PROCEEDINGS OF THE SYMPOSIUM

ON

LIVING RESOURCES *of* THE SEAS AROUND INDIA

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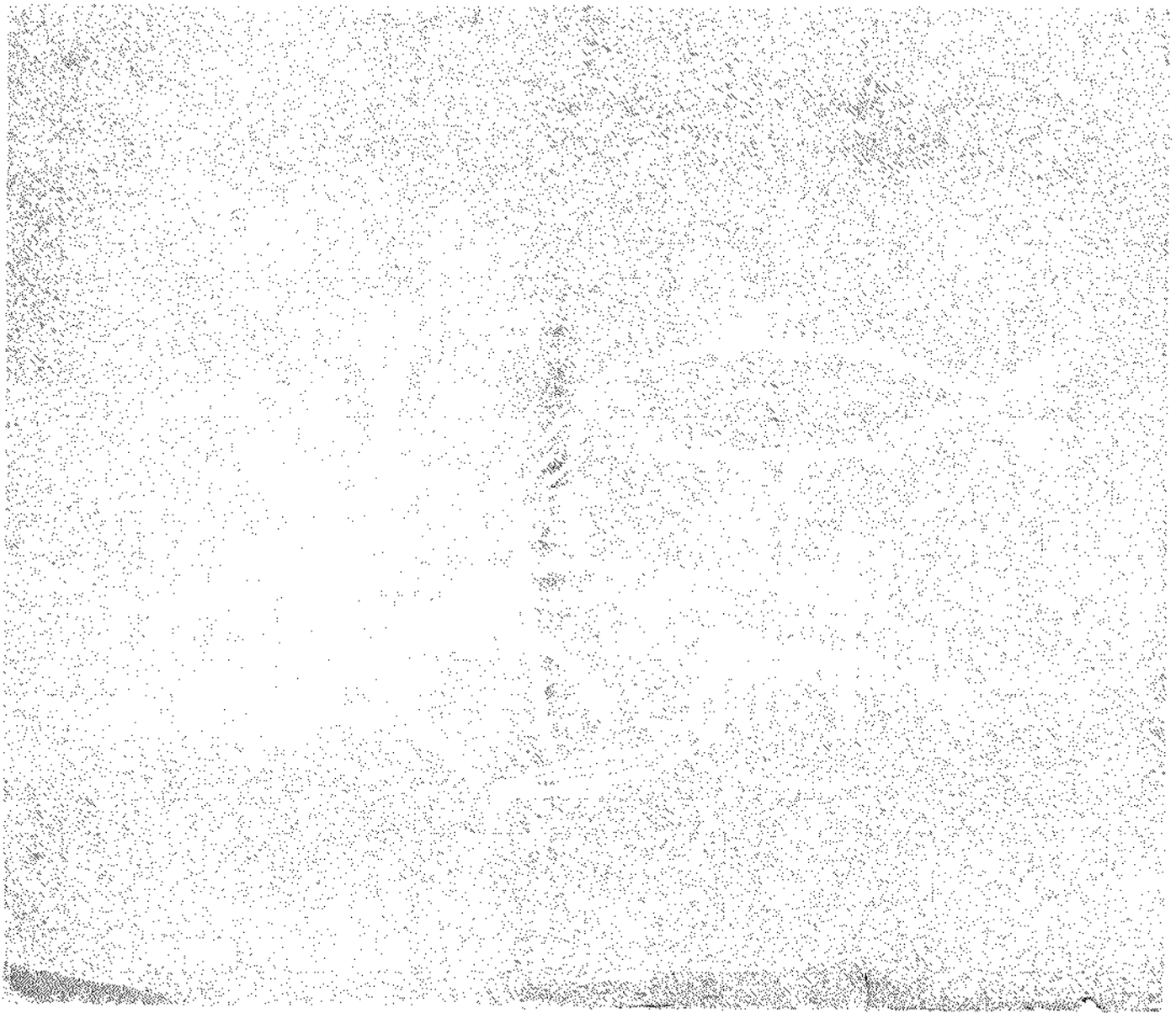

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LIVING RESOURCES OF THE SEAS AROUND INDIA

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AN EVALUATION OF MARINE FISH RESOURCES OF INDIA

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ABSTRACT

In this paper the potential harvest has been estimated by fitting trend line to catch data and extrapolating. On the basis of trend lines of individual fisheries as well as the total landings expected production figure for the immediate future has been arrived at by extrapolation.

INTRODUCTION

FISHERY is an important sector of food production. With increasing demand of food the expansion of fisheries will continue to increase. At present, India produces annually about 1·34 million tonnes of fish. Sea fish comprises about 64% of total fish production in India. To augment fish production the various methods by way of improved nets and craft are being employed. Results of the scientific investigations are being utilised to increase the fish production. At this stage it is of interest therefore to assess the expected yield from the sea in near future. Generally three methods are available for estimating the potential harvest from the sea. They are:

(i) By fitting trend lines to the production figures and extrapolating.

(ii) By considering the knowledge of unused harvestable resources.

(iii) By calculations based on food chain dynamics.

Schaefer (1968) has discussed each of these while considering the growth of sea fisheries in the world. Kesteven and Burdon (1952) fitted trend lines to study the different fisheries in the colony of Singapore. In this paper attempt has been made to estimate the catch from the sea in the years 1968 to 1972.

METHOD

The data are taken as a time series and an accurate description of the series is given in statistical terms. A second degree trend line is fitted to the marine fish production in India during the years 1950–1967. The trend values for the years 1968 to 1972 are directly extrapolated from the trend line. To study fluctuation of actual catch around the trend line the Von Neuman statistic defined by

$$Q = \Sigma \{\hat{u}_t - u_{t-2})^2 / \Sigma \hat{u}_t^2$$

where $\hat{u}_t$ is the least square estimate of the disturbance u_t in the equation

$$y = \Sigma \beta_t X_t + \hat{u}_t$$

(H. Theil and A. L. Nagar, 1961) was computed. Using the table of significance points computed by Theil and A. L. Nagar the null hypothesis of mutual independence of the residuals in the trend line has been tested.

Estimation of Potential Catch

The total fish production in India since 1950 is represented in Fig. 1. With 1958 as origin the equation of the second degree trend line comes as $Y = 697,915{\cdot}66 + 18,505{\cdot}38\ t - 159{\cdot}80\ t^2$ where Y is the production figure in tonnes, t represents time in unit of year from 1958. The fitted line shows a steady increasing trend. The actual production figure in different years shows a great deal of fluctuations around this trend line. On the basis of the trend line trend values are calculated for the period 1950-1967. The recorded and calculated landings along with their variation are shown in Table I.

Table I

Observed and calculated landings in tonnes

Year	Observed Landings	Calculated Landings	Variation	Per cent variation on observed data
1950	580,022	539,645	+ 40,377	+ 6·96
1951	533,916	560,548	− 26,632	− 4·99
1952	528,348	581,131	− 52,783	− 9·99
1953	581,463	601,394	− 19,931	− 3·43
1954	588,258	621,337	−33,079	−5·62
1955	595,725	640,961	− 45,236	− 7·59
1956	718,779	660,266	+ 58,513	+ 8·14
1957	875,516	679,250	+196,266	+22·42
1958	755,994	697,916	+ 58,078	+ 7·68
1959	584,587	716,261	−131,674	−22·52
1960	879,681	734,287	+145,394	+16·53
1961	683,569	751,994	− 68,425	−10·01
1962	644,244	769,380	−125,136	−19·42
1963	655,484	786,448	−130,964	−19·98
1964	859,582	803,195	+ 56,387	+ 6·56
1965	832,777	819,623	+ 13,154	+ 1·58
1966	890,311	835,731	+ 54,580	+ 6·13
1967	862,631	851,520	+ 11,111	+ 1·29

It will be seen that the difference between recorded and calculated landings does not vary to a great extent. When these differences are expressed as percentage of observed landings, the per cent variation ranges from 1·29 to 22·52. In respect of 5 years of 1957, 1959, 1960, 1962 and 1963, the average percentage variation comes to 20·17, whereas for the rest of the 13 years the average percentage variation works out to be 6·15. The overall average per cent variation is only 10·05.

To study the nature of fluctuations the Von Neuman statistic works out to be 1·89 This value is above the theoretical value of 1·25 and 1·53 at 1 and 5 per cent level respectively. Therefore we cannot reject the null hypothesis that the residuals in the equation

$Y = 697,915{\cdot}66 + 18,505{\cdot}38\,t - 159{\cdot}80\,t^2$ are assumed to be mutually independent. Basing this trend line the trend values for the years 1968 to 1972 work out to be

Year	Trend values in tonnes
1968	866,989
1969	882,139
1970	896,969
1971	911,479
1972	925,670

These trend values will give estimate of total production of marine fish in India during the next five years.

Discussion

The secular trend shown in Fig. 1 indicates the general response of the fishing industry to the growing demand of the populations and to different factors operating over a number of years. The direction and gradient of the trend line depicts the historical feature of fishing industry also. The trend line shows an increasing fish production over the years 1950 to 1967 and during the same period trend values show an increase by 57·79%. On the basis of trend analysis it may be concluded that without radical changes in fishing techniques or occurrence of some unnatural phenomenon, the annual marine fish landings in India will vary between 0·87 to 0·93 million tonnes during 1968 to 1972.

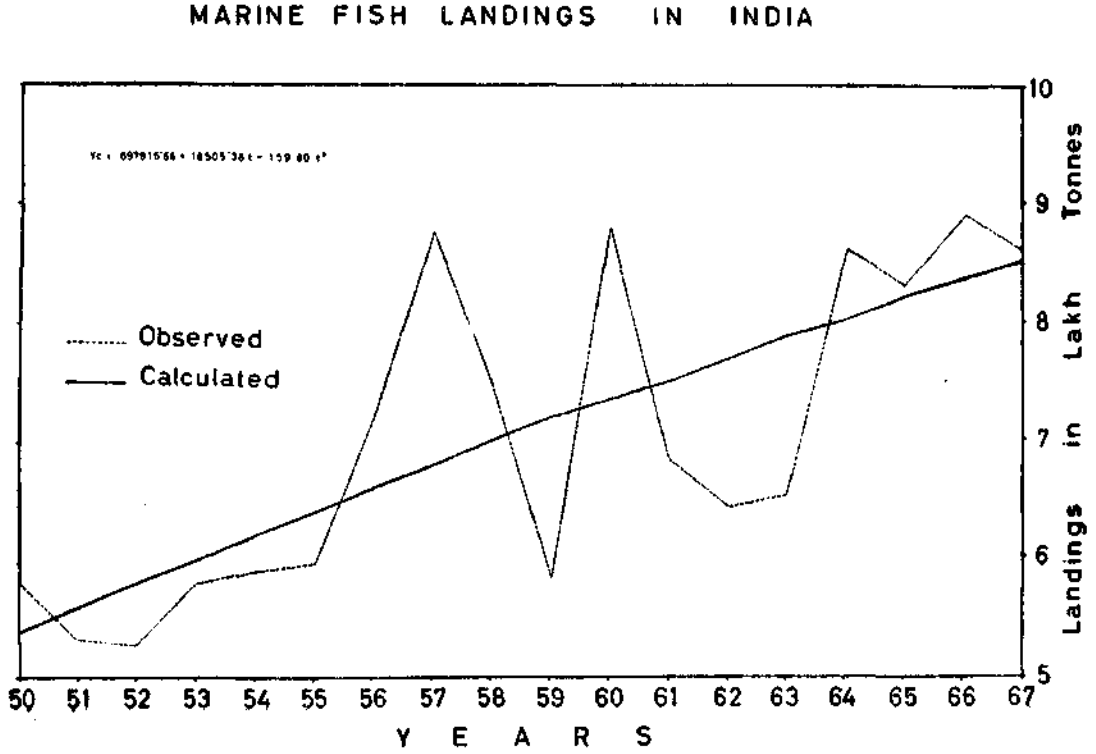

Fig. 1

During the last 18 year period the average trend values work out to be 702, 827 tonnes and the same for the next five year period comes as 896, 649 tonnes thus showing an increase by 27·58%. It is seen from Table 1 that barring five years, the deviation of the observed landings from the trend values ranges from 1·29% to 10%. It is seen that landing pattern witnessed in each of these five years a sudden shift from the same in adjacent years. In 1957 landings of oil sardine was recorded as 191 thousand tonnes as compared to 7 thousand tonnes in 1956; similarly yield of mackerel came to 89 thousand tonnes in 1957 as against 16 thousand tonnes in the previous year. In 1959 a very significant decrease was recorded in oil sardine and mackerel. In 1960, both fisheries recovered to a great extent. Similarly a great variation was seen in 1962 and 1963 as compared to adjacent years. These sudden changes might have induced deviation of trend values by about 20% from the actual landings. So it may perhaps be assumed that if the landings of oil sardine and mackerel do not vary to a great extent from the same in adjacent years, the trend values will be a fair approximation to the actual landings.

Total landings are influenced by landings of individual fisheries. So it is necessary to consider the trend of production from different fisheries. It is seen that the fisheries of cat fishes, *Anchoviella* and *Thrissocles*, other clupieds, *Harpodon nehereus*, scienids, ribbon-fish, carangids, pomfrets, mackerel and crustaceans show a declining trend. It may be possible to monitor the effort in such a way that we may expect to obtain in the immediate future, the yield equal to the maximum attained by each fishery in course of last 18 years. Again the fisheries of Oil sardine, other sardines, *Leiognathus* and *Gazza* and Elasmobranchs show increasing trends. The figures shown under miscellaneous fishes also are in ascending order. The expected production from these figures can be extrapolated from the trend lines fitted to the production figures of these fisheries during 1951–65 (Nair and Chakraborty, under publication.) The second degree trend line fitted to the figures under miscellaneous fishes during the period 1951–65 comes to $Y = 90{,}047 \cdot 56 + 2{,}678 \cdot 45\, t + 182 \cdot 73\, t^2$ where Y and t have their usual significance. The expected contribution from the different fisheries may be summarised in Table II.

TABLE II

Expected contributions from the different fisheries

(Figures in tonnes)

Name of fishery/Year	1968	1969	1970	1971	1972
Elasmobranchs ..	53,632	58,340	63,394	68,793	74,539
Catfishes ..	29,872	29,872	29,872	29,872	29,872
Oil sardine ..	301,705	327,703	354,716	382,745	411,789
Other sardines ..	43,846	46,983	50,472	54,312	58,504
Anchoviella and Thrissocles	59,563	59,563	59,563	59,563	59,563
Other clupeids ..	34,358	34,358	34,358	34,358	34,358
Harpodon nehereus ..	127,713	127,713	127,713	127,713	127,713
Sciaenids ..	73,211	73,211	73,211	73,211	73,211
Ribbon-fishes ..	56,298	56,298	56,298	56,298	56,298
Carangids ..	56,628	56,628	56,628	56,628	56,628
Leiognathus and Gazza ..	34,836	38,024	41,409	44,994	48,776
Pomfrets ..	25,678	25,678	25,678	25,678	25,678
Mackerel ..	133,655	133,655	133,655	133,655	133,655
Crustaceans ..	159,552	159,552	159,552	159,552	159,552
Miscellaneous ..	135,105	141,621	148,502	155,749	163,361
TOTAL ..	1325,652	1369,199	1415,021	1463,121	1513,497

Table II shows that the total landings during 1968 to 1972 may vary between 1·3 million tonnes to 1·5 million tonnes. There exists a wide difference between these estimates and the same obtained from the trend analysis of total landings during 1950–'67. The figures shown in Table II can be achieved only if the efforts put in fisheries showing declining trends are so monitored that the maximum attained in those fisheries during 1950–1965 will be reached during the next five year period and the fisheries showing ascending landing figures will maintain the same trend. This necessitates scientific management of marine fishery in the coming years.

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