

ADOPTION OF SCIENTIFIC PRACTICES IN FISH FARMING

ABSTRACT

The study was conducted at-in six districts of Telangana state *viz.* Karimnagar, Kamareddy, Medak, Wanaparthy, Mahabubabad and Yadadri Bhuvanagiri during 2019-2022 to find out the extent of adoption of scientific fish farming. Ten fish farmers were selected from each of the selected districts using simple random sampling technique thus constituting 60 fish farmers. A structured questionnaire was used to collect responses about the adoption of scientific fish farming specifically based on preliminary survey as well as focus group discussions. The results depicted that nearly half (48.33%) had medium level of adoption followed by high (38.33%) and low (13.34%) level of adoption respectively.

Comment [s1]: Conclusion and recommendation part is missing

Key words: Inland fisheries, fish farmer, fish pond, adoption, scientific practices

Comment [s2]: Arrange alphabetically

INTRODUCTION

Fishery in India is a very important economic activity and a flourishing sector with varied resources and potentials. India is the 3rd largest fish producing and 2nd largest aquaculture nation in the world after China. Fisheries and aquaculture remain an important source of food, nutrition, employment and income for millions, especially the rural populations. In fact, the sector provides livelihood to about 25 million fishers and fish farmers at the primary level and twice the number along the value chain.

Although inland fisheries and aquaculture have grown in absolute terms, the development in terms of its potential is yet to be realized. The vast inland aquatic resources offer great opportunities for enhanced production along with livelihood development and ushering economic prosperity.

Over the last decade, securing livelihoods has become increasingly recognised as an important component of long-term development. However, in India, small and marginal farmers' land-based livelihoods are increasingly becoming unsustainable, as their land is no longer capable of meeting the needs of the family and fodder for their cattle (Hiremath 2007). As a result, rural households are being forced to seek alternate sources of income. The majority of the respondents diversified their livelihoods in to numerous activities and earned a considerable amount of income from multiple sources (Goutam and Jha, 2022).

Comment [s3]: Put comma

The fisheries sector is also a major source of livelihood for a large section of economically weaker section in the country. Share of agriculture and allied activities in the GDP is constantly declining (Islam et al., 2006) and it has been observed that agriculture sector is gradually diversifying towards high value enterprises including fisheries (Anonymous, 2011).

Comment [s4]: Reference?

The Fishery sector has also been a part of a significant role in various socio-economic development programmes, self-employment, income generation and also in providing nutritional security to every sections of the people. Also, this study will help to bring out extent of adoption of scientific practices in fish farming.

Comment [s5]: Even to vegetarian

MATERIALS AND METHODS

The Telangana state was chosen as the locale of the study. The existing 31 districts of the state were divided into three nearly homogeneous strata (each stratum with a given number of districts 10-10-11) based on climate, rainfall, soil quality, resource spread, intensity and diversity of fisheries and aquaculture activities.

For sampling, two districts from each strata were selected in consultation with the Department of Fisheries. Thus six districts were selected for study. Karimnagar, Kamareddy, Medak, Wanaparthy, Mahabubabad and Yadadri Bhuvanagiri districts were selected. Ten fish farmers were selected from each of the selected districts using simple random sampling technique thus constituting 60 fish farmers. Ex-post facto research design was adopted in this study. The data was collected with the help of pretested interview schedule. The statistical methods and tests such as frequency, percentage, correlation, regression were used for the analysis of data.

In the present study adoption refers to the extent to which a practice on scientific management in fish farming was in use by the respondent at the time of interview. An index was developed to measure the extent of adoption of scientific practices in fish farming.

Comment [s6]: Calculation of relevancy weightage is not development of Index

Selection of indicators and statements

Based on the review of literature and discussions with experts, indicators were identified. The selected indicators and statements would reflect different aspects of adoption by respondents. The Performa containing indicators and respective statements of adoption was given to 30 judges personally and 100 judges by means of google forms for their judgment. The evaluation was obtained from experienced and senior behavioural scientists in the field of Social Science, Extension Education and professionals from the Department of Fisheries. Experts were asked to assess the

relevancy of indicators and statements. The degree of relevancy of each indicator and statement had to be given on a three-point continuum. The comparative scores of 3, 2 and 1 were assigned for the “most relevant” (MR), “relevant” (R) and “not relevant” (NR) responses, respectively. Out of 100 judges, 21 judges had filled the google forms duly recording their judgments in a stipulated span of one month. A total of fifty one responses were found to be appropriate for the item analysis.

Relevancy of indicators and statements

Indicators were subjected to an expert panel of judges to indicate them in three-point continuum ('Most Relevant', 'Relevant' and 'Not Relevant' and scored as 3, 2 and 1 respectively). Appropriateness of each indicator and statement was defined with relevancy weightage (RW), relevancy per cent (RP) and mean relevancy score (MRS), using the following formulae given by Chaudhari *et al.*, (2007).

$$\text{Relevancy Weightage of } i^{\text{th}} \text{ indicator (RW}_i\text{)} = \frac{(\text{MR} \times 3) + (\text{R} \times 2) + (\text{NR} \times 1)}{\text{maximum possible score}}$$

$$\text{Relevancy per cent of } i^{\text{th}} \text{ indicator (RP}_i\text{)} = \frac{(\text{MR} \times 3) + (\text{R} \times 2) + (\text{NR} \times 1)}{\text{maximum possible score}} \times 100$$

$$\text{Mean Relevancy Score of } i^{\text{th}} \text{ indicator (MRS}_i\text{)} = \frac{(\text{MR} \times 3) + (\text{R} \times 2) + (\text{NR} \times 1)}{\text{number of judges responded}}$$

Considering the calculated values, the indicators were screened for their relevancy, having RW of more than 0.75, RP of more than 75.00 per cent and MRS of more than 2.25 was considered. Through the process, final indicators and respective statements were selected and modified as per the opinion of judges. For adoption of scientific practices in fish farming a total of thirty statements concerning different practices/principles of fish farming under six indicators were finally selected.

The responses were elicited on three point continuum viz., full adoption, partial adoption and non-adoption with assigned score of three, two and one respectively. The summated score was worked out by totaling the scores on each of the statements, as adoption score of an individual. Based on the total scores of respondents they were further categorized into high adoption, medium adoption and low adoption categories taking into consideration the quartile deviation.

Table 1. List of Adoption and their criteria

S.No.	Category	Criteria
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Comment [s7]: Relevancy Weightage formula is much before 2007. Even Chaudhari *et al.*, (2007) has not claimed that they have developed this formula

Comment [s8]: A scale for measurement of entrepreneurial behaviour of dairy farmers. Chaudhari *et al.*, (2007). Had developed scale but using the same formula

Comment [s9]:

1.	Low adoption	Below lower quartile (Q ₁) (25 th percentile)
2.	Medium adoption	Between Q ₁ and Q ₃ (25 th &75 th percentile)
3.	High adoption	Above upper quartile (Q ₃) (75 th percentile)

Adoption gap was computed as the difference between maximum obtainable score and obtained score of a practice. [This and it](#) was expressed in percentage- (Yadav, 2012).

RESULTS AND DISCUSSIONS

Adoption of the technology by the fish farmers depends greatly on the feasibility, sustainability, stability, compatibility, divisibility, simplicity, visibility and profitability parameters of the recommended technology. In order to assess the extent of adoption, various recommended practices under pond requirement, cultivable fish species, pre-stocking management, pond management, disease management, harvesting and post-harvesting management were taken into consideration and the responses about their adoption were recorded in a 3 point continuum and analysed. The results and discussion under different sub-heads were presented below.

Table 2. Distribution of fish farmers based on their extent of adoption of scientific practices in fish farming

S.No	Statements	Adoption			Mean	Rank	Gap %
		FA	PA	NA			
i. Pond requirement							
(i)	Having pond size of 0.2 to2 ha	49 (81.67)	11 (18.33)	0 (0.00)	2.7	IV	10.00
(ii)	Maintaining depth of water not more than 5ft	51 (85.00)	9 (15.00)	0 (0.00)	2.8	II	6.67
(iii)	Making bottom of pond sloppy for better drainage	60 (100.00)	0 (0.00)	0 (0.00)	3.0	I	0.00
(iv)	Restricting inflow of water from outside	48 (80.00)	12 (20.00)	0 (0.00)	2.8	II	6.67
(v)	Maintaining pond in good hygienic condition	39 (65.00)	21 (35.00)	0 (0.00)	2.4	V	20.00
ii. Cultivable fish species							
(i)	Using Catla-Rohu-Mrigal at 4:3:3 proportion	43 (71.67)	17 (28.33)	0 (0.00)	2.7	I	10.00
(ii)	Cultivating Grass carp and Silver carp with Common carp	35 (58.33)	19 (31.67)	6 (10.00)	2.5	II	16.67
(iii)	Cultivating prawns with fish	0 (0.00)	6 (10.00)	54 (90.00)	1.1	IV	63.33

(iv)	Pearl cultivation with fish	0 (0.00)	0 (0.00)	60 (100.00)	1.0	V	66.67
(v)	Keeping air breathing fish species with carps	16 (26.67)	9 (15.00)	35 (58.33)	1.7	III	43.33
iii. Pre-stocking management							
(i)	Using mahua oil cake to kill unwanted species	0 (0.00)	0 (0.00)	60 (100.00)	1.0	VI	66.67
(ii)	Using lime @ 2.5 qt/ha per annum	23 (38.33)	37 (61.67)	0 (0.00)	2.4	III	20.00
(iii)	Using cow-dung as organic manure	44 (73.33)	16 (26.67)	0 (0.00)	2.7	I	10.00
(iv)	Growing dhaincha for manures	0 (0.00)	33 (55.00)	27 (45.00)	1.8	V	40.00
(v)	Eradicating predators and unwanted species	11 (18.33)	31 (51.67)	18 (30.00)	1.9	IV	36.67
(vi)	Releasing fingerlings at proper time	51 (85.00)	9 (15.00)	0 (0.00)	2.7	I	10.00
iv. Pond management							
(i)	Maintaining stocking density of 2000 fingerlings/ac of pond.	41 (68.33)	11 (18.33)	8 (13.33)	2.6	III	13.33
(ii)	Applying recommended dose of fertilizers	22 (36.67)	31 (51.67)	7 (11.67)	2.2	IV	26.67
(iii)	Intermediary netting to clear water and regulate fish movement	45 (75.00)	15 (25.00)	0 (0.00)	2.2	IV	26.67
(iv)	Applying lime at proper time and dose	50 (83.33)	10 (16.67)	0 (0.00)	2.7	II	10.00
(v)	Giving supplementary feeds as recommended	54 (90.00)	6 (10.00)	0 (0.00)	2.9	I	3.33
(vi)	Removal of aquatic weeds (manually/mechanically)	0 (0.00)	49 (81.67)	11 (18.33)	1.9	VI	36.67
v. Disease management							
(i)	Applying proper control measures in disease attack	60 (100.00)	0 (0.00)	0 (0.00)	3.0	I	0.00
(ii)	Preventing cattle and human bathing	32 (53.33)	28 (46.67)	0 (0.00)	2.6	III	13.33
(iii)	Keeping pond always clean and in hygienic condition	60 (100.00)	0 (0.00)	0 (0.00)	3.0	I	0.00
vi. Harvesting and Post-harvesting management							
(i)	Harvesting of fish by netting only	43 (71.67)	17 (28.33)	0 (0.00)	2.2	III	26.67
(ii)	Harvesting at proper stage	50 (83.33)	10 (16.67)	0 (0.00)	2.7	II	10.00
(iii)	Freezing the fish after harvest if required	0 (0.00)	19 (31.67)	41 (68.33)	1.3	V	56.67
(iv)	Not harvest the fish by completely draining the water	43 (71.67)	17 (28.33)	0 (0.00)	2.1	IV	30.00

Comment [s10]: Bring in one line

Comment [s11]: Bring in one line

(v)	Disposing fish immediately after harvest	60 (100.00)	0 (0.00)	0 (0.00)	3.0	I	0.00
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i. Adoption of pond requirement

Data from the table.2 revealed that, the practice of “making bottom of pond sloppy for better drainage” was fully adopted by cent per cent of fish farmers followed by “maintaining depth of water not more than 5feet” (85.00%), “having pond size of 0.2 to2 ha” (81.67%), “restricting inflow of water from outside” (80.00%) and “maintaining pond in good hygienic condition” (65.00%).

An adoption gap of 20.00% was found in keeping pond in “good hygienic condition”. This might be due to non-availability of sufficient pond and lack of technical know-how about pond hygiene. Sufficient training should be provided regarding pond hygiene to decrease the adoption gap.

ii. Adoption of cultivable fish species

Table.2 indicated that, 71.67 per cent of the fish farmers had fully adopted “culture of catla-rohu-mrigal at 4:3:3 proportion”. Next to this, 58.33 per cent of fish farmers had fully adopted composite fish culture of “cultivating grass carp and silver carp with common carp”. The percentage of non-adopters in “cultivating prawn with fish”, “pearl cultivation with fish” and “keeping air breathing fish species with carps” were 90.00, 100.00 and 58.33 per cent respectively.

The adoption gap of “pearl cultivation with fish, “cultivating prawn with fish” and “air breathing fish species with carps” were 66.67, 63.33 and 43.33 per cent respectively. The possible reason might be due to complexity of the technology and lack of acquaintance of the technology.

iii. Adoption of pre-stocking management

The data from the table.2, revealed that, the practice of “releasing fingerlings at proper time” and the practice of “using cow dung as organic manure” was fully adopted by 85.00 and 73.33 per cent of fish farmers respectively. This might be due to possession of sound knowledge about timing of release of fingerlings and their protection. The adoption gap of “using mahua oil cake to kill unwanted species” and “growing dhaincha for manures” were 66.67 and 40.00 per cent respectively. Knowledge and skill development about use of these locally available materials can decrease the adoption gap.

iv. Adoption of pond management

It was observed from the table.2. that, majority of the fish farmers (90.00%) had fully adopted the practice of “giving supplementary feeds as recommended” followed by “applying lime at proper

time and dose” (83.33%), “intermediary netting to clear water and regulate fish movement” (75.00%), “maintaining stocking density of 2000 fingerlings per acre of pond” (68.33%) and “applying recommended dose of fertilizers” (36.67%). An adoption gap of 36.67 per cent was observed in “removal of aquatic weeds”. This might be due to lack of awareness and knowledge about the damage caused by aquatic weeds and unavailability of suitable pond conditions.

v. Adoption of disease management

A look in to the table.2 indicated that, cent percent of fish farmers had fully adopted the practices like “applying proper control measures in disease attack” and “keeping pond always clean and in hygienic condition”. While 53.33 per cent had fully adopted the practice of “preventing cattle and human bathing”. The adoption gap of practice “preventing cattle and human bathing” was found to be 13.33 per cent. This happened solely due to social problems.

vi. Adoption of harvesting and Post-harvesting management

Data from the table.2 disclosed that, cent per cent of fish farmers had fully adopted the practice of “disposing fish immediately after harvest” followed by “harvesting at proper stage” (83.33%) while equal per cent of 71.67 had fully adopted the practices “harvesting of fish by netting only” and “not harvesting the fish by completely draining the water”. The two practices had high adoption rate because of sound knowledge about the technology.

About 56.67 per cent gap in adoption of “freezing the fish” was seen. This was due to easy disposal of harvested fish, lack of proper freezing equipment and high cost of the technology.

Further, the respondents were categorized basing on their awareness and adoption behavior relating to all the above mentioned recommended practices which was presented in table 2.

Table 3. Categorisation of fish farmers based on the extent of adoption of overall scientific practices in fish farming

S.No.	Category	Adoption	
		F	%
1.	Low adoption	8	13.34
2.	Medium adoption	29	48.33
3.	High adoption	23	38.33
	Total	60	100

Comment [s12]: Range/ lower quartile score

From the data presented in Table.3, it was apparent that, nearly half (48.33%) had medium level of adoption followed by high (38.33%) and low (13.34%) level respectively.

It is clear from results that, majority of fish farmers had high to medium level of adoption behavior of scientific practices. The possible reason might be that fish farmers were profit oriented who adopt scientific practices for good yield and profits. The fish farmers had medium to high level of economic orientation and innovativeness which might have lead to the above results.

Table 4. Correlation and multiple regression of profile characteristics of fish farmers with adoption of scientific practices in fish farming

**Significant at 0.01 level *Significant at 0.05 level NS- Non-significant

S. No.	Profile characteristics	Adoption of scientific practices			
		Correlation coeff.	Reg Coeff.	SE of Reg Coeff.	't' value
X ₁	Age	0.199	-0.009	0.338	0.027 NS
X ₂	Education	0.071	1.166	0.325	4.978**
X ₃	Occupation	0.707*	0.056	0.304	0.184 NS
X ₄	Fish farming experience	0.770**	0.918	0.348	2.640**
X ₅	Annual income	0.770**	0.890	0.417	2.131*
X ₆	Pond size	0.797**	-2.302	0.759	3.034**
X ₇	Type of pond	0.406	-0.063	0.119	0.532NS
X ₈	Pond ownership	0.745*	0.489	0.256	1.909*
X ₉	Extension contact	0.668*	0.085	0.133	0.643 NS
X ₁₀	Economic motivation	0.797**	2.0311	0.2183	9.65**
X ₁₁	Risk orientation	0.532	-0.0592	0.1295	0.39NS
X ₁₂	Market orientation	0.668*	1.1132	0.5092	2.13*
X ₁₃	Innovativeness	0.816**	0.4299	0.1963	2.26**
	R²			0.841	
	F			21.56**	

Relation between profile characteristics of fish farmers Vs adoption of scientific practices in fish farming

It could be observed from the table.4 that, the variables

such as age (X₁), education (X₂), Type of pond (X₇) and Risk orientation (X₁₁) had no significant relationship with the adoption of scientific practices in fish farming.

Comment [s15]: See orientation
 Comment [s13]: Reason for its non sig correlation. Must explain

Comment [s14]: What was adjusted R2 value

Comment [s16]: But, in regression analysis Edu X2 is highly significant. What is the use of correlation when Regression analysis has been used

The variables occupation (X_3), pond ownership (X_8), extension contact (X_9) and market orientation (X_{12}) had significant relationship at 5 per cent level of significance. While the variables Fish farming experience (X_4), annual income (X_5), Pond size (X_6), Economic motivation (X_{10}) and Innovativeness (X_{13}) shown highly significant relationship at 1 per cent level of significance with the adoption of scientific practices in fish farming.

Extent of contribution of profile characteristics of fish farmers on the adoption of scientific practices in fish farming

A close observation of the table.4 revealed that eight variables viz., education, fish farming experience, annual income, pond size, pond ownership, economic motivation, market orientation and innovativeness were significant in multiple regression analysis.

Further, it may be observed from the table.4 that, 84.1 per cent of the variation in the adoption of scientific practices in fish farming could be explained by all the 13 variables included in the Study. R^2 value of 0.841 with significant 'F' value (21.56**) revealed the significance of regression at 1 per cent level.

CONCLUSION

The study revealed that majority of the fish farmers adopted the recommended practices of scientific fish farming from medium to high extent. The variables like fish farming experience, annual income, Pond size, Economic motivation and innovativeness reflected the strong association and effect with the extent of adoption. Based on the above findings the study recommends the following, to promote large scale adoption of scientific fish farming by fish farmers to increase fish production as well as their socio economic conditions. More number of knowledge building activities like meeting, discussion, mass media etc are to be planned and conducted by fisheries extension personnel to increase knowledge and thereby adoption of scientific fish culture. Economic benefits of scientific fish farming need to be vividly highlighted to convince fish farmers to adopt scientific fish farming practices. Cosmopolite methods and channels like exposure visits, study tours etc need to be organized by the concerned extension agency. More number of younger fish farmers need to be encouraged in training on scientific fish culture practices.

Comment [s17]: How it was concluded form research

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