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Growth and Instability of Inland Fish Production in India

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Abstract

The growth value of inland fish production during 1995-2014 was significant in almost all states in the country. During 2005-14, the annual growth rate in inland fish production was highest and significant in states of Jharkhand (17.30%) and Andaman & Nicobar Islands (16.50%). The higher instability of inland fish production in the states of Andaman & Nicobar Islands, Goa, Dehli and Mizoram did not deter from attaining high growth rates. Temporal changes in inland fish production declined in six states *viz.,* Arunachal Pradesh, Delhi, Goa Gujarat, and Madhya Pradesh during the 2005-14 compared to previous period. However, high up and down in the inland fish production during 2005-14 was noticed in all the states. High growth and high instability in the production of inland fish during the current decade needs special attention of the policy makers and researchers.

Keywords: Inland fish production, instability, temporal change, inland fish

Introduction

Fisheries sector contributes significantly to the national economy while providing livelihood to approximately 14.49 million people in the country as per livestock census 2003 (Handbook of Fisheries, 2014). It has been recognized as a powerful income and employment generator as it stimulates growth of a number of subsidiary industries. Fish is a source of nutritious food besides being a source of foreign exchange earner. India is the second largest producer of fish in the world contributing to about 5.68% of global fish production Anon (2014) it also has second rank in aquaculture production after China. Fisheries is a promising sector of agriculture and allied activities in India and a growth target rate of 6% was fixed so as to achieve the overall growth rate of 4.1% for Agriculture during the 11th Five year Plan. During 2013-14, the volume of fish and fishery products exported from India was 9 83 756 tonne, worth ₹ 30 213.26 crores and during 2014-15; export earnings crossed ₹ 30 000 crore for the first time. The country is endowed with a vast expanse of water resources amenable for fisheries and aquaculture. The fishery (Marine and Inland) sector also accounts for 0.83% of total GDP and 4.75% of the Agriculture sector's GDP at current prices for the year 2012-13. Fish production has increased from 41.57 lakh tonne (24.47 lakh tonne for marine and 17.10 lakh tonne for inland fisheries) in 1991-92 to 95.79 lakh tonne (34.43 lakh tonne for marine and 61.36 lakh tonne for inland fisheries) in 2013-14. While the inland fisheries production has registered a robust growth during this period, the growth in marine fisheries has been slower. So this examines attempts to study the growth and instability of inland fish production in India.

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Materials and Methods

The study is based on secondary data of data relating to inland fish production at the state and country level collected from various reports of Government India the last 20 years, from 1994-95 to 2013-14. Data relating to inland fish production at the state and country level collected from various reports of Government India. The period 1994-95 to 2013-14 was divided into two sub-periods *viz.,* period I (1994-95 to 2003-04); period II (2004-05 to 2013-14); and total period III (1994-95 to 2013-14). In order to examine year-wise and whole period trend of inland fish production, linear, exponential and semi exponential functions were fitted. But exponential function was finally selected considering the highest value of coefficient of determination (R^2) variate. The compound growth rate (CGR) is estimated by fitting a semi-log trend equation (1) of the following form:

ln Y = a + bt (1)

where, Y defines the time series data of production of fish, 't' is the trend term and 'a' is the constant coefficient. The slope coefficient 'b' measures the relative change in Y for a given absolute change in the value of explanatory variable 't'. If the relative change in Y is multiplied by 100, we the percentage change or growth rate in Y for an absolute change in variable 't' is obtained. The slope coefficient 'b' also measures the instantaneous rate of growth. The compound growth rate can be calculated using the following equation:

CGR = [antilog b – 1] * 100 (2)

The equation (2) has been estimated by applying Ordinary Least Square (OLS) method. The t- test was applied to test the significance of 'b'. This equation presumes that a change in agriculture output in a given year would depend upon the output in the proceeding year (Deosthali & Chandrehekhar, 2004).

Production of fish is known to fluctuate widely over time and regions. It may also indicate the pitfalls in arriving at any general conclusion on the basis of averages only. In reality, wide variations in these data over time and space can also attribute to the economy of the country. Hence, it might be useful for the purpose of policy making to study the districts/time period, in which the productions of fish were stable/unstable compared with the others. Coefficient of variation (CV) was used as the usual measure of instability. Hence the period-wise coefficients of variation were computed separately for different states of country. The usual measure of CV is given by:

CV = (Standard deviation / Mean) x 100

The CV has an easy interpretation in the context of measuring an overall variation in the data not showing any trend. But usually when a time-series for a variable showing linear or non-linear trend, the CV does not take into account any such time trends of the data while measuring instability in the variable values (Mitra, 1990). The instability Index (II) was, therefore measured by fitting an exponential time trend. There are a number of techniques available to measure the index of instability. Ray (1983) and Chand & Raju (2009) used a technique to study the nature of agricultural instability in the selected district is Odisha. In this study the variability in fish production is measured by a method suggested by Parthasarathy (1984), which was based on residuals,

$$II = \sqrt{\sum_{i=1}^{n} ei^2 / (n - K)}$$

where, ei = value of residual of i th observation n = number of observation; and k = number of variables. Sen (1989) pointed out that the measure of instability based on exponential time trend is scale free and can be readily used for cross comparisons. This index is unit-free and very robust, and it measures deviations from the underlying trend. The measure of instability based on exponential time trend was studied by Chand & Tewari (1991) also used this method for measuring instability of exports and imports of agricultural commodities in India.

Results and Discussion

The results of state wise compound growth rates of inland fish production are presented in Table 1. It can be observed from the table that the compound growth rates of inland fish production during 1995-2004 were found positive and significant the states (Out of total states 14 states) of in states share of these states in the total inland fish production of India for that period was 70.45% (Table 4) on 5% level of significance. During 2005-14, the highest compound growth rate increase in inland fish production was positive and significant in case of Jharkhand (17.30%), Andaman & Nicobar (16.50%), Sikkim (13.78), Tripura (13.29), Haryana (12.38), Andhra Pradesh (11.21%), Chhattisgarh (10.84, Kerala (10.73%) and Other 12 states. The overall period showed positive and significant (at 5% level of significant) growth rates of inland fish production in almost all the states during 1995-2014.The significance level (Probability are less than 0.005) test through regression analysis. In general, it may be concluded that higher instability of inland fish production in different states of country did not deter the concerned states from attaining high growth rates. Nadkarni & Deshpande (1983) also found the positive association between growth and instability in crop yields in Karnataka.

The level of instability in inland fish production is very important for sustainable production. State-wise instability in inland fish production for period I, period II and all periods were estivated (Table 2). The higher instability of inland fish production in

Table 1. Compound Growth Rates of state wise inland fish production in India (in %)

States/UTs	1994-95 to 2003-04	2004-05 to 2013-14	1994-95 to 2013-14
Andaman & Nicobar	7.08**(0.62)	16.50**(0.84)	9.48*(0.79)
Andhra Pradesh	24.15**(0.75)	11.21**(0.92)	15.81**(0.91)
Arunachal Pradesh	2.78(0.01)	-5.98(0.03)	-0.44(0.01)
Assam	1.39*(0.68)	4.39**(0.91)	2.91**(0.87)
Bihar	2.22(0.36)	4.91**(0.75)	3.24**(0.77)
Chandigarh	-2.49(0.06)	-2.41(0.01)	4.35**(0.84)
Chhattisgarh	—	10.84**(0.93)	11.08**(0.90)
Delhi	-6.46(0.54)	-1.50(0.07)	-11.78**(0.82)
Goa	1.57(0.21)	2.72(0.05)	0.04(0.01)
Gujarat	-6.39(0.48)	5.45(0.24)	2.86**(0.88)
Haryana	4.12**(0.85)	12.38**(0.96)	9.13**(0.86)
Himachal Pradesh	2.56**(0.61)	3.01**(0.69)	2.00**(0.76)
Jammu & Kashmir	1.97**(0.71)	0.76(0.32)	0.76**(0.51)
Jharkhand	—	17.30**(0.91)	3.93**(0.67)
Karnataka	1.17(0.03)	9.05**(0.85)	4.47**(0.66)
Kerala	6.47**(0.79)	10.73**(0.90)	6.13**(0.80)
Madhya Pradesh	-9.38(0.36)	4.09(0.56)	-1.50(0.11)
Maharashtra	4.38(0.52)	0.75(0.23)	1.93(0.57)
Manipur	4.46**(0.96)	4.64**(0.75)	3.63**(0.87)
Meghalaya	6.12(0.38)	1.14(0.04)	2.08(0.21)
Mizoram	4.86**(0.92)	3.07(0.02)	3.20*(0.58)
Nagaland	8.88**(0.89)	4.24**(0.97)	4.42**(0.89)
Orissa	3.16*(0.60)	4.90**(0.97)	4.53**(0.93)
Pondicherry	18.22(0.26)	2.18(0.01)	6.93*(0.65)
Punjab	14.19**(0.95)	3.22(0.41)	8.01**(0.90)
Rajasthan	2.88(0.16)	12.02*(0.67)	7.02*(0.65)
Sikkim	1.34(0.09)	13.78**(0.65)	5.01(0.45)
Tamil Nadu	-0.39(0.07)	3.25**(0.74)	4.00**(0.83)
Tripura	-0.90(0.01)	13.29**(0.99)	4.24(0.58)
Uttar Pradesh	7.86**(0.96)	6.43**(0.98)	6.94**(0.98)
Uttaranchal	—	4.93**(0.94)	7.75*(0.64)
West Bengal	3.99**(0.98)	2.78**(0.78)	3.92**(0.96)
Total	5.74**(0.95)	6.31**(0.98)	5.77**(0.96)

Note: Figure in parentheses indicate value of R^2
**and* indicates 5 and 1% level of significance, respectively

the states of Pondicherry (1.0), Andhra Pradesh (0.80), Jharkhand (0.38), Arunchal Pradesh (0.27) and Chandigarh (0.21) did not deter the concerned states from attaining high growth rates except Andhra Pradesh and Jharkhand states. Nadkarni & Deshpande (1983) also found the positive association between growth and instability in crop yields in Karnataka. Uttar Pradesh, West Bengal, Manipur and Assam (0.01) has the lowest degree of instability in inland fish production. In period II, the magnitude of instability in inland fish production of all the states (except Andaman & Nicobar Islands, Goa, Punjab, Sikkim, Delhi and Mizoram province) decreased as compared to period I. The production instability of Andaman & Nicobar Islands (0.18), Goa (0.23), Dehli (0.12) and Mizoram (0.10), increased as compared to period I (Table 2). The instability has been increased in fisheries production during study period due to adoptions of modern technology. It can be concluded that the higher

Table 2. Instability Indices of State wise Inland Fish Production

States/UTs	1994-95 to 2003-04		2004-05 to 2013-14		1994-95 to 2013-14	
	CV	Instability index	CV	Instability index	CV	Instability index
Andaman & Nicobar Islands	28.17	0.08	41.92	0.18	61.27	0.13
Andhra Pradesh	59.90	0.80	33.20	0.04	64.17	0.53
Arunachal Pradesh	55.48	0.27	29.84	0.27	43.44	0.26
Assam	5.18	0.01	13.81	0.02	18.79	0.02
Bihar	10.86	0.06	17.45	0.04	22.12	0.05
Chandigarh	23.42	0.21	49.98	0.24	60.25	0.21
Chhattisgarh	138.32	0.18	32.30	0.03	61.50	0.08
Delhi	23.07	0.06	29.65	0.12	71.45	0.09
Goa	10.66	0.07	26.79	0.23	19.74	0.16
Gujarat	25.91	0.12	27.45	0.13	33.39	0.12
Haryana	13.00	0.03	33.00	0.04	56.23	0.04
Himachal Pradesh	9.34	0.03	11.09	0.03	13.51	0.03
Jammu & Kashmir	6.88	0.02	3.97	0.02	6.07	0.02
Jharkhand	142.48	0.38	42.22	0.11	40.80	0.20
Karnataka	21.64	0.09	26.10	0.07	33.02	0.08
Kerala	20.24	0.03	32.61	0.05	40.77	0.04
Madhya Pradesh	40.61	0.15	17.52	0.05	33.53	0.11
Maharashtra	16.09	0.06	4.73	0.02	13.50	0.05
Manipur	13.23	0.01	16.73	0.02	22.82	0.02
Meghalaya	29.30	0.16	14.81	0.09	22.68	0.12
Mizoram	14.43	0.03	27.45	0.10	28.22	0.07
Nagaland	24.83	0.05	12.52	0.01	24.58	0.04
Orissa	12.50	0.04	14.54	0.01	27.12	0.03
Pondicherry	36.31	1.00	22.77	0.21	30.75	0.68
Punjab	40.00	0.03	14.52	0.07	40.93	0.06
Rajasthan	27.03	0.14	41.88	0.11	53.67	0.12
Sikkim	10.13	0.06	54.35	0.10	53.75	0.08
Tamil Nadu	3.98	0.02	11.07	0.03	26.02	0.05
Tripura	13.12	0.08	35.28	0.03	36.67	0.07
Uttar Pradesh	23.35	0.01	18.69	0.01	38.26	0.01
Uttaranchal	156.96	0.20	14.63	0.02	66.70	0.25
West Bengal	11.77	0.01	9.09	0.02	22.48	0.01
India	17.36	0.03	18.52	0.01	33.32	0.02

instability of inland fish production in the states of Andaman & Nicobar Islands, Goa, Delhi and Mizoram did not deter from attaining high growth rates in fish production except some states.

Temporal changes in state wise inland fish production presented in Table 3. That the production of inland fish has declined in six states *viz.,* Arunachal Pradesh, Delhi, Goa, and Madhya Pradesh during the period ending 2005-14 compared to previous period. The multipurpose nature of use pattern in inland waters has relegated fisheries to low priority in most of these riparian states and their importance relative to other production systems has not been given due recognition. Consequently, most of the inland open water resources have witnessed habitat degradation with accompanying low fish yields. Due to adoptions of modern technology a quantum jump in inland fish production during 2005-14 was noticed in almost all the states except Arunachal

Table 3. Temporal Change in state-wise Inland Fish Production

States/UTs	Unit (000′ tonnes)		Percent change in Col. 4 over Col. 3
	1995-04	2005-14	
1	2	3	4
Andaman & Nicobar Islands	0.056	0.14	150.00
Andhra Pradesh	339.23	988.42	191.37
Arunachal Pradesh	2.75	2.74	-0.73
Assam	159.99	214.79	34.26
Bihar	234.04	320.81	37.08
Chandigarh	0.074	0.15	111.11
Chhattisgarh	65.0	188.14	189.44
Delhi	3.64	0.78	-78.38
Goa	3.57	3.51	-1.76
Gujarat	58.73	87.14	48.38
Haryana	31.86	82.48	158.88
Himachal Pradesh	6.59	7.84	18.99
Jammu & Kashmir	18.27	19.28	5.56
Jharkhand	53.46	66.97	25.33
Karnataka	98.12	151.29	54.20
Kerala	66.16	114.34	72.81
Madhya Pradesh	83.36	69.99	-16.02
Maharashtra	116.22	136.2	17.19
Manipur	14.84	20.66	39.25
Meghalaya	4.25	4.80	12.96
Mizoram	2.81	3.82	36.46
Nagaland	4.45	6.25	40.69
Orissa	153.09	242.78	58.59
Pondicherry	3.99	5.10	27.61
Punjab	46.93	93.56	99.36
Rajasthan	14.70	30.01	104.11
Sikkim	0.13	0.23	67.39
Tamil Nadu	108.74	175.75	61.63
Tripura	27.03	40.88	51.26
Uttar Pradesh	192.13	370.29	92.73
Uttaranchal	2.66	3.35	25.90
West Bengal	837.09	1246.99	48.97
India	2696.78	4700.09	74.29

Pradesh, Goa and Delhi. Increase in Inland fish production during 2005-14 over the period 1995-2004 was maximum in case of Andhra Pradesh (191.37%) followed by Chattisgarh (189.44%), Andaman & Nicobar (150%), Haryana (158.88), Chandigarh (111.11%) and Rajasthan (104.11%) etc. But the relative share of all these states in the total inland fish production is negligible except Andhra Pradesh (Table 4). A perusal of Table 4 shows that the relative share of Andhra Pradesh in the total national inland fish production was 12.58% during 1995-04 which increased to 21.03% in 2005-14, though its absolute production increased from 339.23 to 988.42 thousand tonnes during that period. This was due to decrease in the relative share of all other states, except Chandigarh, Uttar Pradesh, Haryana, Punjab and Rajasthan.

During the period 2005-14, West Bengal ranked first in relative share of total inland fish production

Table 4. Relative Share of Different states in Inland Fish Production of India

States/UTs	1995-2004 ('000 tonnes)	Percentage share	2005-14 ('000 tonnes)	Percentage share
Andaman & Nicobar Islands	0.06	0.00	0.14	0.00
Andhra Pradesh	339.23	12.58	988.42	21.03
Arunachal Pradesh	2.76	0.10	2.74	0.06
Assam	159.99	5.93	214.79	4.57
Bihar	234.04	8.68	320.81	6.83
Chandigarh	0.07	0.00	0.15	0.00
Chhattisgarh	65.00	2.41	188.14	4.00
Delhi	3.64	0.14	0.79	0.02
Goa	3.57	0.13	3.51	0.07
Gujarat	58.73	2.18	87.15	1.85
Haryana	31.86	1.18	82.49	1.76
Himachal Pradesh	6.59	0.24	7.84	0.17
Jammu & Kashmir	18.27	0.68	19.28	0.41
Jharkhand	53.44	1.98	66.97	1.42
Karnataka	98.12	3.64	151.29	3.22
Kerala	66.16	2.45	114.34	2.43
Madhya Pradesh	83.35	3.09	70.00	1.49
Maharashtra	116.22	4.31	136.20	2.90
Manipur	14.84	0.55	20.67	0.44
Meghalaya	4.25	0.16	4.80	0.10
Mizoram	2.81	0.10	3.83	0.08
Nagaland	4.45	0.16	6.26	0.13
Orissa	153.09	5.68	242.79	5.17
Pondicherry	4.00	0.15	5.10	0.11
Punjab	46.93	1.74	93.57	1.99
Rajasthan	14.70	0.55	30.01	0.64
Sikkim	0.14	0.01	0.23	0.00
Tamil Nadu	108.74	4.03	175.75	3.74
Tripura	27.03	1.00	40.89	0.87
Uttar Pradesh	192.13	7.12	370.30	7.88
Uttaranchal	2.66	0.10	3.35	0.07
West Bengal	837.10	31.04	1247.00	26.53
India	2696.78	100.00	4700.09	100.00

(26.53 %). Which was followed by Andhra Pradesh (21.03%), Uttar Pradesh (7.88%), Bihar (6.83%), Pondicherry (5.17%), Assam (4.57) and Chhatishgarh (4.0%).

Positive and significant growth rates of inland fish production were seen in almost all the states during 1995 -2014. During 2005-14, the highest increase in annual rate of inland fish production was in Jharkhand (17.30%) and Andaman & Nicobar (16.50). Relatively higher instability of inland fish production in different states did not deter the concerned states from attaining high growth rates. The temporal changes in inland fish production declined in four states *viz.,* Arunachal Pradesh, Delhi, Goa and Madhya Pradesh during period 2005-2014 compared to previous period. However, the reason for high growth and high instability in the production of inland fish in the current decade needs to be studied to suggest corrective measures for maintaininga positive growth rate in fish production.

Policy Implication

Ø The study also indicates high instability in some states in period II, as compared to period I. The instability can be declined through controlling the price of inland fish production, decreasing the prices of inputs, strengthening the extension services.

Ø The study observed that in period II, the growth rate of inland fish production in the some states significantly declined. Therefore the production growth rate needs to be increased. This can be done through: improving their socio-economic conditions, increasing the sources of catching inland fish production, diversification of fishing efforts, development of value added products, and enhancement of per capita fish consumption.

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