A Descriptive Analysis of Fisheries Sector in Haryana

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Abstract

The present study makes an analysis of fisheries sector in Haryana. For this purpose, data are collected from various issues of Statistical Abstracts of Haryana and Handbook on Fisheries Statistics. Collected data are analyzed by computing descriptive statistics, compound annual growth rate (CAGR) and regression model. It is found that fish farming area and fish production have grown at the CAGR of 5.127 per cent and 9.636 per cent respectively for the period 2004-05 to 2017-18. Unfortunately, for the same period, number of fishing licenses issued is found to be experiencing negative CAGR equal to -0.057. Meanwhile, production of fish seeds have grown at CAGR of 16.183 per cent during 2004-05 to 2013-14. However, GSDP from fisheries sector is compounded annually at the appreciable rate of 21.288 per cent which is higher than the growth rate of agricultural GSDP (13.315 per cent) and overall GSDP (15.720 per cent). Moreover, elasticity of agricultural GSDP as well as overall GSDP with respect to fisheries GSDP are found to be 0.617 and 0.700 respectively during the time period under consideration. On the basis of these results, it can be inferred that to sustain and uplift the contributions of fisheries sector in Haryana focused attention towards the development of this sector is urgent.

Key words: Fisheries, GSDP, CAGR, Elasticity, Haryana

Introduction

With the advent of Haryana in 1966, it has remained an Agriculturist State where large part of population is engaged in agriculture and associated activities. Recently, an allied area of agriculture that is ‘fisheries sector’, has gained a new momentum here, and this sector is recognized as a powerful generator of income and employment in India including Haryana (Kumar et al., 2010). Despite its recent origin, fish culture has attained appreciable progress in the State. In line with Haryana Kissan Ayog (2012) and Department of Economic and Statistical Analysis, Haryana (2019), at the time of formation of Haryana, only 58 hectare of village ponds were under fish culture while total fish production was 600 tonnes which shot up to 23200 tonnes in 1990, reached to 33040 tonnes in 2000, and nearly 2 lakh tonnes by 2018. Consequently, among Indian States, Haryana has achieved second rank in the average annual fish production per unit area (5600 kilogram per hectare). Though, Haryana contributes only 2.1 per cent in inland fish production of India, but the productivity is twice the national average and is growing faster than the rest of India during the last two decades.

A recent report of Fisheries Department, Haryana indicates that fish farmers in Haryana are earning a handsome amount of 3.20 lakh as net profit per hectare per annum from fish farming in their water-logged land. Further, the State has achieved the great success in fish breeding, therefore, the National Bureau of Fish Genetic Resources has declared Haryana a ‘fishdisease -free state’ (Sarin, 2017). Fish farmers in Haryana are nourishing not only famous varieties of fish including rohu, mrigal, catla, common carp, silver carp and grass carp but also shrimps and prawn. Along with this, to promote ornamental fish culture, the Government of Haryana is setting up a hi-tech and ultra-modern ornamental fish hatchery in Jhajjar district at a cost of 13.68 crore (Saini, 2017).

With the growing significance of fisheries sector in agriculture in Haryana, the present study is an attempt to carry out its descriptive analysis. The rest of the paper is organized as follows: The next section provides the review of concerned literature, highlighting the objectives and research methodology. A major section of the paper has been dedicated to analysis and results and the paper concludes by discussing the policy implications of the study.
Review of Literature

Being an important component of agriculture, fisheries sector is continuously attracting the concentration of researchers, agricultural scientists, economists, environmentalists as well as policy makers. Consequently, sufficient literature is available, some part out of which is reviewed as under:

Bhatta (2003) examined the socio-economic issues in fisheries sector in India. The study highlighted that the marine production in India is reaching maximum sustainable yield levels and in the case of some commercially important species, the symptoms of over harvesting such as stagnation of total production and decline in the catch per unit of fishing effort are observed. This has negative socio-economic implications in terms of lack of fish availability to local community and nutritional insecurity. However, the current level of fish consumption is very low compared to other countries. According to authors, the socio-economic conditions of fisher folk in terms of education, employment, income, food and nutrition security are not encouraging.

Dastagiri and Mruthyunjaya (2003) made an attempt to analyze fish supply and demand in India. They found that fish production have increased steadily from 7.5 lakh tonnes in 1950-51 to 56.6 lakh tonnes in 1999-00. Marine fisheries remained the major contributors till 1990-91. The share of inland fisheries increased drastically reaching to 50 per cent in 1999-00 due to policy shift in favour of inland fisheries, particularly aquaculture. The results obtained from supply-demand gap revealed that in 2020, India would be having 4.48 million tonnes surplus in fish produce. Therefore, keeping in view the dynamic nature of the export markets and to reap the benefits of surplus, quality control of both input and output, export promotion and marketing strategies need to be pursued more aggressively.

Debnath et al. (2007) made a research on economics of aquaculture feeding practices in Punjab. They found that net return obtained in semi-intensive farming were $1878/hectare/year as compared to $1821/hectare/year among traditional farmers. However, benefit cost ratio was better in semi-intensive system (1.81) than the traditional system (1.75). Despite that semiintensive farmers were getting a production of 5699 kilogram/hectare/year, while those of traditional farmers obtained a production of 5853 kilogram/hectare/year. While, the net return per kilogram fish was found to be better in semi-intensive farming ($0.33/kg) as compared to traditional farming ($0.31/kg). The application of Cobb-Douglas production function analysis showed that the revenue of farmers could be significantly increased by increasing feed and fertilizers inputs. However, the results also indicated that, any increase in labor and other variable costs would reduce the income of farmers.

Singh et al. (2015) examined the profitability and technical efficiency aspects of aquaculture in Punjab by using primary data for the year 2007-08. They employed cost and return concepts and stochastic frontier production function, respectively. Study showed that just 40 per cent of the farms were using nursery ponds for fingerlings and only a few number of farmers were using branded feed. The results obtained from stochastic frontier production function explores the differences between observed and frontier output thereby showing the presence of technical inefficiency in aquaculture. Further, use of nursery, high proportion of rohu and training received by fish farmers were significantly affecting the technical efficiency. The researchers implicated that the farmers need to be trained for use of nursery ponds and optimum mix of resources to increase profitability in fish production.

Saravanan (2015) examined the production and export performance of fisheries sector in India for the period of 2000-01 to 2010-11. The study found that both marine and inland fish production have grown over the years. Besides, among four Indian States including Andhra Pradesh, Karnataka, Kerala and Tamil Nadu, Karnataka is proved to be a leading State in marine fish production which increased at compound growth rate (CGR) of 4.63 per cent during the period under consideration. On the other hand, inland fish production is found to be high in Andhra Pradesh with CGR of 9.17 per cent. Moreover, annual growth rate for the value of exports is seen highest 28.39 per cent in 2010-11.
Goswami and Zade (2015) analyzed fish production in India. They found that marine fish production was lower than inland fish production till 1995. But unanticipatedly, marine fish production became approximately equal to inland fish production in the year 2000 and finally; marine fish production exceeded the inland fish production since 2005. The total fish production during 2013-14 is at 9.58 million metric tonnes with a contribution of 6.14 million metric tonnes from inland sector and 3.44 million metric tonnes from marine sector respectively. In inland fish production, Andhra Pradesh is showing aggressive growth pattern from 2006 to 2014. During 2006-07 to 2010-11, West Bengal was the top producer of inland fish but after that it holds second position and shows a steady growth. Other good performing States including Gujrat, Kerela, Tamilnadu, Maharashtra, and Karnataka have experienced flat growth in case of inland fish production.

Islam et al. (2016) studied the status, challenges and future potential of fisheries sector in Bangladesh. They found that farmers have started to shift their crop land to aquaculture as they considered it more profitable compared to rice production. Consequently, production of inland fisheries is growing at the rate of around 5-7 per cent annually since 1989-90. Along with this, marine fish production have also experienced rising trend but with fluctuated growth rate. Further, the study also revealed the challenges faced by fisheries sector. These challenges include food security, degradation of habitat, urbanization, and expansion of industry sector etc. However, to overcome these challenges, the authors suggested a rationale to develop liable fisheries management and optimum usage of water bodies.

Vyashnavi and Rao (2016) explored the importance of marine fisheries in Indian economy. They concluded that the country exported 10.51 lakh tonnes of marine products, which resulted in export earnings of 33441.61 crores and US $ 5511.12 million in 2014-15. In the year 2015-16 the marine products were largely exported to South East Asia, where as exports to China were lowest. Moreover, development programmes in five year plans resulted in growth and expansion of marine fisheries sector in the country. However there is a need to exploit the untapped marine resources and government schemes towards fishing households.

Kaur (2017) made an extensive research on the economics of inland fish production in district of Ludhiana in Punjab by taking a sample of sixty fish farmers based on random sampling technique. The study revealed that during the last three decades that growth in inland fish production was higher than marine fish production and the quantity of fish exports had increased more than 14 times. Moreover, cost-return analysis of fish farming on sample fish farms revealed that gross returns per hectare on private fish farms were higher (3.15 lakh) than panchayati fish farms (2.80 lakh). Net returns per hectare were higher on panchayati fish farms (0.85 lakh) as compared to private fish farms (0.48 lakh). Meanwhile, the results of regression confirm the significance of variables including area, marketing cost and labour. However, the researcher found that fish farmers are facing certain challenges including poaching, fish diseases, flooding, less subsidy, low price, irregular payment and inadequate infrastructure etc., which needs to be overcome.

Kummari et al. (2018) attempted to review the status of fisheries sector in the State of Telangana and found that fish production have crossed 2.36 lakh tonnes mark with a water spread area of 5.7 lakh hectares in 2015-16. They identified the existence of gap between fish production and resource availability. Despite that the presence of excellent sub-tropical climate and varied types of water bodies may stimulate the development of aquaculture in the State. Further, the study stressed that quantitative as well as qualitative improvement in fish production requires standardization of breeding techniques and adoption of scientific technologies and innovative techniques, which must be eco-friendly. Moreover, Government support is also essential to reduce economic losses and risks involved in fish farming. Meanwhile, farmers require training regarding the scientific management of fish farm.

Maurya et al. (2018) made an attempt to study fisheries resources, trend of fish seed and fish production and their inter relationship in State of Uttar Pradesh for the period 2000-01 to 2016-17. The study revealed that just 48.97 per cent of the available aquaculture resources were utilized for fish production in the State thereby indicating
the potential of horizontal expansion in fish production. Meanwhile, during 2001-02 to 2016-17, average annual growth rate (AAGR) in fish seed production and fish production was found to be 7.67 per cent and 7.56 per cent respectively. Besides, the estimated linear regression line of fish production on seed production showed the fact that, with increase of one million fry, fish production increases by 0.249 thousand tonnes.

So, a brief look at literature shows that there is dearth of studies on this sector in the State of Haryana. Motivating from this fact, the present study is undertaken to make a descriptive analysis of fisheries sector in the State of Haryana.

Objectives and Research Methodology

Objectives of the study

Fundamentally, two specific objectives are worked upon.

1. To examine the growth of fisheries sector in terms of:
   - Area Stocked for fisheries sector
   - Number of Fishing Licenses issued
   - Total Fish Production in the State
   - Fish Production Per Hectare
   - Fish Seed Production in the State

2. To investigate the contribution of fisheries sector in the State of Haryana in terms of:
   - Contribution of fisheries GSDP in agricultural GSDP of Haryana
   - Contribution of fisheries GSDP in overall GSDP of Haryana

Research Methodology

The present study uses secondary data which are collected from various issues of Statistical Abstract of Haryana published by Department of Economic and Statistical Analysis, Haryana; and Handbook on Fisheries Statistics published by Department of Animal Husbandry, Dairying and Fisheries, Government of India. Considering the availability of data, the study covers the time period of 15 years that is from 2004-05 to 2018-19.

To attain the first objective, data are analyzed by using descriptive statistics and by calculating compound annual growth rate (CAGR) with fitting of exponential trend.

Mathematically,

\[ Y = AB^t \quad (1) \]

where, \( B = 1 + r \); and \( r \) is CAGR

The natural logarithmic transformation of equation (1) gives:

\[ \ln Y = \ln A + t \ln B \quad (2) \]

or

\[ Y^* = \alpha + \beta t \quad (3) \]

where, \( Y^* = \ln Y; \alpha = \ln A; \beta = \ln B \)

Equation (3) is a log linear function. The estimates of parameters, \( \alpha \) and \( \beta \) can be obtained by using Ordinary Least Square (OLS) method. Now, the formula to calculate CAGR is:

\[ r(\%) = \left( e^\beta - 1 \right) \times 100 \quad (4) \]

In response to second objective, the contribution of fisheries GSDP in agricultural and overall GSDP, log linear regression model is used as follows:

\[ \ln Y_t = \alpha + \beta \ln X_t + U_t \quad (5) \]

Estimates of regression coefficients \( \alpha \) (intercept) and \( \beta \) (slope) is obtained by applying OLS. The estimated slope
coefficient (β) explains the elasticity of Y with respect to X. In other words, the resultant percentage change in Y if X is incremented by 1 per cent is expressed by β.

Prior to this, descriptive statistics and compound annual growth rate (CAGR) is also applied to the required data.

Analysis and Interpretation

In this section, as per the objectives, analysis of fisheries sector is done in terms of judging the growth of fisheries sector as well as its contribution in GSDP of Haryana.

Growth of Fisheries Sector

Table 1. Fisheries Sector in Haryana During 2004-05 to 2017-18

<table>
<thead>
<tr>
<th>Years</th>
<th>Area Stocked (In Hectare)</th>
<th>Number of Fishing Licenses issued</th>
<th>Total Fish Production (In tonnes)</th>
<th>Fish Production Per Hectare (In tonnes)</th>
<th>Fish Seed Production (In million fry)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004-05</td>
<td>8882</td>
<td>6632</td>
<td>42052</td>
<td>4.73</td>
<td>249.57</td>
</tr>
<tr>
<td>2005-06</td>
<td>10532</td>
<td>6810</td>
<td>48200</td>
<td>4.58</td>
<td>282.08</td>
</tr>
<tr>
<td>2006-07</td>
<td>11836</td>
<td>7286</td>
<td>60050</td>
<td>5.08</td>
<td>331.14</td>
</tr>
<tr>
<td>2007-08</td>
<td>12885</td>
<td>6194</td>
<td>67235</td>
<td>5.22</td>
<td>309.76</td>
</tr>
<tr>
<td>2008-09</td>
<td>14304</td>
<td>7868</td>
<td>76285</td>
<td>5.33</td>
<td>332.20</td>
</tr>
<tr>
<td>2009-10</td>
<td>15290</td>
<td>6667</td>
<td>88130</td>
<td>5.76</td>
<td>404.99</td>
</tr>
<tr>
<td>2010-11</td>
<td>17094</td>
<td>7239</td>
<td>93950</td>
<td>5.50</td>
<td>643.41</td>
</tr>
<tr>
<td>2011-12</td>
<td>18765</td>
<td>6171</td>
<td>106000</td>
<td>5.65</td>
<td>744.21</td>
</tr>
<tr>
<td>2012-13</td>
<td>16817</td>
<td>6316</td>
<td>85211</td>
<td>5.07</td>
<td>734.55</td>
</tr>
<tr>
<td>2013-14</td>
<td>16922</td>
<td>7628</td>
<td>80221</td>
<td>4.74</td>
<td>909.37</td>
</tr>
<tr>
<td>2014-15</td>
<td>17016</td>
<td>6100</td>
<td>111203</td>
<td>6.54</td>
<td>-----</td>
</tr>
<tr>
<td>2015-16</td>
<td>17800</td>
<td>7373</td>
<td>121000</td>
<td>6.80</td>
<td>-----</td>
</tr>
<tr>
<td>2016-17</td>
<td>18975</td>
<td>7621</td>
<td>144210</td>
<td>7.60</td>
<td>-----</td>
</tr>
<tr>
<td>2017-18</td>
<td>18550</td>
<td>6131</td>
<td>190000</td>
<td>10.24</td>
<td>-----</td>
</tr>
<tr>
<td>Mean</td>
<td>15404.860</td>
<td>6859.714</td>
<td>93841.214</td>
<td>5.916</td>
<td>494.128</td>
</tr>
<tr>
<td>SD(σ)</td>
<td>3234.595</td>
<td>631.743</td>
<td>39403.425</td>
<td>1.514</td>
<td>239.107</td>
</tr>
<tr>
<td>CV (%)</td>
<td>20.997</td>
<td>9.209</td>
<td>41.989</td>
<td>25.592</td>
<td>48.390</td>
</tr>
<tr>
<td>CAGR (%)</td>
<td>5.127</td>
<td>-0.057</td>
<td>9.636</td>
<td>4.185</td>
<td>16.183</td>
</tr>
</tbody>
</table>

Source: Department of Economic and Statistical Analysis, Haryana Department of Animal Husbandry, Dairying and Fisheries, Government of India.

Firstly, aligning with objective 1, the data and results are presented in table 1. The table reveals that fish farming area, fish production in total as well as per hectare, and production of fish seed have raised over the years. It is found that fish farming area in Haryana have increased from 8882 hectare in 2004-05 to 18550 hectare in 2017-18 at the CAGR of 5.127 per cent. However, the number of fishing licenses issued has experienced negative CAGR of –0.057 per cent which confirms the reduction in licenses number of fishing issued from 6632 in 2004-05 to 6131 in 2017-18. Meanwhile, by compounded annually at the rate of 9.636 per cent, total fish production is reached to 190000 tonnes in 2017-18 in comparison of 42052 tonnes in 2004-05. Similarly, per hectare fish production is found to be 10.24 tonnes in 2017-18 which is more than double in comparison of 2004-05. Besides, fish seed production was 249.57 million fry in 2004-05 but increased to 909.37 million fry in 2013-14 at an appreciable CAGR of 16.183 per cent. From the perspective of variations, highest variations are seen in case of fish seed production as CV (Coefficient of variation) is found to be 48.390 per cent; followed by total fish production where CV scores 41.989 per cent.
**Contribution of Fisheries Sector**

As an answer to objective 2, required data and results are evident from tables 1 and 2.

**Table 2**: Share of Fisheries Sector in GSDP of Haryana

<table>
<thead>
<tr>
<th>Years</th>
<th>Fisheries GSDP (In rupees crores)</th>
<th>Agriculture GSDP (In rupees crores)</th>
<th>Overall GSDP (In rupees crores)</th>
<th>Percentage Share of Fisheries GSDP in Agricultural GSDP</th>
<th>Percentage Share of Fisheries GSDP in Overall GSDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004-05</td>
<td>114.06</td>
<td>20815.11</td>
<td>93561.46</td>
<td>0.548</td>
<td>0.122</td>
</tr>
<tr>
<td>2005-06</td>
<td>130.24</td>
<td>21259.96</td>
<td>106393.37</td>
<td>0.613</td>
<td>0.122</td>
</tr>
<tr>
<td>2006-07</td>
<td>162.47</td>
<td>27088.47</td>
<td>130236.10</td>
<td>0.600</td>
<td>0.125</td>
</tr>
<tr>
<td>2007-08</td>
<td>193.89</td>
<td>32194.37</td>
<td>151595.90</td>
<td>0.602</td>
<td>0.128</td>
</tr>
<tr>
<td>2008-09</td>
<td>308.98</td>
<td>40137.23</td>
<td>182522.15</td>
<td>0.770</td>
<td>0.169</td>
</tr>
<tr>
<td>2009-10</td>
<td>356.93</td>
<td>44445.67</td>
<td>223600.25</td>
<td>0.803</td>
<td>0.160</td>
</tr>
<tr>
<td>2010-11</td>
<td>676.44</td>
<td>71506.66</td>
<td>400662.01</td>
<td>1.349</td>
<td>0.225</td>
</tr>
<tr>
<td>2011-12</td>
<td>1003.22</td>
<td>79299.14</td>
<td>437144.71</td>
<td>1.391</td>
<td>0.217</td>
</tr>
<tr>
<td>2012-13</td>
<td>950.12</td>
<td>72999.14</td>
<td>400662.12</td>
<td>1.198</td>
<td>0.237</td>
</tr>
<tr>
<td>2013-14</td>
<td>1100.80</td>
<td>80204.26</td>
<td>437144.71</td>
<td>1.372</td>
<td>0.252</td>
</tr>
<tr>
<td>2014-15</td>
<td>877.83</td>
<td>84632.88</td>
<td>495249.01</td>
<td>1.037</td>
<td>0.177</td>
</tr>
<tr>
<td>2015-16</td>
<td>1052.76</td>
<td>95786.09</td>
<td>566324.58</td>
<td>1.099</td>
<td>0.189</td>
</tr>
<tr>
<td>2016-17</td>
<td>1408.41</td>
<td>104424.89</td>
<td>626053.52</td>
<td>1.349</td>
<td>0.225</td>
</tr>
<tr>
<td>2017-18</td>
<td>1531.36</td>
<td>110998.34</td>
<td>707126.33</td>
<td>1.391</td>
<td>0.217</td>
</tr>
<tr>
<td>Mean</td>
<td>715.063</td>
<td>61872.46</td>
<td>334377.4</td>
<td>1.028</td>
<td>0.197</td>
</tr>
<tr>
<td>SD(σ)</td>
<td>475.852</td>
<td>30296.86</td>
<td>196600.00</td>
<td>0.336</td>
<td>0.060</td>
</tr>
<tr>
<td>CV(%)</td>
<td>66.547</td>
<td>48.967</td>
<td>58.814</td>
<td>32.685</td>
<td>30.457</td>
</tr>
<tr>
<td>CAGR(%)</td>
<td>21.288</td>
<td>13.315</td>
<td>15.720</td>
<td>7.037</td>
<td>4.812</td>
</tr>
</tbody>
</table>

**Source**: Department of Economic and Statistical Analysis, Haryana

Table 2 demonstrates that the gross state domestic product (GSDP) from fisheries sector is found to be increased from rupees 114.06 crores in 2004-05 to rupees 1531.36 crores in 2018-19 at the CAGR of 21.288 per cent. However, GSDP in fisheries sector is found to increase at highest CAGR in comparison of agriculture sector (13.315 per cent) and overall (15.720 per cent) as shown in table 2. Moreover, percentage share of fisheries sector in agricultural GSDP as well as total GSDP was 0.548 per cent and 0.122 per cent respectively in 2004-05 but in 2018-19 this share has reached to 1.391 per cent and 0.217 per cent respectively. For the same time period, percentage share of fisheries in GSDP of agriculture as well as overall has increased at the CAGR of 7.037 per cent and 4.812 per cent respectively. However, during 2012-13, the percentage shares of fisheries’ GSDP was highest that is 1.403 per cent for agriculture and 0.289 per cent in case of overall GSDP.

Further, by using regression analysis, the contribution of fisheries’ GSDP in agricultural GSDP as well as in overall GSDP is examined. The results of which are accumulated in table 3. For this purpose, simple linear regression model is used as shown by equations (A) and (B) and estimated with the help of Ordinary least square method.

\[ \text{Ln (agricultural GSDP)}_t = \alpha + \beta \text{Ln (fisheries GSDP)}_t + U_t \]  \( (A) \)

\[ \text{Ln (overall GSDP)}_t = \alpha + \beta \text{Ln (fisheries GSDP)}_t + U_t \]  \( (B) \)

**Table 3. Results of Simple Linear Regression Model**

<table>
<thead>
<tr>
<th>Dependent Variables</th>
<th>( \hat{\alpha} ) (Intercept)</th>
<th>( \hat{\beta} ) (Slope)</th>
<th>R</th>
<th>R(^2)</th>
<th>F-statistic</th>
<th>DW-statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ln (agricultural GSDP)</td>
<td>7.034 (SE=0.190) (t=36.943) (Sig.=.000)</td>
<td>0.617 (SE=0.030) (t=20.486) (Sig.=.000)</td>
<td>0.985</td>
<td>0.970</td>
<td>419.695 (Sig.=.000)</td>
<td>1.175*</td>
</tr>
<tr>
<td>Ln (overall GSDP)</td>
<td>8.153 (SE=0.306) (t=26.646)</td>
<td>0.700 (SE=0.048) (t=14.466) (Sig.=.000)</td>
<td>0.970</td>
<td>0.942</td>
<td>209.266 (Sig.=.000)</td>
<td>0.708PA</td>
</tr>
</tbody>
</table>

**Source**: Researchers’ calculations in SPSS 16.0
**Note:** For \( N=15 \) and One regressor (excluding intercept), the lower and upper bounds of Durbin-Watson critical values at 5 per cent level of significance are \( d_L=0.811 \) & \( d_U=1.070 \)

PA indicates Positive autocorrelation

The results highlighted in table 3 can be interpreted as follows:

The estimated values of intercept (\( \alpha \)) are found to be 7.034 and 8.153 respectively for the two regression models having dependent variables agricultural GSDP and overall GSDP respectively in natural logarithmic form. However, these estimated intercepts are significant at less than 1 per cent level of significance. The intercept values reveals that in the absence of fisheries GSDP, the value of Ln (agricultural GSDP) will be 7.034 that is agricultural GSDP will be rupees 1134.560 crores (antilog of 7.034) while, overall GSDP attain the value rupees 3473.785 crores (antilog of 8.153).

The slope coefficient (\( \beta \)) stood at 0.617 when dependent variable is Ln (agricultural GSDP), thus, a 1 per cent increase in fisheries GSDP leads to a rise of 0.617 per cent in agricultural GSDP. In other words, if fisheries GSDP is raised by rupees 1 crores then agricultural GSDP is increased by rupees 0.617 crores. On the other hand, slope coefficient for the regression model having dependent variable as Ln (overall GSDP) is 0.700 which indicates that rise of rupees 1 crores in fisheries GSDP brings an increase of rupees 0.700 crores in overall GSDP. On the whole, the elasticity of agricultural GSDP and overall GSDP with respect to fisheries GSDP are 0.617 and 0.700 respectively.

The correlation coefficient (R) measures the degree of relationship between variables and reveals that there is high degree of positive correlation between fisheries GSDP and agricultural GSDP as the R scores 0.985 which is more than 0.9. Similarly, fisheries GSDP is also highly correlated with overall GSDP as R scores 0.970.

Coefficient of Determination (R^2) measures the goodness of fit of the regression model by revealing what percentage of variations in dependent variable is explained by explanatory variable. It is shown in table 3 that R^2 score 0.970 and 0.942 respectively for two regression models. This indicates that the explanatory variable Ln(fisheries GSDP) explains more than 90 per cent variations in dependent variables including Ln(agrlicultural GSDP) as well as Ln(overall GSDP). Thus, both of the fitted regression models are good.

F-statistic is sufficiently high to be significant at 1 per cent level of significance which indicates that both the regression models are overall significant. Thus, the estimated parameters \( \alpha \) and \( \beta \) are significant and fit for predictions.

DW (Durbin-Watson) statistic is used to judge the presence of autocorrelation in the fitted regression model. In first regression model, DW statistic scores 1.175 which lies between critical limits of DW that is \( d_U \) (1.070) and \( 4-d_U \) (2.930) at 5 per cent level of significance. This indicates that the regression model is free from autocorrelation. While in second regression model, computed DW-statistic is 0.708 which is lower than the critical value of DW (\( d_L= 0.811 \)). This implies the presence of positive autocorrelation which makes the OLS estimate inefficient that is they should not be used for predictions.

**Conclusion and Policy Implications**

In nut-shell, fisheries sector have achieved considerable progress in Haryana. The fish farming area, production of fish as well as fish seeds, and fish production per hectare have grown; but, the number of fishing licenses issued has found to be declined over the years. Moreover, CAGR of fisheries GSDP is found to be higher than the agricultural GSDP and overall GSDP for the period under investigation. Meanwhile, percentage share of fisheries GSDP in agricultural GSDP as well as in overall GSDP is increased over the years. Besides, regression reveals that the elasticity of agricultural GSDP and overall GSDP with respect to fisheries GSDP is 0.617 and 0.700 respectively for the period 2004-05 to 2018-19. However, the estimated 0.700 cannot be said as efficient due to the presence of autocorrelation. Therefore, one should be cautious before making any predictions based on this value.
Based on the findings, it can be implicated that to sustain and uplift the contributions of fisheries sector in Haryana, focused attention towards the development of this sector is urgent. In this regard, to promote fish farming, training programs for farmers are the need of the day. Further, there is rationale to create self-help groups of fish farmers and to encourage small scale entrepreneurs for establishment of aquaria shops. Besides, public-private partnerships for the production of quality fish seed and feed, infrastructure development, and cold storage facilities for marketing can be helpful in encouraging fish culture. Moreover, calamity relief measures need to be provided for fisheries and aquaculture to reduce the risk and economic losses. There is need to launch Fisheries Mission with concrete plan of action in the State of Haryana. Last but not least, researchers are encouraged to research on this sector in Haryana in more detail for enhanced, embellished and more generalizable results.

References


