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Adoption of Improved Scientific Practices of Composite Carp Culture Technology in South 24 Parganas

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ABSTRACT

The study was undertaken in South 24 Paraganas district of West Bengal with an aim to study the adoption of Composite Carp Culture technology. Primary data were collected from 142 fish farmers practicing composite carp culture using structured schedule. The study indicates that 16.2, 61.3 and 22.5 per cent of the respondents were in the category of high, medium and low level of adoption, respectively. Supplementary feeding with pellet feed and careful disposal of dead animals were the most widely adopted practices in carp culture by the farmers. A positive and significant correlation of education level, exposure to mass media, knowledge level, extension contact and experience with level of adoption of composite carp culture technology was observed. A set of 7 independent variables collectively explains 68 percent (R^2= 68%) of the variation in adoption of the technology.

Keywords: Adoption, Composite carp culture, Determinants, Fish farmers

INTRODUCTION

Aquaculture is the world's fastest growing food producing sector and rapidly growing fisheries sector in India with an annual growth rate of over 7 percent (GOI, 2018). Seventy one per cent of the total fish production of the country comes from inland fishery resources. The contribution of freshwater aquaculture to inland fisheries has increased to about 80 per cent in recent years from that of 34 per cent in mid-1980 (DADF, 2019). Freshwater aquaculture is accounted for 63.8 per cent of global total aquaculture production of 47, 102, 391 t (FAO, 2016). India is blessed with 3.15 million ha of reservoirs, 2.42 million ha of ponds and tanks as well as 0.19 million ha of rivers and canals. This indicates the huge potential for the development in aquaculture in India. However, only around 50 per cent of ponds and tanks are being used currently for aquaculture. (Jayasankar and Das, 2015).

Fish provides an important source of protein and micronutrients and can contribute to food and nutritional security (Bogard *et al.*, 2016; Hicks *et al.*, 2019). The fish production in India has significantly increased from 0.75 MT in 1950-51 to 12.61 MT during 2017-18. Government of India has also set a target of 20 MT fish production by the year 2022-23. The Government is laying renewed focus on the sector through a flagship scheme "Blue Revolution". It emphasizes mainly on increasing fisheries production and productivity from aquaculture and fisheries resources, both inland and marine with the objectives of ensuring food and nutritional security, generating employment and export earnings, ensuring inclusive development and empowering fishers and aquaculture farmers (DADF, 2019). The Union Government has also recently launched Pradhan Mantri Matsya Sampada Yojana to turn India in to a hot spot for fisheries and aquaculture product through appropriate policy, marketing and infrastructure support.

West Bengal is a state in the eastern region of India along the Bay of Bengal. The state has 6.83 lakh ha of freshwater resources. The state occupies second position

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after Andhra Pradesh in inland fish production among various states of India. The state has a total inland water bodies of 5.7 lakh ha in which tanks and ponds has the maximum share of 2.6 lakh ha followed by brackish water (2.1 lakh ha), beels (42082 ha), small, medium & large reservoir (28050 ha) and derelict water resources of 26925 ha (GoI, 2018). The inland fish production has gone up to 15.57 lakh tonnes in 2017-18 from 12.9 lakh tonnes in 2011-12. The district South 24 Parganas has a freshwater resources area of 49237 ha constituting 8.63 per cent towards the state inland resources and a production of 156111 ton i.e., 10 percent share of the state (GoWB, 2017). Adoption of scientific fish farming practices by the farmers is of paramount importance for bridging this gap. Adoption of modern technologies is one of the most promising strategies to increase farm incomes (Varshney *et al*., 2020). The recent measures therefore have targeted Intensive Aquaculture in ponds and tanks through integrated fish farming, carp polyculture, freshwater prawn culture, running water fish culture and development of riverine fisheries (DADF, 2019). Composite carp culture is the stocking of different carp species viz., catla, rohu and mrigal (Indian major carps) together with three other exotic carps viz., silver carp, grass carp and common carp having different feeding habits. The three Indian major carps viz. catla, rohu and mrigal contribute the major chunk of the freshwater aquaculture production followed by the exotic carps silver carp, grass carp and common carp forming the second important group (Rutaisire *et al.*, 2017). Composite carp culture technology is one of the most widely adopted technologies in fish farming. Adoption of this technique will open avenues for self-employment, supplement the income of the farmers and enhance fish production (Hussain *et al.*, 2013). The roles of new fish technology are to simplify and make fish production more effective and efficient. Olutunji *et al.* (2016) stressed on the need to understand the extent to which fish farming technologies have been transferred to farmers and the extent to which the technology end-users have been benefitted. Hence, this study was undertaken in South 24 Parganas district of West Bengal to find out the extent of adoption of composite carp culture technology and its determinants.

METHODOLOGY

South 24 Parganas district of West Bengal with a population of the district is 81, 61,961 and geographical area of 9,960 sq. km was randomly selected. Out of the 22 blocks, data were collected from randomly selected 4 blocks (Mathurapur, Sonarpur, Kultali and Jayanagar) with the help of structured interview schedule. Selection of village and respondent was done through multistage random sampling. From each block three villages and from each village twelve fish farmers were selected to make the sample size 142. For the collection of primary data from 142 respondents through personal interview, a structured interview schedule pretested on 20 fish farmers, was developed. The data was collected from Oct-Dec 2019 onwards. Secondary data was collected through reviewing various literature, from Directorate of fishery, West Bengal and District Fishery Office, South 24 Parganas. The tabulated data were analyzed using suitable statistical tools *viz.*, frequency, percentage, mean, standard deviation, correlation and regression analysis.

The schedule contained information on the socioeconomic factors, which were likely to influence the adoption of recommended technology of composite carp culture. Variables included were age, education level, pond area, extension contact, exposure to mass media and knowledge level on recommended technology. For measurement of variables *viz.*, exposure to mass media and knowledge level, the total score of an individual was computed and the respondents were categorized into 3 groups by computing the mean and standard deviation. The three groups are- low (< Mean - SD), medium (Between Mean ± SD) and high (>Mean ± SD). For measuring the adoption level, a total number of 13 practices that constitute composite carp culture technology were selected. The farmers were asked to respond whether they adopt or do not adopt the practices. Score of 1 and 0 were assigned to adoption and non-adoption of the technology respectively. Therefore, maximum possible score was 13 for each respondent. From the adoption score of each of the respondent, adoption quotient was computed by using the adoption quotient formula developed by Pareek and Chattopadhyaya (1966). Accordingly, the following formula was used to calculate the general adoption level.

$$\text{Adoption quotient} = \frac{\text{No. of practices adopted}}{\text{No. of practices advocated}} \times 100$$

After computing individual adoption quotient scores, the respondents were grouped into three categories (low, medium and high) with mean and standard deviation as measure of check. Data were analyzed with the help of correlation and regression analysis.

RESULTS AND DISCUSSION

Socio-economic profile of the fish farmers

Socio-economic and personal characteristics of the respondents presented in Table 1 shows that majority of the respondents (45.07%) were from the old age group (>50) while 41.55 per cent of them were falling in the middle aged category of (35-50) and only 13.38 per cent of them were in 20-35 years age group. With regard to education level 30.99 per cent of the respondents had middle level of education followed by primary level (19.72%), matriculation (16.20%), higher secondary (11.27%), graduation (6.34%), no formal schooling (11.97%) and 2.82 per cent of them were in the category of illiterate. Majority (44.37%) of them had a pond area of 1-2 ac, whereas 26.76 per cent of the respondents had a pond area of less than 1 ac and only 28.87 per cent of the respondents had more than 2 ac of pond. Majority (40.14%) of the respondents were having low level of

Table 1: Distribution of respondents based on their Socio-economic characteristics (Independent variable) (n=142)

Independent Variables	Category	Frequency	Percent
Age	Young (20-35 years)	19	13.38
	Middle (35-50 years)	59	41.55
	Old (>50 years)	64	45.07
Education level	Illiterate	4	2.8
	No formal schooling	17	11.97
	Primary	28	19.72
	Middle	44	30.99
	Matriculation	23	16.20
	Higher secondary	16	11.27
	Graduation	9	6.34
	Post-graduation	1	0.70
Pond area	<1 ac	38	26.76
	1-2 ac	63	44.37
	>2 ac	41	28.87
Extension contact	Low	57	40.14
	Medium	53	37.32
	High	32	22.54
Exposure to mass media	Low (<41.33)	33	23.24
	Medium (41.33-63.62)	64	45.07
	High (>63.62)	45	31.69
Knowledge level	Low (< 38.81)	45	31.69
	Medium (38.81-69.29)	66	46.48
	High (> 69.29)	31	21.83
Fish farming experience	1-5 years	18	12.68
	6-10 years	62	43.66
	11-15 years	44	30.98
	16 years and above	18	12.68
Yield (tonnes/ha/yr)	Range	1.89 – 5.50	
	Mean	3.6	

extension contact followed by medium level (37.32%) and high level (22.54%). Most (45.07%) of the respondents have medium level of exposure to mass media followed by high level (31.69%) and low level (23.24%) of exposure to mass media. Most (46.48%) of the farmers possessed a medium level of knowledge while 31.69 per cent of them were having a low knowledge level and only 21.83 per cent of them possessed a high knowledge level. Roy and Bhagat (2012) also reported that majority of the respondents belonged to medium knowledge level in adoption of technology. Majority (43.66%) of the farmers have experience of 6-10 years in fish farming. Around 31 per cent of the respondents have an experience of 11-15 years followed by 12.68 per cent each were having an experience of 1-5 years and 16 years and above. Farmers of South 24 Parganas district reported to have obtained yield from fish pond that ranges from 1.89 to 5.50 tonnes/ha/year. Mean yield is worked out as 3.6 tonnes/ha/year.

From Figure 1 it is evident that majority (86.62%) of the respondents were practicing supplementary feeding with pellet feed. The second and third most widely adopted practices were 'Water pH was adjusted through lime or alum' (80.28%) and 'Pond preparation for every crop cycle' (77.46%) respectively. Sixty eight per cent respondents were adopting the practice of 'Careful disposal of dead animals. Both 'Fertilization and manuring done as per recommendation' and 'Predatory and weed fishes removed' were practiced by 64 per cent fish farmers each. Other recommended practices in decreasing order of adoption were Fortnightly sampling to check the health status of the fish'(58.45%), 'Water exchange and aeration adopted for maintaining water quality'(48.59%), 'Seeds were stocked after proper acclimatization'(43.66%), 'Water inlet and outlet were provided with filters'(38.03%), and 'Plankton crash was observed during crop cycle'(32.39%). 'Disinfection of seed before stocking' was the least adapted practice only by 30.28 per cent respondents. This may be due to lack of knowledge and awareness about composite carp culture technology. Among the constraints in technology adoption, the most prominent one is the lack of information and credit (Varshney *et al.*, 2019). Abraham *et al.* (2010) in their study on aquaculture practices by farmers in West Bengal also observed that manuring was not practiced

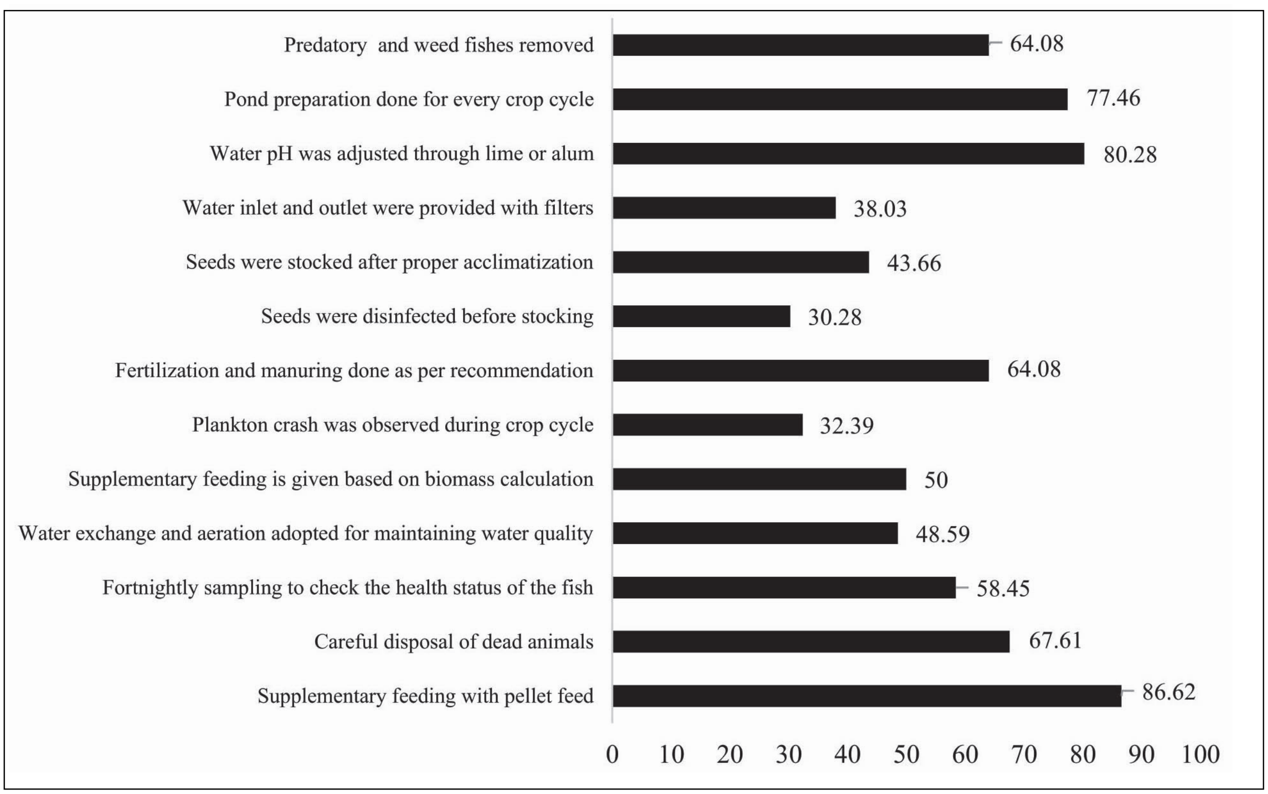

Figure 1: Distribution of the respondents on the basis of adoption of the recommended practices of composite carp culture technology (n=142)

by 64% of farmers possibly due to good natural production or the fear of disease transmission particularly white spot on gills or argulosis from organic manure input. There was no water exchange, feeding schedule, regular health and water quality monitoring. The results indicated the reluctance of the farmers in adopting scientific fish farming. Production of fishes and profitability is more than double in composite fish culture over the local practice which is because of adoption of good management practices (Hussain *et al.*, 2013).

Adoption level and relationship with selected socio-economic variables

Socio-economic status, entrepreneurial interest, organized market are among the factors that determine growth and development of any sector and aquaculture sector is not an exception. Ekong (2010) explained that adoption is a decision making process which involves a number of stages. Although adoption as the integration of an innovation into farmers' normal farming activities, adoption is not a permanent behaviour.

It is clearly depicted from Figure 2 that 61.27 per cent respondents were in the category of medium adoption, whereas, 22.53 per cent had a low level of adoption followed by high level of adoption (16.20%) of the recommended practices. It was observed that majority of the respondents belonged to medium to high category of adoption level and the remaining had high adoption level regarding recommended scientific fish culture practices (Goswami *et al.*, 2012; Das *et al.*, 2018).

The relationship between selected socio-economic characteristics of fish farmers and their level of adoption was worked out by correlation coefficient and the computed 'r' values are presented in Table 2. It indicates that the variables viz., education level (X_2), exposure to mass media (X_4), extension contact (X_5), knowledge level (X_6) and experience (X_7) had a positive and significant association with the level of adoption of the technology, whereas, age (X_1) was negatively correlated with the level of adoption of composite carp culture technology. Mass media participation and extension agency contact had positive and significant correlations with the extent

Table 2: Correlation coefficient of selected socio economic variables with adoption (n= 142)

Independent variables	r	Sig. (2-tailed)
Age (X_1)	-0.366**	0.000
Education level (X_2)	0.672**	0.000
Pond Area(X_3)	0.008	0.928
Exposure to mass media(X_4)	0.695**	0.000
Extension Contact	0.612**	0.000
Knowledge level (X_6)	0.703**	0.000
Experience (X_7)	0.499**	0.000

** Significant at 1% level of significance; *Significant at 5% level of significance
NS - Non Significant

Figure 2: Distribution of respondents based on level of adoption (dependent variable) (n=142)

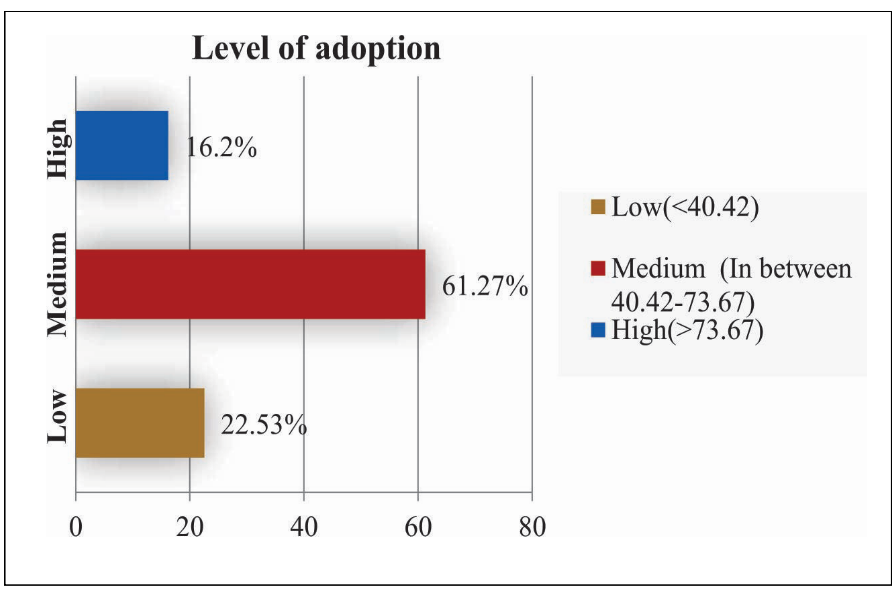

Table 3: Regression coefficient of extent of adoption (Y) with socio-economic characteristics of fish farmers

Variables	Beta	t	Sig	R square	F value
Age (X_1)	-0.064	-1.190	0.236^{NS}		
Education level (X_2)	0.279	4.209	0.000**		
Pond area (X_3)	-0.116	-2.305	0.023*	0.681	40.925
Exposure to mass media (X_4)	0.196	2.394	0.018*		
Extension contact (X_5)	0.224	3.617	.000**		
Knowledge level (X_6)	0.261	3.265	0.001**		
Experience (X_7)	0.028	0.430	0.668^{NS}		

** Significant at 5% level of significance; * Significant at 1% level of significance
NS - Non Significant

of adoption, whereas age of the respondents was negatively correlated with the extent of adoption. Fish farmers acquired more knowledge of fish culture practices from different sources mass media. It also gave them a chance to learn about the useful role of training, credit and subsidy, etc. (Goswami *et al.*, 2012; Roy and Bhagat, 2012).

Determinants of adoption

Multiple regression analysis was carried out to determine the influence of the independent variables in adoption behaviour of farmers. Level of adoption is influenced not by a single variable but a set of socio-economic variables. A set of six independent variables *viz.*, age (X_1), education level (X_2), Pond Area (X_3), exposure to mass media (X_4), extension contact (X_5), knowledge level (X_6) and experience (X_7) were studied to develop the regression model. The findings of the analysis are presented in Table 3.

The regression equation can be presented as:

$$Y= 9.598 -0.064 X_1+ 0.279 X_2-0.116 X_3 -0.196 X_4+ 0.224 X_5+0.261 X_6+0.028 X_7$$

Table 3 depicts the results of regression analysis carried out to understand the determinants of adoption and the amount of variability contributed towards extent of adoption. The beta coefficient and their corresponding t-values indicate varying level of contribution of variables. It is also observed that all the variables had combinedly explained a variation of 68.1% (R^2) percent towards the level of adoption of the technology. Kappen *et al.* (2013) in their study also indicated that twelve variables taken together for the multiple regression analysis explained 71% of variation in the adoption level in freshwater fish farming. The present study could not factor in several potential variables which might have contributed rest of the variation. Ndah *et al* (2011) studied that that inputs provided by public or non-governmental bodies, favourable environmental conditions and socio-cultural attitudes act together as driving factors towards fish farming adoption in Cameroon. The variable age (X_1) was found negatively significant, that is probably due to the fact that older people are reluctant to adopt the recommended practices. Education level (X_2) and knowledge level (X_6) were found to contribute more towards the level of adoption of the technology. Prasad and Choudhary (2010) also observed that age of farmers is negatively associated with extent of adoption while education emerged as the main potential predictor of adoption of the technology. More the level of education, more will be the progressiveness. The study observed that farmers who had more years of education and who possessed more knowledge about aquaculture were high adopter of scientific technology.

CONCLUSION

The adoption behaviour of fish farmers of South 24 Parganas district of West Bengal indicates that more than half of the respondents have medium level of adoption. Low to medium level adoption of scientific practices coupled with other socio-economic factors contributed to the low fish yield. Education level, exposure to mass media, extension contact, knowledge level and experience were found to have a positive association with the level of adoption of composite carp culture technology. In order to enhance the production as well as productivity, adoption quotient has to improve which implies recommended practices to be put to use to the fullest extent. The Government has laid renewed emphasis and launched flagship schemes to boost fisheries sector. It envisages creating right infrastructure for production as well as for fish marketing. It is for the farmers and entrepreneurs to take advantage of scientific technology and the enabling environment and realize its potentials.

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REFERENCES

Abraham, T.J., Sil, S.K. and Vineetha, P. (2010). A comparative study of the aquaculture practices adopted by fish farmers in Andhra Pradesh and West Bengal, *Indian Journal of Fisheries*, **57**(3), 41-48.

Anonymous. (2017). Handbook of Fisheries Statistics 2016-17, Department of Fisheries, Directorate of Fisheries, Govt. of West Bengal.

Anonymous. (2018). Handbook on Fisheries Statistics. Government of India, Ministry of Fisheries, Animal Husbandry and Dairying, Department of Fisheries, Krishi Bhavan, New Delhi.

Anonymous. (2018). Agricultural Statistics at a Glance. Government of India. Ministry of Agriculture & Farmers Welfare Department of Agriculture, Cooperation & Farmers Welfare, Directorate of Economics and Statistics. 468 pp.

Anonymous. (2014). Guidelines for the Centrally Sponsored Scheme "National Mission on Agricultural Extension and Technology (NMAET)" to be implemented during the XII Plan. 110p.

Anonymous. (2019). Hand Book on Fishery Statistics 2018. Government of India. 190 pp.

Anonymous. (2017). Report of the Committee on Doubling Farmers' Income. Volume XI. "Empowering the Farmers through Extension and Knowledge Dissemination", Agricultural Extension & Knowledge Diffusion, Skill and ICT: Empower every Farmer in every Corner. Department of Agriculture, Cooperation and Farmers' Welfare, Ministry of Agriculture & Farmers' Welfare, Government of India, 154 pp.

Bogard JR, Marks GC, Mamun A, Thilsted SH. (2016). Non-farmed fish contribute to greater micronutrient intakes than farmed fish: results from an intra-household survey in rural Bangladesh, *Public Health Nutrition,* **20**(4), 702–711, doi.org/10.1017/S1368980016002615

DADF. (2017). Annual Report 2016-17. Department of Animal Husbandry, Dairying and Fisheries. Ministry of Agriculture, Government of India, 162 pp.

DADF. (2019). Annual report 2018-19. Department of Animal Husbandry, Dairying and Fisheries. Ministry of Agriculture, Government of India, 162 pp.

Edwards P. (2000). Aquaculture, poverty impacts and livelihoods, natural resources perspective, ODI. No. 56, June, 2000.

Ekong EE. (2010). Rural Sociology -Third Edition. Uyo: DOVE Educational Publishers. pp. 438.

Goswami, B., Mukhopadhyay, S.B. and Dana, S.S. (2012). A study on factors influencing the adoption behaviour of fish farmers with special reference to scientific fish culture in West Bengal, *India International Journal of Bio-resource and Stress Management,* **3**(3), 362-367.

Hicks, C.C., Cohen, P.J., Graham, N.A.J., Nash, K.L., Allison, E.H., D'Lima, C., Mills, D.J., Roscher, M., Thilsted, S.H., Thorne-Lyman, A.L. and MacNeil, M.A. (2019). Harnessing global fisheries to tackle micronutrient deficiencies, *Nature,* **574**, 95 - 98. https://doi.org/10.1038/s41586-019-1592-6

https://south 24 Parganas.nic.in/about-district/district-at-a-glance/

Hussain, S.M., Sen, D., Pathak, M. and Singh, M.P. (2013). Comparative Study of Composite Fish Culture (CFC) and Local Practices of Fish Culture in East Siang District, Arunachal Pradesh, *Indian Journal of Hill Farming,* **26**(2), 32-34.

Jayasankar, P. and Das, P.C. (2015). Vertical expansion strategy for increased freshwater aquaculture production, *Fishing Chimes,* **35**, 44-51.

Jayasankar, P. (2018). Present status of freshwater aquaculture in India - A review, *Indian Journal of Fisheries,* **65**(4), 157-165.

Kappen, D.C., Thomson, K.T. and Dinesh, K. (2013). Adoption of Improved Practices in Freshwater Fish Farming, *Fishery Technology*, **50**, 191-195.

Ndah, H.T., Knierim, A. and Ndambi, O.A. (2011). Fish Pond Aquaculture in Cameroon: A Field Survey of Determinants for Farmers' Adoption Behaviour, *Journal of Agricultural Education and Extension,* **17**(4), 309-323.

Olatunji, S.O. and Ogunremi, J.B. (2016). Assessment of Awareness and Adoption of Fish Farming Technologies in Obio-Akpor Local Government Area of Rivers State, Nigeria, *The Journal of Agricultural Sciences*, **11**(3), 147-154.

Pareek, U. and Chattopadhyaya, S.N. (1966). Adoption Quotient: A Measure of Multipractice Adoption Behaviour, *The Journal of Applied Behavioural Science*, **2**(1), 95-108.

Parida, P.K., Behera, B.K., Sahu, S.K., Mohanty, B.P. and Das, B.K. (2018). A road map for Inland fisheries development in the state of West Bengal, India, *Journal of Inland Fisheries Society of India,* **50**(1), 53-59.

Prasad, S.N. and Choudhary, A.K. (2010). Extent of Adoption and Constraints in Boro Rice Cultivation Faced by the Farmers in Darbhanga District of Bihar, *Indian Journal of Extension Education*, **46**(1&2), 106-111.

Roy, S. and Bhagat, R. (2012). Level of Knowledge and Extent of Adoption of Farmers on Recommended Tuberose Production Practices, *Indian Journal of Extension Education*, **48**(1&2), 78-80.

Rutaisire, J., Nandi, S. and Sundaray, J.K. (2017). A review of Uganda and India's freshwater aquaculture: Key practices and experience from each country, *Journal of Ecology and the Natural Environment,* **9**(2), 15-29.

Varshney, D., Joshi, P.K., Roy, D. and Kumar, A. (2020). PM-KISAN and the Adoption of Modern Agricultural Technologies, *Economics & Political Weekly,* **55**(23), 6.

Varshney, D., Joshi, P.K. and Dubey, S.K. (2019). Direct and Spillover Effects of Agricultural Advisory Services: Evidence from Uttar Pradesh, India, 1850, IFPRI, Washington, DC.