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Growth performance of milk and fish production in Bihar

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Abstract
This study is based on the secondary data collected from Department of Animal Husbandry, Government of Bihar and Department of Fishing, Government of Bihar, Patna. The growth rate of milk production from 2001-02 to 2016-17 and the growth rate of fish production from 2000-01 to 2016-17 were estimated by linear equation. The growth rate of milk production was about 7.00% per annum as compound rate while in the case of fish production it was higher than milk production being 7.55% per annum as compound rate. The projection of milk production and fish production by 2025 is also estimated for the state on the basis of production of milk and production of fish over periods and by 2025 the state would be able to produce nearby 1.19 crore tones and about 6.30 lakh tones of milk production and fish production respectively, in the state.

Keywords: Growth rate, milk production, fish production

Introduction
Bihar is a third most populous state in the country. The average size of farm holding is about 0.40 hectare, which is lowest in the country except Kerala (2010-11). The migration from rural to urban area is about 12% in the state, which is also high among the states except Uttar Pradesh (Economic Times, 8th January 2018). To check the rural migration and improve the economic status of marginal farm holding, subsidiary occupation can playing an important role in the state. Bihar is having 4521 thousand milch cattle in which 65 percent are local cow and 35 per cent improved cow. The strength of buffaloes is about 3113 thousand contributing 6 per cent share in the country buffaloes population (2012).
Fishing is another sector through which rural population can further generate additional income and employment in the state. Among all three sub agro climatic zones of the state, agro-climatic sub zone one and sub zone two are most important zone for fish production and milk production in the state.
Recently government of Bihar has initiated several programme to enhance milk production as well as fish production in the state. These schemes would might have some positive impact on these two enterprises. An attempt has been made to analyze rate of change in the production of fish and milk and projected production for 2025-26 in the state.

Materials and methods
The study was undertaken in the Bihar state to meet the main objectives pertaining to production of milk and fish production. The study was based on secondary data on milk and fish production, which was collected from Department of Animal Husbandry, Bihar and Department of Fishery, Government of Bihar, respectively. To examine the trend of milk production and fish production in Bihar state linear regression equation of the following form was fitted.

$Y = ab^t$; where $b = 1 + r$
Or $\log Y = \log a + t \log b$
Or $\log b = (\log Y - \log a)/ t$
Substituting $(1 + r)$ for 'b', we get
$\log (1+ r) = (\log Y - \log a) / t$
Say $(\log Y - \log a) / t$ = Some quantity of 'x'

Therefore, $(1 + r) = \text{Antilog } X - 1$
Compound annual growth rate = (Antilog x -1) x 100
Since 'x' = Log b
R= (Antilog 'b' -1) x 100

Trend value

The straight line equation was carried out by using linear mathematical equation of the first degree of probability i.e. Y = a + bx. Since time series data of milk production contains even number of years, However, the 'x' origin is to be placed midway between the two middle years, also time deviation may be multiplied by the '2' in order to make integral values. Other statistical tools such as percentage, compound growth rate, etc. were also used to interpret the analyses data. The results were interpreted with the help of simple tabular forms.

Results and discussion

The analysis of data resulted into many ameliorating inference which are discussed as under:-

Trend in milk production

Trend is that component of variation which reveals general direction of change over a period of time. The estimation of trend is essential to study the general behavior of time series data and to work out period indices. The trend in the milk production in Bihar was obtained by using time series data from 2001-02 to 2016-17 and result is presented in the table no. 1.

Table 1: Milk production Index in Bihar

Year	Production (000 MT)	Index	Percentage over base year
2001-02	2664	100.00	--
2002-03	2869	107.70	7.70
2003-04	3180	119.37	19.37
2004-05	4743	178.04	78.04
2005-06	5060	189.94	89.94
2006-07	5451	204.62	104.62
2007-08	5783	217.08	117.08
2008-09	5934	222.75	122.75
2009-10	6124	229.88	129.88
2010-11	6517	244.63	144.63
2011-12	6643	249.36	149.36
2012-13	6844	256.91	156.91
2013-14	7192	269.97	169.97
2014-15	7775	291.85	191.85
2015-16	8288	311.11	211.11
2016-17	8374	314.34	214.34
CGR = 6.55 per cent			

Source: Department of Animal Husbandry, Government of Bihar, Patna

It is evident from the table 1 that it appeared a continuous increasing trend in the milk production The index of milk production taking as 2001-02 as base year was 217.07, in 2007-08, 249.36 in 2011-12 and further as high as 314.34 in 2016-17, respectively over the base year. The compound growth rate of milk production was 7.14 per cent in the state. It also reveled that the the value of 'x' is significant at 1 per cent level, wherein R square value is 0.95.

Estimation of milk production

On the basis of data (table 1) of milk production in the Bihar an effort has been made to estimate the trend value of milk production for the corresponding years. For the purpose, linear regression analysis being the best fit was applied and result worked out in the following equation;

$$\hat{Y} = a + bx$$

Table 2: Trend equation (Y= a+bx) for milk production

Year	Actual Production (000 MT)	Estimated value (Y= 5840.68 + 183.44 X)			
2001-02	2664	5840.68	+	-2751.60	3089.08
2002-03	2869	5840.68	+	-2384.72	3455.96
2003-04	3180	5840.68	+	-2017.84	3822.84
2004-05	4743	5840.68	+	-1650.96	4189.72
2005-06	5060	5840.68	+	-1284.08	4556.60
2006-07	5451	5840.68	+	-917.20	4923.48
2007-08	5783	5840.68	+	-550.32	5290.36
2008-09	5934	5840.68	+	-183.44	5657.24
2009-10	6124	5840.68	+	183.44	6024.12
2010-11	6517	5840.68	+	550.32	6391.00
2011-12	6643	5840.68	+	917.20	6757.88
2012-13	6844	5840.68	+	1284.08	7124.76
2013-14	7192	5840.68	+	1650.96	7491.64
2014-15	7775	5840.68	+	2017.84	7858.52
2015-16	8288	5840.68	+	2384.72	8225.40
2016-17	8374	5840.68	+	2751.60	8592.28
2020-21		5840.68	+	4219.12	10059.80
2025-26		5840.68	+	6053.52	11894.20

The results based on the equation, represented in table 2, projection of milk production for 2017-18 to 2025 has also been made on the basis of trend values. The analysis reveals that the actual milk production was much higher than estimated milk production in 2004-05, 2005-06, 2006-07, 2007-08 and also high in 2010-11 and much lesser during 2001-02, 2002-03, 2003-04, 2011-12, 2012-13, 2013-14, 2014-15 and during 2016-17. But for the remaining periods the actual production was found to be almost the same level as that of the estimated milk production. The milk production is expected to increase at 11894200 tons in 2025-26 in the state.

Trend in fish production

The trend in fish production in Bihar was obtained by using time series data from 2000-01 to 2016-17 and the result is exhibited in table 3.

Table 3: Fish production Index in Bihar

Year	Production (000 MT)	Index	Percentage over base year
2000-01	224.16	100	--
2001-02	240.40	107.24	7.24
2002-03	261.00	116.43	16.43
2003-04	266.49	118.88	18.88
2004-05	267.51	119.34	19.34
2005-06	279.53	124.70	24.70
2006-07	267.04	119.13	19.13
2007-08	319.19	142.39	42.39
2008-09	300.65	134.12	34.12
2009-10	297.40	132.67	32.67
2010-11	299.91	133.79	33.79
2011-12	344.47	153.67	53.67
2012-13	400.14	178.51	78.51
2013-14	432.30	192.85	92.85
2014-15	479.80	214.04	114.04
2015-16	506.89	226.13	126.13
2016-17	510.00	227.52	127.52
CGR = 7.144			

Source: Department of Fishery, Government of Bihar, Patna

It is seen from the data (table 3) that there has been continuous increasing trend in fish production except 2006-07, 2008-09 and 2009-10. The index of fish production taking as 2000-01 as a base year was 124.90 in 2005-06, 344.47 in

2011-12 and further as high as 510.00 in 2016-17, respectively over the base year. The compound growth rate of fish production was 6.55%. The analysis also reveled that the value of 'x' is significant at 1 per cent level, wherein R square value is 0.85.

Estimation of fish production

On the basis of data (table 3) of fish production in Bihar an effort has been made to estimate the trend value of fish production for the corresponding years. For this purpose linear regression analysis, being the best fit was used and result work out in the following equation:

$$\hat{Y} = a + bx$$

The results based on the equation shown in table 4, production for 2017 to 2025 has also been estimated on the basis of trend.

Table 4: Trend equation (Y= a+bx) for milk production

Year	Actual Production (000 MT)	Estimated value (Y= 335.11 + 17.31 X)			
2000-01	224.16	335.11	+	-138.40	196.71
2001-02	240.40	335.11	+	-121.17	213.94
2002-03	261.00	335.11	+	-103.86	231.25
2003-04	266.49	335.11	+	-86.55	248.56
2004-05	267.51	335.11	+	-69.24	265.87
2005-06	279.53	335.11	+	-51.93	283.18
2006-07	267.04	335.11	+	-34.62	300.49
2007-08	319.19	335.11	+	-17.31	317.80
2008-09	300.65	335.11	+	17.31	352.42
2009-10	297.40	335.11	+	34.62	369.73
2010-11	299.91	335.11	+	51.93	387.04
2011-12	344.47	335.11	+	69.24	404.35
2012-13	400.14	335.11	+	86.55	421.66
2013-14	432.30	335.11	+	103.86	438.97
2014-15	479.80	335.11	+	121.17	456.28
2015-16	506.89	335.11	+	138.48	473.59
2016-17	510.00	335.11	+	158.79	493.90
2020-21	---	335.11	+	207.72	542.83
2025-26	---	335.11	+	294.27	629.38

The analysis reveals that the actual fish production was higher than estimated fish production in 2000-01, 2001-02,2002-03, 2003-04, 2014-15, 2015-16 and 2016-17, while lesser during 2005-06, 2006-07, 2008-09, 2010-11, 2011-12 and 2012-13. But the remaining periods, the actual production was found to be the almost same level as that of estimated production. The fish production is expected to increase at 5,42,830 tons in 2020-21 and 6,29,380 tons in 2025-26 in the state.

Conclusion

The foregoing study reveals that milk production in the Bihar state has been increased over time. It is projected that milk production would raise about 1,18,94,200 tons in 2025-26 from 26,64,000 tons in 2001-02. Similarly fish production in Bihar has also increasing over time. Now, it is further projected that fish production would increased about 6,29,380 tons in 2025-26. This indicates that milk and fish production can definitely improve nutritional as well as income of the farmers and people of the state.

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