability of estimates of marine fish production arrived at by the Central Marine Fisheries Research Institute based on the stratified multistage random sampling is further proved by testing the same, by fitting regression equations, with the export figures released by the Marine Products Export Development Authority.

Introduction

Over the years, the procedure of estimation of marine fish production in India has been improved in the light of the experience gained by the Central Marine Fisheries Research Institute since 1948 and on the basis of pilot surveys conducted by the Indian Council of Agricultural Research during 1950-56. In this paper the reliability of such estimates is studied in the light of export figures on fishery products and prawns, by fitting regression equations. Thus the present paper differs from the earlier papers cited under reference where the purpose was to fit trend curves only without availing the export data. !

Multistage Random Sampling

The system of collection of fish catch statistics by the Institute is one of stratified multistage random sampling over space and time. The maritime States form the major strata, and in each State, non-overlapping zones, each comprising 20 to 30 contiguous landing centres, form the ultimate strata. However, there are landing centres, such as Neendakara in Kerala and Sassoon Docks in Maharashtra, where the landings are so heavy that they are treated as single-centre zones.

Over time, a calender month is the major stratum, and this major stratum is divided into three groups, each consisting of 10 consecutive days. From the first of these groups 3 consecutive clusters, each of 2 days, are selected, selecting the starting day at random from the first five days of the month. Then from the second and third groups 3 clusters each are selected systematically with 10 as the sampling interval.

First-stage units over space are the landing centres. At the selected centre on the selected day, landing units are observed for data on catch and other details. When the number of landing units are ten then all the units are selected and observed. If it exceeds ten, a preassigned number of units are selected systematically for this purpose. On the selected first day the field staff collect data from 12.00 hrs to 18.00 hrs and the next day from 06.00 hrs to 12.00 hrs. In case of night landings the data are collected by enquiry thus making the total period of observation as 24 hrs. Units landing form the second-stage units. However, the period of observation in West Bengal, Orissa and Andhra Pradesh is 06.00 hrs to 18.00 hrs on both the days of observation.

FLUCTUATIONS

Marine fish landings in India exhibit very wide fluctuations over the years. Two factors, namely, fishery independent and fishery dependent are responsible for such fluctuations. Added to these, chance variations also act on the estimates. Since these estimates on marine fish landings are at present based on a sampling coverage of 1.5 to 3.0%, fluctuations in these estimates will be wide. Owing to the importance of these estimates on national economy it is desirable to know the precision of these estimates. Central Marine Fisheries Research Institute makes available estimates for the annual landings along with its standard error. However, for large-scale surveys such as this one, it is desirable to have independent estimates for comparison and verification. Independent estimates can be obtained in many ways as through (i) sub-sampling, (ii) independent surveys such as market surveys and (iii) the study of related variable using regression analysis.

REGRESSION ANALYSIS

Since the sampling coverage is too small as to rely on sub-sampling for comparison of estimates, and as at present there exists no such independent surveys like market surveys on marine fish arrivals, the only course left open is to find out whether any reliable estimates exist on related items. The figures on fish and shrimp exports obtained form the port authorities, compiled and published by Marine Products Export Development Authority, are available to serve the purpose. However, these figures pertain to processed items and not fresh landings. Assuming, therefore, that there exists a close relationship between processed weights and their corresponding fresh weights these export figures are taken for analysis. Since no separate figures on the exports of shrimps are available prior to 1961, data from 1961 till 1977 are considered. These data along with estimates obtained by Central Marine Fisheries Research Institute for total and prawn landings (Table 1) are analysed and the regression equations are fitted.

PRAWN CATCH PREDICTION

In fig. 1. total prawn catch and prawn exports are plotted against years. In both these graphs it is seen that the trend in prawn landings is more steep

TABLE 1. *Export figures for fishery products and prawns and estimates of total marine fish landings and prawn landings during 1961-77. (fig in tonnes)*

| | Exports | | Estimates of landings | | |
	Total	Prawns	Total	Prawns	Penaeid prawns only
1961	17297	6795	683569	62768	39083
1962	11619	6276	644244	73235	48251
1963	17908	8007	655484	81593	41071
1964	21458	9953	859582	94895	63389
1965	15457	9878	832777	79500	38085
1966	19153	11470	890311	90914	56146
1967	21764	14913	891888	94422	63310
1968	24810	18046	934611	101436	69514
1969	30584	23937	913680	106097	72133
1970	37175	26199	1085607	121691	89857
1971	34032	25729	1161389	148843	72109
1972	38271	31747	980049	163849	78361
1973	48785	38378	1220240	151156	136514
1974	46629	35993	1217797	170718	114934
1975	53412	47191	1422693	220751	141713
1976	62151	48090	1352855	191427	114640
1977	64964	47602	1259782	170464	94989

than that in the exports over the years. A high correlation coefficient of 0.94 is found between the prawn catch and years and so also between the prawn catch and its exports, the correlation coefficient being 0.95. The regression of prawn catch (y) on years (X_1) and the prawn exports (X_2) is

$$Y = 51.4119 + 1.0263 \ X_1 + 2.6642 \ X_2 \quad ....(1)$$

with R_2 the square of the multiple correlation coefficient as 92.32%. The estimates of prawn catch from the above equation is 2.07 lakh tonnes with a standard error of 15.6 kilo tonnes for 1978. The corresponding estimate from the data on landings is 1.79 lakh tonnes and this lies in the 95% confidence interval.

TOTAL PENAEID PRAWN CATCH PREDICTION

Since total prawn landing contains nonpenaeid prawn also and since the prawn exports do not generally include this item a regression of total penaeid prawn landings (Y) on years (X_1) and prawn exports (X_2) is fitted and the equation is

$$Y = 11948.56 - 2474.89 \ X_1 + 2.76 \ X_2 \quad ....(2)$$

with R_2 as 81.59%. From the above equation the penaied prawn catch for 1978 is found to be 1.32 ± 0.35 (s.e.) lakh tonnes. The sample survey estimate of the penaeid prawn landings is 1.29 lakh tonnes in 1978 which lies well within the reasonable limits.
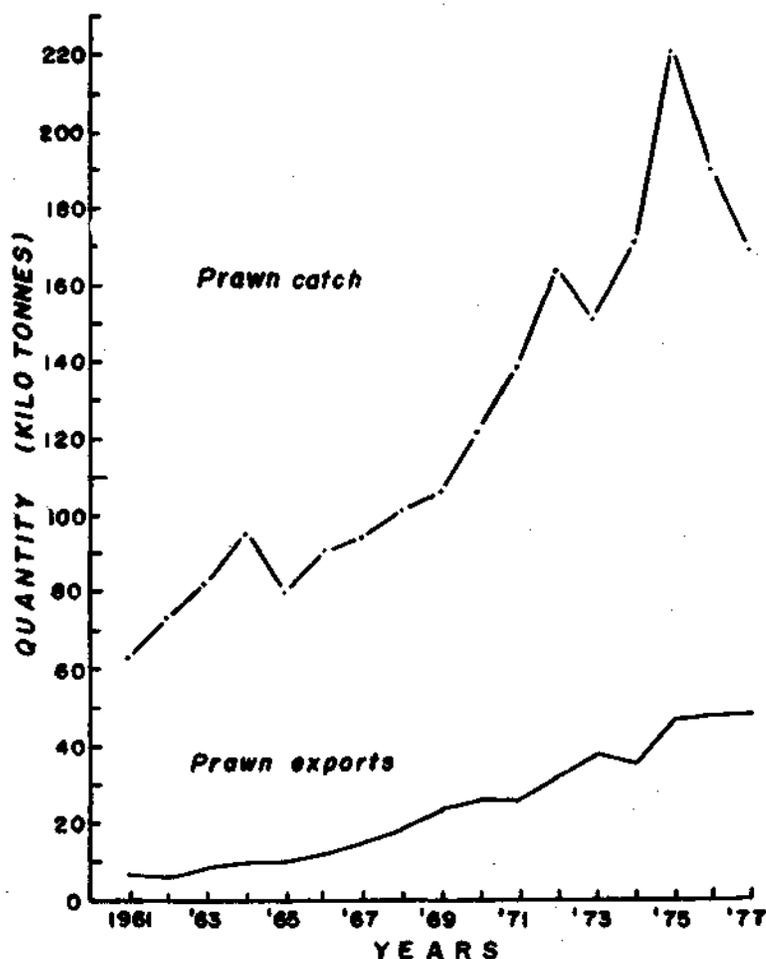

FIG. 1. Prawn catch and exports (in kilo tonnes) during 1961-77.

TOTAL CATCH PREDICTION

In figure 2 are the graphs for the total catch and total exports against years. A more or less similar trend in both the cases is found and the correlation coefficients between total catch and years and total exports and years are 0.95 and 0.92 respectively. Here also a multiple regression of total catch (Y) on years (X_1) and total exports (X_2) is fitted and the equation is

$$Y = 581.0227 + 37.2542X_1 + 2.5276X_2 \quad \ldots (3)$$

with R_2 of 90.38%. The estimate for 1978 from (3) for the total catch is found to 1.44 million tonnes with a s.e. of 1.14 lakh tonnes. Here also the estimate of total landings for 1978 obtained through sample surveys (1.40 million tonnes) is well within the reasonable limits.
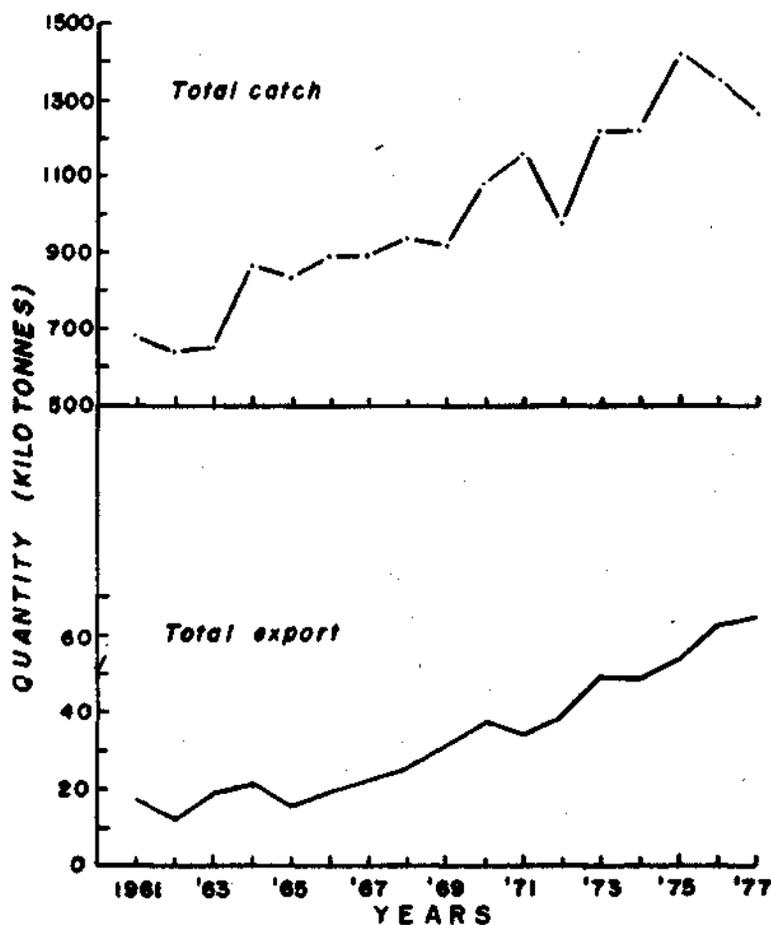

FIG. 2. Total catch and exports (in kilo tonnes) during 1961-77.

It is interesting to note that the total estimated marine fish landings when plotted against years followed a quadratic trend (fig. 3) resulting in

$$Y = 820340. \ 74 + 30359.04t + 915.49t_2 \quad \ldots (4)$$

with R_2 as 87.47%. This yields an estimate of 1.42 million tonnes with s.e. at 1.04 lakh tonnes for 1978. This is comparable with the estimate 1.40 ± 0.114 million tonnes obtained from the data on the landings.
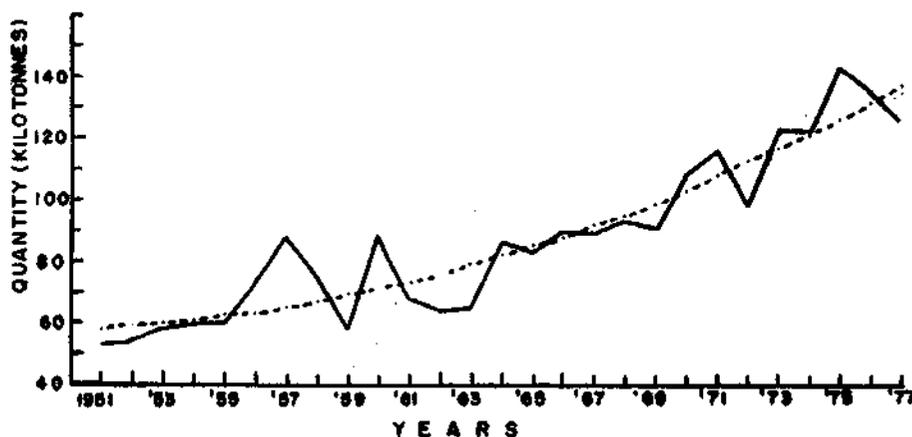
FIG. 3. Estimates of total marine fish landings in kilo tonnes during 1961-77.

From the foregoing it is apparent that the estimates obtained through sample surveys by the Central Marine Fisheries Research Institute are very much within the reliable range and thus the estimates are comparable with those obtained from the studies of related variables.

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