



Role of Fisheries in Indian Economy – An Mathematical Analysis

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Abstract

Fisheries is an important sector in India. It contributes to the national income, exports, food and nutritional security. It provides employment to millions of people. India is the 3rd largest fish producing and 2nd largest aquaculture nation in the world after China. The Blue Revolution in India demonstrated importance of Fisheries and Aquaculture sector. The sector is considered as a sunrise sector and is poised to play a significant role in the Indian economy in near future. In the present paper, an attempt has been made to study the production trend and growth rate for Inland and Marine fish by using statistical techniques. It is observed that there is an increasing trend in production for both Inland and Marine fish. The growth rate has been highest at the level of 11.08 % per annum during 2009-10 to 2019-20 for Inland and 4.54% during 1969-70 to 1979-80 in case of Marine. A Least Square Model has been developed using data from 1994-95 to 2019-20. The projected fish production for Inland and marine has been worked for 2024-25 and 2029-30. Authors have also suggested the strategies for enhancing the returns of the potato crop and its products through appropriate marketing strategy and trade liberalization. Finally, recommendations for enhancing production have been suggested such as developing micro level database, application of GIS, insurance, marketing strategy, grading, processing, export incentives and credit facilities by government, public sector and private sector involvement.

Keywords : Growth Rate, Inland, Least Square Technique, Marine, Production

Introduction

Fisheries sector plays an important role in the Indian economy. It provides employment to millions of people and contributes to food security of the country. India is the 3rd largest fish producing nation in the world after China. The Blue Revolution in India demonstrated importance of Fisheries and Aquaculture sector. The sector is considered as a sunrise sector and is poised to play a significant role in the Indian economy in near future. In the recent past, Indian fisheries has witnessed a paradigm shift from marine dominated fisheries to inland fisheries. Fisheries sector is an emerging and rapidly growing sector, assures nutritional security and provide cheap source of animal protein. This sector has been showing a steady growth in total Gross Value added for about 7.28% share of Agriculture GDP. Fisheries sector is the fastest growing agro-industry worldwide and offers great scope for the increase productivity and economy of the country.

Objective

- Identifying various Region responsible for Marine fish production, Inland fish production and combined fish production.
- Estimating the Growth rate in production
- Projecting the Marine fish production and Inland fish production
- Development linear model at all India level for Marine fish, Inland fish and combined production in India.

Methodology Used

Least square method for developing a linear model for

$$Y = a + b X$$

Where Y is Fish production

a is constant

b is regression of Y on X

X is years

The moving average has been estimated using the following formula:

$$Y_{i+1} = \frac{(Y_i + Y_{i+1} + Y_{i+2})}{3}$$

We have estimated simple growth rate and compound growth using the following:

$$G = \frac{(Y_t - Y_0)}{Y_0} * 100$$

$$\text{Compound Growth rate } R = \left[\left\{ \frac{Y_t}{Y_0} \right\}^{1/n} - 1 \right] * 100$$

Projection has been worked out by

Least Square Technique has been applied for the following linear model:

$$Y = a + b X$$

Where Y is Fish Production

a is constant

b is regression of Y on X,

X is year (X=1 for 1994-95

=2 for 1999-2000 & so on)

Major thrust areas

- Optimizing production and productivity
- Augmenting export of marine products
- Generating employment.
- Improving welfare of fishermen and their socio economic status.

Result and Findings

All India level analysis and projection

Table-1. All India Fish Production during 1990-91 to 2019-20

Year	X	Y ₁ – Marine Lakh Tones	Y ₂ – Inland Lakh Tones	Y ₃ = Y ₁ +Y ₂ Lakh Tones
1990-91	1	23.00	15.36	38.36
1991-92	2	24.47	17.10	41.57
1992-93	3	25.76	17.89	43.65
1993-94	4	26.49	19.95	46.44
1994-95	5	20.92	20.97	41.89
1995-96	6	27.07	22.42	49.49
1996-97	7	29.37	23.81	53.48
1997-98	8	29.50	24.38	53.88
1998-99	9	26.06	26.02	52.08
1999-00	10	28.52	28.23	56.75
2000-01	11	28.11	28.45	56.56
2001-02	12	28.30	31.26	59.56
2002-03	13	29.90	32.10	62.00
2003-04	14	29.41	34.58	63.99
2004-05	15	27.79	35.26	63.05
2005-06	16	28.16	37.56	65.72
2006-07	17	30.24	38.45	68.69
2007-08	18	29.20	42.07	71.27
2008-09	19	29.78	46.38	76.16
2009-10	20	31.04	48.94	79.98
2010-11	21	32.50	49.81	82.31
2011-12	22	33.72	52.94	86.66
2012-13	23	33.21	57.19	90.40
2013-14	24	34.43	61.36	95.79
2014-15	25	35.69	66.91	102.6
2015-16	26	36.00	71.62	107.62
2016-17	27	36.25	78.06	114.31
2017-18	28	36.88	89.02	125.90
2018-19	29	38.53	97.20	135.73
2019-20	30	37.27	104.37	141.64
Total		1171.87	1319.66	2227.53
Average		39.06	43.99	74.25

Table-1 present the production of marine fish, inland fish and combined since 1990-91 to 2019-20. It is seen that marine fish production has been increased from the level of 23.00 Lakh tones in 1990-91 to 37.27 lakh tones in 2019-20. Similarly Inland fish production has also been increased to 104.37 Lakh tones in 2019-20 from 15.36 lakh tones in 1990-91.

Table -2 Three years moving average of Fish production

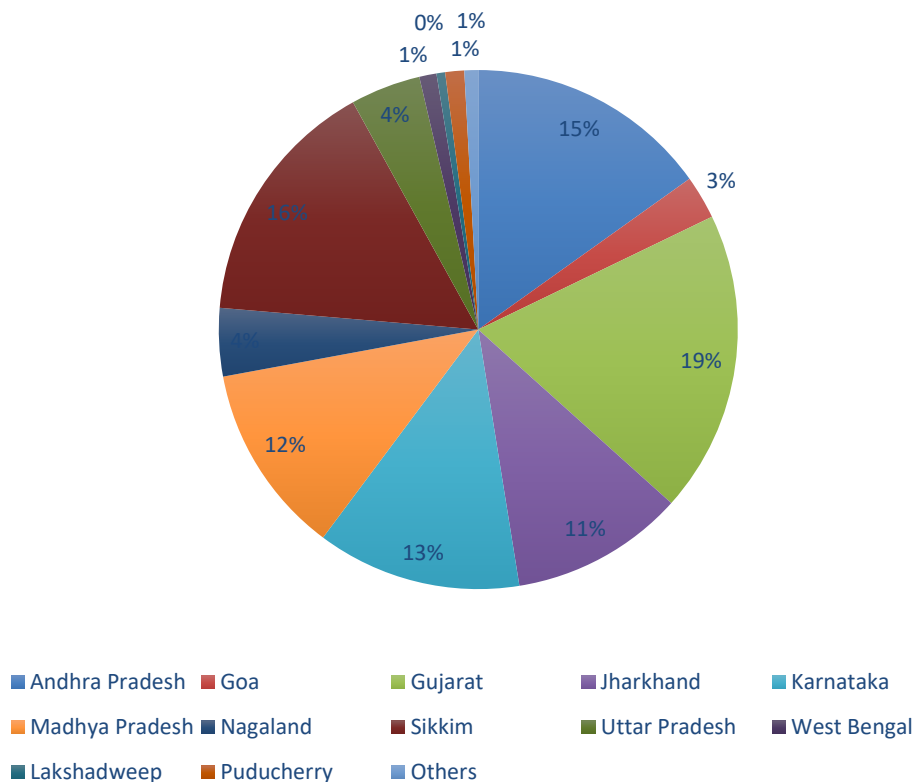
Year.	Marine Lakh Tones	Growth rate per annum	Inland Lakh Tones	Growth rate per annum	Combined Lakh Tones	Growth rate per annum
1969-70	10.40		6.42		16.82	
1979-80	15.12	4.54	8.50	3.25	23.63	4.05
1989-90	21.31	4.09	14.24	6.75	35.55	5.05
1999-00	27.86	3.08	27.57	9.35	55.43	5.59
2009-10	31.11	1.16	48.38	7.55	79.48	4.34
2019-20	37.69	2.12	101.98	11.08	139.67	7.57

Table-3. Marine Fish Producing State during 2019-20

States	Production Lakh Tones	%age Share	Cumulative %age Share
Andhra Pradesh	5.64	15.13	15.13
Goa	1.01	2.71	17.84
Gujarat	7.01	18.81	36.65
Jharkhand	4.03	10.81	47.46
Karnataka	4.75	12.74	60.21
Madhya Pradesh	4.43	11.89	72.10
Nagaland	1.58	4.24	76.33
Sikkim	5.83	15.64	91.98
Uttar Pradesh	1.63	4.37	96.35
West Bengal	0.40	1.07	97.42
Lakshadweep	0.20	0.54	97.96
Puducherry	0.44	1.18	99.14
Others	0.32	0.86	100.00
ALL INDIA	37.27	100	

Table-2 presents the three yearly moving averages of fish production for Marine, Inland and combined. It is observed that there is an increasing trend in fish production for both Marine as well Inland. In case of Marine, the production has been increased from the level of 10.40 Lakh Tones in 1969-70 to 37.69 Lakh Tones in 2019-20. The growth rate has been highest at the level of 4.54 % per annum during 1969-70 to 1979-80 and lowest 1.16% during 1999-2000 to 2009-10. The production of Inland fish has been constantly increased from the level of 6.42 Lakh Tones in 1969-70 to 101.98 Lakh Tones during 2019-20. The highest growth rate was observed during 2009-10 to 2019-20 (11.08 %) and lowest (3.25%) during 1969-70 to 1979-80. The state-wise share of Marine Fish production is presented in Table-3. It is seen that the total marine fish production in the country has been 37.27 lakh tones. The percentage share has been 18.81% in Gujarat, 15.64% in Sikkim, 15.13% in Andhra Pradesh, 12.74% in Karnataka and 11.89% in Madhya Pradesh. These States contributes more than 85% of the total marine fish production in the country.

Major Marine Fish Producing States



The state wise percentage share of the inland fish production is given in Table -4. It is seen that the total inland fish production during 2019-20 is of the order of 104.37 lakh tones in the country. The percentage share has been 34.89% in Andhra Pradesh ,16.66% in Uttar Pradesh, 6.81% in Tripura, 6.17% in Nagaland, 6.19% in Bihar, 5.03 % in Chhattisgarh, 3.41% in Assam and 2.92% in Tamil Nadu’ These State contributes about 80% of total inland fish production in the country.

Table-4. Inland Fish Production in Major States during 2019-20

States	Production Lakh Tones	%age Share	Cumulative %age Share
Andhra Pradesh	36.10	34.89	34.89
Assam	3.73	3.41	38.29
Bihar	6.41	6.19	44.49
Chhattisgarh	5.72	5.03	49.52
Gujarat	1.58	1.46	50.98
Haryana	1.91	1.85	52.83
Jammu & Kashmir	2.23	2.14	54.97
Jharkhand	2.29	2.04	57.01
Karnataka	2.05	1.98	58.98
Kerala	2.00	1.78	60.76
Madhya Pradesh	1.18	1.03	61.79

Nagaland	6.60	6.17	67.96
Orisha	1.51	1.39	69.35
Sikkim	1.74	1.75	71.10
Tamil Nadu	3.00	2.92	74.02
Tripura	6.99	6.81	80.83
Uttar Pradesh	16.19	16.66	97.49
Others	3.14	2.51	100.00
ALL INDIA	104.37	100	

Table-5. Marine and Inland combined Fish Producing Major States during 2019-20

States	Production Lakh Tones	%age Share	Cumulative %age Share
Andhra Pradesh	41.74	29.47	29.47
Assam	3.73	2.63	32.10
Bihar	6.41	4.53	36.63
Chhattisgarh	5.72	4.04	40.67
Goa	1.05	0.74	41.41
Gujarat	8.59	6.06	47.47
Haryana	1.91	1.35	48.82
Jammu & Kashmir	2.23	1.57	50.40
Jharkhand	6.32	4.46	54.86
Karnataka	6.80	4.80	59.66
Kerala	2.00	1.41	61.07
Madhya Pradesh	5.61	3.96	65.03
Nagaland	8.18	5.78	70.81
Orisha	1.51	1.07	71.87
Sikkim	7.57	5.34	77.22
Tamil Nadu	3.00	2.12	79.33
Tripura	6.99	4.94	84.27
Uttar Pradesh	17.82	12.58	96.85
West Bengal	0.40	0.28	97.13
Lakshadweep	0.20	0.14	97.27
Puducherry	0.51	0.36	97.63
Others	3.35	2.37	100.00
ALL INDIA	141.64	100	

Table-5. Present the Marine and Inland combined fish in major state during 2019-20. It is observed that Andhra Pradesh share has been 29.47% of the total production of 141.64 lakh tones at all level. Share of Uttar Pradesh has been 12.58%. Andhra Pradesh, Uttar Pradesh, Gujarat, Nagaland, Sikkim, Tripura, Bihar, Karnataka, Jharkhand and Madhya Pradesh account for more than 83% of total fish production in the country.

The following Table presents the projected fish production for Marine, Inland and combined for 2024-25 and 2029-30. The least square model has been used for projection. It is seen that the estimated production for Marine Fish will be 38.86 lakh tones in 2024-25 and 41.04 lakh tones in 2029-30. The combine has been estimated of the order of 144.30 lakh tones in 2024-25 and 162.11 lakh tones in 2029-30.

Table –6 Projected Marine, Inland and Combined Fish production (Lakh Tones)

	2024-25	2029-30
Marine	38.86	41.04
Inland	10.55	12.11
Combined	144.30	162.11

Concluding Remarks

- Development of Micro level MIS for Marine, Inland and combine fish production for constant review of progress.
- Application of Geographical Information System for area specific information for fish availability in different regions.
- Socio economic status may be provided by involving all stock holders involved in fish marketing in the country.
- The grading of fish products should be done in such a way that fishermen should get better price in export market.
- Latest technology for fishermen equipment should be used in fish catching.
- Fishermen training and extension programs should be strengthen.
- The basic infrastructure should be developed and post-harvest techniques should be improved.
- Aquaculture for inland fishermen should be modernized.

References

- i. Agricultural Statistics at a Glance (2020), Ministry of Agriculture & Farmers Welfare, Department of Agriculture, Cooperation & Farmers Welfare, Directorate of Economics & statistics, Government of India.
- ii. Annual Report (2020-21), Department of Fisheries, Ministry of Fisheries, Animal Husbandry & Dairying, Government of India
- iii. Department of Agriculture, Cooperation & Farmers Welfare, Government of India website, <https://agricoop.nic.in>
- iv. S C Gupta, VK Kapoor - Fundamentals of Mathematical Statistics, Seventh Revised Edition, Sultan Chand & Sons (1980)
- v. Handbook on Fisheries Statistics, 2020, Department of Fisheries, Ministry of Fisheries, Animal Husbandry & Dairying, Government of India
- vi. Department of Fisheries, Ministry of Fisheries, Animal Husbandry & Dairying, Government of India, website <https://dahd.nic.in>
- vii. Agarwal, P.C. and Kumar Kishore, "Perspective Scenario of Milk Production in India" presented in the National Conference on Mathematical Modeling and Optimization Techniques organized by Bhartiya Vidhyapeeth University, New Delhi (2007).
- viii. P C Agrawal and Kishore Kumar "Animal Husbandry and Economic Development in India – An analytical Study", H.R. Journal of Management, (An International Journal in Management) Vol 4/No1/Apr-Sept 2011, pp1-6