



# **Trend of Fish and Fish Seed Production in Rajasthan, India**

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## **Authors' contributions**

*This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.*

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## **ABSTRACT**

The present study attempted to elucidate the trends in fish and fish seed production of the Rajasthan state. In order for the study to evaluate the trends of fish and fish seed production, the secondary data for the period of 25 years (1999 to 2023) was collected from various sources and statistical analysis including linear, quadratic and exponential functional forms were applied. The high value of correlation coefficient ( $R^2$ ) in linear equations depicts a positive and significant relationship of variables i.e. time vs production of fish and fish seed. The findings on CGR (8.122 and 7.203%), CV (59.643 and 58.997), Instability indices (43.755 and 247.125) and t-test (8.361 and 8.474) depicted the variability, riskiness and instability in the fish production and fish seed production of the state. The results on trends in fish production and fish seed production would be helpful to scientists and policy makers to develop the strategy for the advanced farming management in the aquatic resources that certainly helps to enhance the fish production and fish seed production in the state of Rajasthan.

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## 1. INTRODUCTION

Fisheries is one of the most important economic farming activities from ancient times for the people living in and around aquatic resources of India. Along with agricultural practices, fish farming rendered high priority to income generating practices for the primary sector of development (Sen, 2009) and for rural development, improving food supply and source of income (Miller, 2009 and Gogoi et al., 2015). India is a federal republic country covering the total geographical area of 3.29 km<sup>2</sup>. It has land of diversity and varied water resources including water surface area of 3.14 lakh km<sup>2</sup> in the form of marine and inland water which provide the richest fish genetic resources to the world. The inland water consists by river system of the country which comprises 14 major rivers, 44 medium rivers and innumerable small rivers. The total length of rivers and canals is 0.19 mill km, 3.15 mill ha of minor and major reservoirs, 2.41 mill ha of ponds and lakes and about 1.2 mill ha of floodplain wetlands (NFDB, 2024). The Fisheries sector contributes approximately 1.09% and 6.72% to India's total gross value added (GVA) and of the total agricultural GVA respectively, amounting to ₹ 1,37,716 crores at constant prices in 2022-23 (GOI, 2023). This sector provides livelihood to about 16 million fishers and fish farmers at the primary level, with additional employment along the value chain. India is the 3<sup>rd</sup> largest fish producer and 2<sup>nd</sup> largest aquaculture producer in the world to produce fishes (16.5 mill tones) which comprises 75% from the Inland and 25% from the marine fisheries sector.

Rajasthan is the largest state of the country, it is surrounded by different states like Punjab in north, Haryana and Uttar Pradesh in north-east, Madhya Pradesh in southeast, Gujarat in south-west and other country like Pakistan in the west and north-west. The geographical area of the state is 3.42 lakh km<sup>2</sup> that is about 10.4% of the country. The state is endowed with 15,838 numbers of water bodies including reservoirs 1.76 lakh ha, ponds and tanks 4.24 lakh ha, rivers and canals 0.3 lakh ha and water logged area 0.8 lakh ha and salt affected area 1.80 Lakh ha (Jhahria, 2017). The diggies/farm ponds (25000 No.) built under Rashtriya Krishi Vikas Yojana and Agriculture State Plan of state government were also used for fish culture in the state (Ujjania et al., 2019). The aquatic resources

are a vital component for fish farming (capture and culture) and the state has become a notable fish producer of the country. The inland fish production of India was 131.13 lakh tones in which Rajasthan contribution was 0.91 lakh tones in the year 2022-23 (GOI, 2023). In the state, fisheries contribution ₹ 1446.00 crores with growth rate (35.14%) in gross state domestic product (GSDP). The fish production potential of the state is more than 1.5 lakh MT per year and it can be further increased up to 2.0 lakh MT by application of suitable and advanced technological in fish culture interventions.

The fish production in the state is very low although it has suitable water resources while it has importance for livelihood, food security, revenue, employment and development of the state of Rajasthan hence, in this paper an attempt is made to study the trend of fish and fish seed production to assist the target of suitable strategies to improve production and productivity of the aquatic resources of Rajasthan.

## 2. METHODOLOGY

The present study is entirely based on secondary data sources including annual reports published by the Directorate of Fisheries (Government of Rajasthan, 2024) and Handbook on Fisheries Statistics, (2022) published by Department of Fisheries (Government of India). The data on fish production and fish seed production were compiled for the duration of 25 years (1999 to 2023).

The trend in the production of fish and fish seed of the state was analysed which was fitted by coefficient of multiple determination ( $R^2$ ) and computed by the use of following formulas.

Linear function,  $Y = a + b X$

Quadratic function,  $Y = a + b X + cX^2$

Exponential function,  $Y = a \cdot b^X$

Where, Y is the variable for production of fish and fish seed and X is the variable for time.

Compound growth rates (CGR %) was computed by linear equation to follow the equation:

Linear equation,  $Y = a + bX$

Compound growth rate,  $CGR (\%) = (\text{Antilog of } 'b'-1) \times 100$

Where, Y is the variable for production of fish and fish seed, X is the variable for time and b is the regression co-efficient of Y on X.

The significant of growth rates was statistically verified by t-test and magnitude of variability by co-efficient of variation (CV %). Furthermore, the instability index was also calculated to examine the instability in fish and fish seed production in the state to follow the formula prescribed by Sharma and Kalita (2004):

Instability Index (I) =  $(1-R^2) \times CV^2$

Where, R is the correlation coefficient and CV is co-efficient of variation

The statistical analysis and graphical presentation of these data were computed by MS Excel (2013).

### 3. RESULTS AND DISCUSSION

The observations on the production of fish and fish seed are described in Table 1 that shows the average fish production of 37.189 thousand MT and fish seed production of 668.543 million fry. The minimum fish production recorded was 12.14 thousand MT and maximum of 91.349

thousand MT while fish seed production was minimum 186 million fries and maximum 1360.000 million fry in the state (Table 1). Keer et al., (2017) and Ujjania et al., (2025) reported a similar trend of fish production in the state.

The increasing growth trend of fish and fish seed production was noted in the state which was quantify by the application of different statistical equations viz; linear, quadratic and exponential coefficients of determination ( $R^2$ ) and observed 0.916, 0.980 & 0.988 for fish production and 0.928, 0.950 & 0.938 for fish seed production respectively (Table 1). The  $R^2$  values of quadratic function for production of fish and fish seed was higher than linear and exponential functions hence it was selected for fitting the trend of fish production and fish seed production. The variation and instability in the production of fish and fish seed was determined by the calculation of compound growth rate (CGR) and co-efficient of variation (CV) in which CGR (8.122 and 7.203%) and CV (59.643 and 58.997) was observed for fish production and fish seed production respectively (Table 1). The values of the instability indices for fish production and fish seed production were 43.755 and 247.125 respectively (Table 1). The values of the student t-test of single sample were found (8.361) for fish production and (8.474) for fish seed production that was significantly different ( $p=0.01$ ). The findings on CGR, CV, Instability index and student t-test shows the variability, riskiness and instability in fish and fish seed production of

**Table 1. Observations and statistical findings of fish and fish seed production in Rajasthan state**

Aspects		Fish Production (000' MT)	Seed Production (Mill fry)
Duration	Year	25.000	25.000
Minimum		12.141	186.000
Maximum		91.349	1360.000
Mean		37.189	668.543
Standard error		4.436	78.884
Compound growth rate	%	8.122	7.203
Coefficient of variation	%	59.643	58.997
Instability Index		43.755	247.125
t-cal.		8.361**	8.474**
Quadratic function	A	13.446	143.100
	B	- 0.174	19.262
	C	2.885	1.245
Correlation coefficient ( $r^2$ )	Linear	0.916	0.928
	Quadratic	0.988	0.950
	Exponential	0.980	0.938

\*\*significantly different ( $p=0.1\%$ )

the state. Mohan & Kalita, (2020), Kumar et al., (2021) and Sonvanee et al., (2021) also reported similar findings. Mohan & Kalita, (2020) reported that higher value of CV (>49) depicts more risk in the fish production of Assam whereas Sonvanee et al., (2021) reported CGR, CV and instability index based trend in fish production of Chhattisgarh and the findings of present study evident of these findings.

#### 4. CONCLUSION

The findings of this manuscript help to conclude the trends of fish and fish seed production in the state of Rajasthan. The growth in fish and fish seed production was increasing order and positive. The compound growth rate (%), coefficient of variation (%) and instability indices of these variables of fish and fish seed production exhibited more riskiness and greater instability in the production of fish and fish seed of the state. It is recommended that advanced farming management practices implemented in the potential aquatic resources, certainly helpful to increase the fish and fish seed production in the state of Rajasthan.

#### DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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