STUDY OF COMPARATIVE INVESTIGATION OF MARINE FISH ABUNDANCE IN MAHARASTRA COAST

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ABSTRACT

India is surrounded by seas and ocean on its three sides there is enough commercial potentiality for trading in fish and other aquatic animals. Fish statistics is subject to certain peculiar situations that stand in the way of accuracy of statistics of fish production. The fishing crafts are varied and changing. Statistical investigations of available marine fish production statistics for some economically important fish species has been undertaken using appropriate statistical methodology. There is no satisfactory system of obtaining information on fish production and its related observations. It required committed managerial effectiveness.

KEYWORDS : Marine Fish, Bombay Duck , Cat Fish, Fish Production

Collection and investigation of statistics of fish production is as important as that for cereals and animal products. For cereals and animal products collection, investigation, experimentation and reporting using statistical methodology are well-organized throughout the country and the methodology is more or less standardized as relatively more importance is being given to these sectors since long. Though statistics of fish catch is being collected in different parts of the country for a number of years. Coverage area and reporting procedures in this sector need much more improvements. Statistics of marine fish production is generally collected species-wise, landing centre wise and season-wise from landing sites. Such data are then cumulated to district level data for reporting fish-production species-wise and season-wise. Information on variation of species-wise catches in different years, districts, seasons and their interactions are necessary for proper organization and improvement in fish trading. Such information has to be extracted through appropriate statistical investigation of available catch data. Due to high variation in prices and catch-magnitudes over the species of fish, it is necessary to make such studies specie's-wise (Annon, 1995, 1994-2002; Bal and Rao, 1990; Bsnnji, 1969 and Bapat and Alwani, 1973.).

MATERIALS AND METHODS

This study based (Retrospective) study has been conducted species wise for six commercially important species viz ;(i) Catfish (ii) Bombay duck. (iii) Non-Penaeids Prawns, (iv) Penaeids Prawns, (v) Pomfrets and (vi) Ribbon, fish that are available in sufficient quantity in the following five coastal districts of Maharashtra (a) Thane, (b) Gr. Mumbai. (c) Raigad, (d) Ratnagiri and (e) Sindhudurg over each of the four seasons of seven years viz. 1995-96 to 2001-02. But, for the purpose of current publication Bombay duck and Cat Fish have been included.

The data analyzed here are the species-wise seasonal data collected from annual reports published by Government of Maharashtra. The main purpose of the analysis is to estimate average catches for different districts and years in the form of annual productions but not in the form of seasonal productions. The seasonal means are presented in form of seasonal productions. The analysis of variance tables has been obtained showing the variance estimates due to districts, years, seasons and their interactions. There is another series of seasonal data collected from Thane district for 12 years (Published by CMFRI, Cochin). As the data are spread over 12 years, these have been investigated for studying variation over the years for each species separately (FAO, 1997).

OBSERVATIONS AND DISCUSSION

Missing observations: The present data on marine fish production involve three factors of variability viz., (a) Districts, (b) Years and (c) Seasons. Missing observations are frequent in fisheries data. In the present situations, suitable analysis of variance technique is being adopted for studying the variability due to these three factors and their interactions. The mean squares of three factor interaction is being used here as error variance. The ANOVA model of these data has as many parameters as the number of observations. These data cannot be analyzed as per the

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Table 1a: Nature of Abundance of Catfish and Its Distribution

SPECIES AND DATA FILES NAMES:	CAT FISH	CATSEYDO
	UNIT	TONS
OVERALL MEAN (PER YEAR) AND CV	1888.29	59.40

Table 1b: District, Year And Season; Season In Sub-plot

SOURCES	DF	SS	MS	F
DISTRICT	4	10769144	2692286	**8.0****
YEAR	6	700342	116724	0.3
YRX DT	24	8027859	334494	**2.0***
SEASON	3	6333044	2111015	**12.5****
SEN X DT	12	3947131	328928	1.9
SEA X YR	18	1744453	96914	0.6
ERROR	72	12191560	169327	
TOTAL	139	43713530		

Table 1c: DISTRICT MEANS (PER YEAR)

THANE	GR. MUMBAI	RAIGAD	RATNAGIRI	SINDHUDURG
2739.71	3187.14	403.14	2366.57	744.86

S.E. (DIST. MEAN)= 218.60

Table 1d: YEAR MEANS (PER YEAR)

99-00	00-01	01-02	02-03	03-04	05-06	06-07
1304.60	1678.00	1957.60	2095.80	1911.20	2086.20	2184.60

S.E. (YEAR MEANS)= 258.65

Table 1e: SEASON MEANS (PER SEASON)

APRIL-JUNE	JULY -SEPTEMBER	OCTOBER-DECEMBER	JANUARY-MARCH
324.03	835.71	406.40	322.14

S.E. (SEASONS MEAN) = 69.56

existing methodology of analysis of variance due to three way classification where number of I observations becomes less than the number of parameters in the ANOVA model. Accordingly, certain assumptions with approximate methods are normally used here. In the present study, a missing observation of particular season has been estimated by taking the average of existing observations in the same season and district in other years where observations of the corresponding season are available (Bsnnji S.K.,1969;Bapat S.V.,1973 and Biradar R.S.,1987)

Economic values: The economic values of fish production for each species have been obtained for each district on annual basis and also for the entire coast comprising of the districts under investigation. If the market price of fish is Rs. P per kg and fish production in a district is

M tons per year, then the economic value can be obtained as:

Economic value = $M \times P \times 1000$ rupees

= $M \times P \div 10000$ crores

In the above Table 1,(a,b,c,d,e and f) the results of analysis of variance along with the mean values of different factors with their standard errors, wherever necessary, have been presented. For year and district means along with the cell means in district x year table, the per year production unit has been used while for seasonal means per season unit has been used. The season x year and season x district tables are not presented when the variability due to the corresponding interaction is not significant (Meng L. and Peter B.,1994).

As the district x year interaction is significant at 5% level of significance, the district x year mean table has

Table 1f: District and Year Means

DISTRICTS/YEARS	99-00	00-01	01-02	02-03	03-04	05-06	06-07
THANE	1952.0	2889.0	4834.0	4167.0	1364.0	2028.0	1944.0
GR.MUMBAI	3094.0	3777.0	2333.0	1727.0	3471.0	2947.0	4961 .0
RAIGAD	400,0	347.0	322.0	208.0	766.0	427.0	352.0
RATNAGIRI	550.0	639.0	902.0	2927.0	3421.0	4795.0	3332.0
SINDHUDURG	527.0	738.0	1397.0	1450.0	534.0	234.0	334.0

S.E. CELL MEANS = 578.35

COST PER/KG DURING THE PERIOD IS RS. 35
total coastal economic value (in rs crores) IS 33.04
district wise economic values in chronological order as shown in table above in
crores are -   9.59, 11 .16, 1.41, 8.28 & 2.61.

been presented. This table is also useful to examine the nature of variation of the year means over different district means and thereby help in commercial decision making. This table will be presented for other categories of fish even though the corresponding interaction is not significant.

Variation due to year is not significant while that due to districts is significant at 1% level of significance. The season variability (Mean Squares) is significant even at 1 % level. But the two interactions with seasons are not significant. The overall mean of catfish on the entire coast bordering the five districts and over all the seven years is 1888.29 tons per year with 218.60 as S.E. The coefficient of variation (C.V.) is calculated using the total mean square as percent of mean. The overall variation is of moderate variability for catfish(Collins et al.,1999 and Maceina et al.,1994).

The district means differ significantly with the minimum of 403.14 tons marine fish production per year in Raigad and the maximum of 3187.14 tons per year in Greater Mumbai over the years. The means for the three districts viz. Gr. Mumbai, Thane and Ratnagiri are more or less of the same order and their differences do not differ significantly. The two districts of Raigad and Sindhudurg form a low yielding group. The mean yields of the years over the districts do not show much variation remaining in the range of 1304.6 tons to 2184.6 tons. The seasonal means differ significantly even at 1 % level. Actually, the October-December mean yield viz, 835.7 ton is very large as compared to those in the other seasons for which the maximum is 406.4 tons.

A critical view of district x year mean table shows that catfish is available in abundance in both Thane and Greater Mumbai districts. The yield remains mostly over 2000 tons per year. Barring the first three years, yield is higher than 2000 tons in the remaining 4 years in Ratnagiri district. The yields in Raigad district are uniformly low in all the years. The yields in Sindhudurg also shows mostly similar trend over the years. Using market price of catfish Rs.35.00 per kg during the period of investigation, the total coastal economic value of catfish works out to be Rs.33.04 crores. And such value for Greater Mumbai district comes out maximum with Rs.11.16 crores followed by Thane district with Rs.9.59 crores economic value.

In the Table 2 (a,b,c,d,e, f and g)the results of the analysis of variance of Bombay duck over the five coastal districts of Maharashtra are presented along with mean values of different factors with their standard errors wherever necessary.

The data from this species are not available from the Sindhudurg district. In other districts also, in general there were 16 missing observations. The error degree of freedom is reduced due to such missing observations as can be seen in the tables of analysis of variance for different species excepting catfish for which there is no missing observation. As there are 16 missing observations for Bombay duck species, the error d.f.is 38 being less by 16 from the expected d.f. 54 when there is no missing observation. The overall mean for this species is 14475.93

Table 2a: Nature of abundance of Bombay duck (*Harpodonneherus*) and its distribution

SPECIES AND DATA FILES NAMES:	Bombay duck	Harpsydo
	UNIT	TONS
OVERALL MEAN (PER YEAR) AND CV	**14475.93**	**104.42**

Table 2b:ANAYSIS OF VARIANCE TABLE: DISTRICT, YEAR AND SEASON; SEASON IN SUB-PLOT

SOURCES	DF	SS	MS	F
DISTRICT	3	2456139024	818713000	**209.5****
YEAR	6	28722912	4787152	1.2
YRX DT	18	70346634	3908146	1.4
SEASON	3	1011200328	337066800	**116.5****
SEN X DT	9	2612273015	290252600	**100.3****
SEA X YR	18	51742207	2874567	1.0
ERROR	38	109926300	2892798	
TOTAL	111	6340350447		

Table 2c:DISTRICT MEANS (PER YEAR)

THANE	GR. MUMBAI	RAIGAD	RATNAGIRI	SINDHUDURG
46218.15	10207.71	1133.86	344.00	0

S.E. (DIST. MEAN) = 747.20

Table 2d:YEAR MEANS (PER YEAR)

99-00	00-01	01-02	02-03	03-04	04-05	05-06
14806.00	13745.00	18488.50	12711.00	13654.50	12005.75	15920.75

S.E. (YEAR MEANS) = 988.45

Table 2e: SEASON MEANS (PER SEASON)

APR.-JUN.	JUL.-SEP.	OCT.-DEC.	JAN.-MAR.
2136.14	709.79	8816.25	1813.75

S.E. (SEASONS MEAN) = 321.43

Table 2f:DISTRICT X YEAR MEAN (PER YEAR)

DISTRICTS/YEARS	99-00	00-01	01-02	02-03	03-04	04-05	05-06
THANE	46553.0	44195.0	61133.0	41184.0	41546.0	37191.0	51725.0
GR.MUMBAI	11162.0	9705.0	10740.0	8166.0	11549.0	9009.0	11123.0
RAIGAD	952.0	766.0	1714.0	1182.0	1202.0	1479.0	642.0
RATNAGIRI	557.0	314.0	367.0	312.0	321.0	344.0	193.0

S.E. CELL MEANS = 1976.90

tons per year with 104.42 percent as coefficient of variation (c. v.). This coefficient of variation is large to some extent due to high productions in Thane and Greater Mumbai and very low in the remaining two districts of Raigad and Ratnagiri.

The analysis of variance table shows that the district, season and season x district variances are highly significant even at 1 % level of significance. These indicate that the district means differ highly and so also the season means. Again, the patterns of variation of the seasonal

Table 2g: District X Season

SEASONS	APR-JUN.	JUL-SEP.	OCT-DEC.	JAN-MAR.
THANE	6379.9	3693.1	31140.3	5004.9
GR.MUMBAI	2018.9	2377.6	3817.1	1994.1
RAIGAD	75.9	748.4	258.3	51.3
RATNAGIRI	70.0	20.0	49.3	204.7

S.e. Dis1.x Season Cell Means = 642.9

cost per/kg during the period is rs. 40
total coastal economic value (in rs crores) is 231.61
district wise economicvalues in chronological order as shown in table above in
crores are -   184.87, 40.83, 4.54 & 1.38

means are different for different districts. As in catfish, the yields of the species over different years are more or less maintaining the similar pattern of change over districts.

The district average yields are highly variable with maximum of 46,218 tons per year in Thane followed by 10,207 tons in Greater Mumbai. Both these averages further differ significantly. The average yields of the remaining two districts viz. Raigad and Ratnagiri are very low and do not differ significantly. The mean yield over the years is more or less similar varying between the minimum of 12005.75 tons per year and the maximum of 18488.5 tons. The season to season variation of yield is also very high with the maximum of 8816.3 tons per season in October December and the minimum of 1709.8 tons per season in July-September. Like catfish the high yielding season is October-December while the average yield in the other three seasons do not differ significantly but these are significantly lower than the yield in October-December season(Somvanshi VS.,1998 and Tripathi,1998).

An examination of the district x year table of means shows that in Thane district the total yield over the seasons are uniformly higher in all the year. But .such yields in Greater Mumbai are higher but much less than those in Thane in different years. The average yields in Raigad and Ratnagiri generally remained of the same order. The variability due to the interaction between district x season is very high. It is seen that the October-December yield in surpassing the yield in the other seasons. But in Greater Mumbai, the average yields over the seasons are of more or less same order. The average yields in the district of Raigad

and Ratnagiri differs significantly as compared to Thane and Greater Mumbai. Using price of the species as Rs 4O per investigation, it is seen that the high yield of this variety occurs only in Thane and Greater Mumbai districts indicates high trade potentiality even though its unit price is low. The total coastal economic value comes out here is Rs. 231.61 crores with the maximum in Thane district as Rs.184.87 crores followed by Greater Mumbai as Rs.40.83 Crores (Upare and Mayadevi,2001).

CONCLUSION

Fish is an important commodity with great commercial potential through trading with foreign countries. The present status of obtaining information on fish production and its variation over seasons, years and species is not satisfactory. It is necessary to improve different infrastructure related to fish production and trading and also improve organizational and management activities. Short term forecast also are required to held commercial activities in this sector.

Recent happening like Tsunami tragedy accompanied by unimaginable speed of very high tides and related extreme disturbances may disturb density and distribution of certain species of marine fish. Therefore, It is necessary to investigate possibility of such changes through collection and analysis of suitable observations on fish density etc.

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