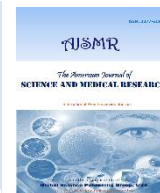




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## Research Article

### Examining the Extent of Knowledge Among Fish Farmers on Composite Fish Culture Practices in Bapatla, Andhra Pradesh, India

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#### ABSTRACT

This research evaluates the understanding of 60 fish farmers in Bapatla District, Andhra Pradesh, regarding composite fish culture practices employing an ex post facto design for the years 2024–25. Findings from a 41-item knowledge assessment revealed that 68.33% of participants possessed medium knowledge, 18.33% had high knowledge, and 13.34% demonstrated low knowledge. The farmers showed proficiency in nutrient management and species selection, achieving scores between 90% and 96.67%, yet exhibited significant deficiencies in their comprehension of pesticide application (30%) and stocking rates (15%). Regression analysis ( $R^2 = 0.6898$ ) indicated that education, social participation, and engagement with extension services were significant predictors of knowledge ( $p < 0.05$ ). It is essential to implement targeted extension programs to bridge these knowledge gaps and promote the sustainable adoption of composite fish culture practices.

## 1. Introduction

Fish serves as an essential food source worldwide, recognized for its high-quality, well-balanced, and easily digestible protein. India's fish production has seen a remarkable increase from 0.75 million metric tonnes (MMT) in 1950–51 to 17.44 MMT in 2023–24, marking a 23-fold rise. Inland fisheries now represent over 75% of total production, a significant increase from 29% in 1950, largely due to the growth of aquaculture (Department of Fisheries, 2025). Freshwater aquaculture accounts for approximately 95% of aquaculture output, enhancing national pond and tank productivity to about 3,000 kg/ha, a notable improvement over the last twenty years attributed to technological advancements (Invest India, 2022). Andhra Pradesh, the foremost fish-producing state, contributed 5.07 MMT in 2022–23, which is 29.10% of India's overall fish production. The state's vast pond and tank resources, spanning 0.62 million hectares, bolster its leadership in freshwater aquaculture and shrimp exports (Statista, 2024; MoFAH&D, 2025). Nevertheless, obstacles such as insufficient access to quality fish seeds, elevated feed costs, and limited implementation of modern farming practices hinder further growth in Andhra Pradesh (Agri Farming, 2024).

Understanding composite fish culture is crucial for its successful implementation. Knowledge influences individual

behavior, and to enhance the adoption of composite fish culture practice in rural areas, it is essential to assess the knowledge levels of fish farmers. This assessment will enable the effective application of knowledge in a manner that is economically viable. In light of these considerations, the current study aims to evaluate the extent of knowledge regarding composite fish culture practices and to investigate the direct and indirect impacts of specific independent variables on this knowledge.

## 2. Materials and Methods

The present study was carried out using an ex post facto research design during the years 2024–25 in the deliberately selected Bapatla District of Andhra Pradesh. A combination of purposive and systematic random sampling techniques was employed. This district was chosen specifically due to its rich and diverse inland fishery resources, which are particularly conducive to the implementation of composite fish practices. From the 18 mandals, Karlapalem, Amruthaluru, and Bapatla were selected for the study based on the notable presence of fish farmers within these populations. Three villages were randomly chosen from each of the three mandals through a simple random sampling method, resulting in a total of 9 villages that collectively formed the study's unit. A detailed list of fish farmers was compiled from these selected villages. The fish farmers in these villages, representing the entire

**Table-1.** Extent of knowledge of fish farmers about specific recommended composite fish practices. (n=60)

| S.No | Knowledge items                                                                                                                                                                                | Response categories |       |                      |       |
|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|-------|----------------------|-------|
|      |                                                                                                                                                                                                | Yes knowledgeable   |       | No not knowledgeable |       |
|      |                                                                                                                                                                                                | f                   | %     | f                    | %     |
| 1.   | What kind of soil is good for fish culture?                                                                                                                                                    | 55                  | 91.67 | 5                    | 8.33  |
| 2.   | What is the minimum depth of water required for fish culture?                                                                                                                                  | 50                  | 83.33 | 10                   | 16.67 |
| 3.   | What are the nutrients required for production of natural fish food organisms in fish pond?                                                                                                    | 45                  | 75    | 15                   | 25    |
| 4.   | Is it necessary to use lime in fish culture?                                                                                                                                                   | 41                  | 68.33 | 19                   | 31.67 |
| 5.   | How do you correct acidic condition of fish culture pond?                                                                                                                                      | 42                  | 70    | 18                   | 30    |
| 6.   | Do you know the recommended dosage of lime used in general?                                                                                                                                    | 40                  | 66.67 | 20                   | 33.33 |
| 7.   | Should we have to manure the fish culture ponds?                                                                                                                                               | 58                  | 96.67 | 2                    | 3.33  |
| 8.   | What are the advantages of manuring fish culture pond?                                                                                                                                         | 58                  | 96.67 | 2                    | 3.33  |
| 9.   | Name some common organic manures used in fish culture                                                                                                                                          | 58                  | 96.67 | 2                    | 3.33  |
| 10.  | Do you know the rate of application of cow dung (including initial dose and subsequent monthly doses)?                                                                                         | 33                  | 55    | 27                   | 45    |
| 11.  | How many days before of stocking of fish seed manure should be applied?                                                                                                                        | 45                  | 75    | 15                   | 25    |
| 12.  | Is it necessary to use inorganic fertilizers in addition to organic manures in fish culture?                                                                                                   | 52                  | 86.67 | 8                    | 13.33 |
| 13.  | What are the advantages of using inorganic fertilizers?                                                                                                                                        | 50                  | 83.33 | 10                   | 16.67 |
| 14.  | Is it necessary to eradicate excess aquatic weeds?                                                                                                                                             | 33                  | 55    | 27                   | 45    |
| 15.  | Name some aquatic weeds?                                                                                                                                                                       | 45                  | 75    | 15                   | 25    |
| 16.  | Do you feel predatory and weed fishes are desirable in fish culture pond?                                                                                                                      | 5                   | 8.33  | 55                   | 91.67 |
| 17.  | Mention any 2 predatory and 2 weed fishes known to you                                                                                                                                         | 51                  | 85    | 9                    | 15    |
| 18.  | What is the manual method of eradication/control of predatory and weed fishes?                                                                                                                 | 41                  | 68.33 | 19                   | 31.67 |
| 19.  | Mention any 2 predatory and 2 weed fishes known to you                                                                                                                                         | 51                  | 85    | 9                    | 15    |
| 20.  | Do you know the recommended dosage of mohua oil cake?                                                                                                                                          | 18                  | 30    | 42                   | 70    |
| 21.  | Name three Indian major carps?                                                                                                                                                                 | 58                  | 96.67 | 2                    | 3.33  |
| 22.  | Name three exotic carps?                                                                                                                                                                       | 51                  | 85    | 9                    | 15    |
| 23.  | Which are the fastest growing major carp and exotic carp?                                                                                                                                      | 50                  | 83.33 | 10                   | 16.67 |
| 24.  | Catla& Silver carp are surface feeders. Rohu is a column feeder.<br>Mrigal feeds on bottom vegetation                                                                                          | 54                  | 90    | 6                    | 10    |
| 25.  | Which fish grows well in weed infested tanks?                                                                                                                                                  | 57                  | 95    | 3                    | 5     |
| 26.  | What is recommended rate of stocking for irrigation tanks when composite fish culture is practiced?                                                                                            | 9                   | 15    | 51                   | 85    |
| 27.  | Do you know he recommended species combination for poly culture?<br>3. spp – 400 C:300 R:300 M (or 300CC)<br>4 spp – 300 C: 250 R: 150M:300CC<br>6 spp-150 C:250 R: 100 M:200 SC: 100GC: 200CC | 18                  | 30    | 42                   | 70    |
| 28.  | What is the ideal size of fish seed for stocking?                                                                                                                                              | 57                  | 95    | 3                    | 5     |
| 29.  | Whether supplementary feeding is necessary in CFC?                                                                                                                                             | 54                  | 90    | 6                    | 10    |
| 30.  | Name the commonly used supplementary feeds?                                                                                                                                                    | 54                  | 90    | 6                    | 10    |
| 31.  | What in the best method of feeding?                                                                                                                                                            | 58                  | 96.67 | 2                    | 3.33  |
| 32.  | Generally supplementary feeding in provide at                                                                                                                                                  | 57                  | 95    | 3                    | 5     |
| 33.  | After stocking. Once in how many days manuring should be done?                                                                                                                                 | 53                  | 88.33 | 7                    | 11.67 |
| 34.  | Do you know the recommended manuring schedule to be practiced after stocking?                                                                                                                  | 52                  | 86.67 | 8                    | 13.33 |
| 35.  | Do you know the indicator of oxygen depletion in fish pond?                                                                                                                                    | 55                  | 91.67 | 5                    | 9.33  |
| 35.  | Do you know the indicator of oxygen depletion in fish pond?                                                                                                                                    | 55                  | 91.67 | 5                    | 9.33  |
| 36.  | Is it necessary to stop manuring and feeding when pond water turns greenish?                                                                                                                   | 58                  | 96.67 | 2                    | 3.33  |
| 37.  | Name any fish disease that occurs in fish culture ponds?                                                                                                                                       | 50                  | 83.33 | 10                   | 16.67 |

....Table-2.

| S.No | Knowledge items                                                                  | Response categories |       |                      |       |
|------|----------------------------------------------------------------------------------|---------------------|-------|----------------------|-------|
|      |                                                                                  | Yes knowledgeable   |       | No not knowledgeable |       |
|      |                                                                                  | f                   | %     | f                    | %     |
| 38.  | How do out control disease out breaks?                                           | 40                  | 66.67 | 20                   | 33.33 |
| 39.  | Is it necessary to check the growth after stocking?                              | 45                  | 75    | 15                   | 25    |
| 40.  | In general, after how many months of stocking the fish crop should be harvested? | 58                  | 96.67 | 2                    | 3.33  |
| 41   | What should be the optimum size of harvesting?                                   | 58                  | 96.67 | 2                    | 3.33  |
| 42   | What in the best method of feeding?                                              | 58                  | 96.67 | 2                    | 3.33  |
| 43.  | Generally supplementary feeding in provide at                                    | 57                  | 95    | 3                    | 5     |

**Table 2.** Multiple regression of knowledge level of fish farmers with independent variable (n=60)

| Sl No           | Independent variables                   | Regression Coefficient (b) | SE of reg. Coefficient (b) | 't' value |
|-----------------|-----------------------------------------|----------------------------|----------------------------|-----------|
|                 | <b>A. Personal variables</b>            |                            |                            |           |
| X <sub>1</sub>  | Age                                     | 0.2050                     | 0.1092                     | 1.878     |
| X <sub>2</sub>  | Education                               | 0.6096                     | 0.7501                     | 2.811     |
| X <sub>3</sub>  | Family type                             | 3.2087                     | 3.7124                     | 2.213     |
| X <sub>4</sub>  | Family size                             | -5.5777                    | 2.7984                     | 1.632     |
| X <sub>5</sub>  | Fish farming experience                 | 0.1282                     | 0.6187                     | 0.207     |
| X <sub>6</sub>  | Occupation status                       | 0.3523                     | 1.1742                     | 0.285     |
|                 | <b>B. Socio economic variables</b>      |                            |                            |           |
| X <sub>7</sub>  | Caste                                   | 0.4357                     | 1.3022                     | 0.366     |
| X <sub>8</sub>  | Social participation                    | 0.1782                     | 0.5898                     | 2.428     |
| X <sub>9</sub>  | Possession of fishing equipments        | 0.1437                     | 0.5348                     | 0.325     |
| X <sub>10</sub> | Size of land holding                    | 1.7123                     | 1.7643                     | 1.689     |
| X <sub>11</sub> | Annual income                           | 0.8713                     | 1.4849                     | 0.587     |
| X <sub>12</sub> | Economic performance                    | 0.0321                     | 0.0499                     | 0.428     |
|                 | <b>C. Psychological variables</b>       |                            |                            |           |
| X <sub>13</sub> | Risk orientation                        | 0.1267                     | 0.2432                     | 0.613     |
| X <sub>14</sub> | Scientific orientation                  | 0.6871                     | 0.4987                     | 1.548     |
| X <sub>15</sub> | Innovative proneness                    | 0.2391                     | 0.2737                     | 0.898     |
|                 | <b>D. Communication variables</b>       |                            |                            |           |
| X <sub>16</sub> | Extension participation                 | 0.2381                     | 0.6742                     | 0.478     |
| X <sub>17</sub> | Extension agency contact                | 0.1876                     | 0.6235                     | 0.342     |
| X <sub>18</sub> | Mass media participation                | 0.3759                     | 0.568                      | 1.471     |
|                 | <b>E. Situational variables</b>         |                            |                            |           |
| X <sub>19</sub> | Size of water body                      | 0.5918                     | 0.8698                     | 0.698     |
| X <sub>20</sub> | Distance of water body to the residence | 0.5636                     | 0.6118                     | 0.989     |
| X <sub>21</sub> | Duration of water availability          | 2.3248                     | 1.0754                     | 3.265     |
| X <sub>22</sub> | Source of water                         | 0.2941                     | 0.8729                     | 0.315     |
| X <sub>23</sub> | Extent of weed infestation              | 2.7701                     | 1.0178                     | 1.9752    |

population, were classified according to their numbers. Fish farmers from each village were selected using a proportionate and simple random sampling approach, leading to a total of 60 fish farmers, with proportionate representation from each village, who participated as respondents in the study. Knowledge was evaluated through a teacher-developed knowledge test comprising 41 questions, where each correct response earned a score of one and each incorrect response received a score of zero. Thus, the maximum possible score for knowledge was 41, while the minimum was zero, and the level of knowledge was determined using the following formula:

Extent of knowledge =  

$$\frac{\text{Number of correct responses}}{\text{Total number of knowledge items}} \times 100$$

Following an extensive examination of pertinent literature and consultations with experts in the field, 23 independent variables that may affect the dependent variables were recognized for the research. These variables encompassed socio-personal, socio-economic, communicational, psychological, and situational traits of the participants, which were assessed empirically using tailored methodologies.

## 1. Results and Discussion

In this study, knowledge was defined as the extent of understood information held by respondents concerning specific recommended composite fish culture practices in the study area.

**Table 3.** Overall knowledge level of fish farmers regarding recommended composite fish practice (n=60)

| S.No | Level of knowledge      | Fish farmers |          |
|------|-------------------------|--------------|----------|
|      |                         | Frequency    | Per cent |
| 1    | Low (up to 66.13)       | 8            | 13.34    |
| 2    | Medium (66.14 to 88.65) | 41           | 68.33    |
| 3    | High (88.66 and above)  | 11           | 18.33    |
|      | Total                   | 60           | 100      |

The findings presented in Table 1 indicate that a significant proportion (68.33%) of fish farmers exhibited a medium level of knowledge, while 18.33% demonstrated a high level of knowledge. Conversely, 13.34% of the fish farmers were found to have a low level of knowledge. These results are consistent with the studies conducted by Goswami et al. (2016), Mahesh Babu et al. (2015), and Sabari Shankar et al. (2014), which similarly reported that most fish farmers possessed a medium level of knowledge regarding fish culture practices.

Fish farmers in the Bapatla District of Andhra Pradesh demonstrated a commendable understanding of nutrient management, with 96.67% recognizing the significance of manuring, its advantages, and the various types of organic manures utilized in fish ponds. This high level of awareness contributes to the maintenance of healthy pond ecosystems and promotes fish growth (Tacon & De Silva, 1997). Almost all farmers (96.67%) were also aware of the importance of monitoring fish growth, selecting the appropriate harvest time, and determining the optimal harvest size, which are crucial for achieving substantial yields (Pillay, 1990). Furthermore, 96.67% were knowledgeable about Indian major carps, 90% understood the feeding behaviors of species such as Catla, Rohu, Mrigal, and Common carp, and 95% were informed about the ideal fish seed size for stocking.

These results underscore a robust understanding of species selection and stocking practices vital for composite fish culture (CFC) (Jhingran, 1991; Kumar Thatipamula et al, 2017). A majority of farmers (91.67%) identified the suitable soil type for fish ponds and recognized the indicators of low oxygen levels, reflecting a solid knowledge of pond preparation and maintenance essential for fish health (Boyd, 1995). However, only 83.33% were aware of fish diseases, and merely 66.67% knew how to manage outbreaks, highlighting the necessity for enhanced training in disease control, which can significantly affect production (Subasinghe, 2005). Knowledge regarding liming was moderate, with 68.33% acknowledging its importance, 70% understanding how to rectify acidic conditions, and 66.67% being aware of the appropriate dosage. Similarly, 86.67% recognized the function of inorganic fertilizers, and 83.33% were aware of their benefits, yet deficiencies in these areas indicate a need for improved education to enhance water quality and productivity (Boyd & Tucker, 1998). Farmers' comprehension of pest and weed control was limited, with only 55% acknowledging the necessity to manage aquatic weeds, and 68.33% knowing manual methods to control predatory and weed fish, despite 91.67% agreeing that these species are detrimental. This reveals a gap in practical control strategies (Helfrich et al., 2009). Only 55% understood the correct application rates for cow dung.

R<sup>2</sup> = 0.6898 F= 5.12 'a' = 2.983d.f: 21,784  
= Significant at 0.05 level of probability

## Multiple regression of knowledge level of fish farmers with independent variable

The regression analysis detailed in the table indicates an R<sup>2</sup> value of 0.6898, suggesting that approximately 68.98% of the variability in the dependent variable can be attributed to the independent variables. The F-value of 5.12, with degrees of freedom (21, 784), confirms the overall statistical significance of the model. This analysis identifies key predictors of effective fish farming practices. Education (X2) demonstrates a significant positive impact, indicating that higher levels of education improve fish farming results (Helfrich et al., 2009). Fish farming experience (X5) shows a marginally significant effect, suggesting a slight positive contribution to productivity (Knud-Hansen, 1998). Social participation (X8) is statistically significant, indicating that increased involvement in social activities enhances fish farming success (Pretty & Ward, 2001). Scientific orientation (X14) is also statistically significant, suggesting that a scientific approach positively affects the dependent variable (Rogers, 2003). Extension participation (X16) reveals a significant effect, highlighting the importance of engagement with extension services for better aquaculture practices (Swanson & Rajalahti, 2010). Participation in mass media (X18) is statistically significant, indicating that exposure to mass media positively affects fish farming outcomes (Chapman & Tripp, 2004). The size of the water body (X19) is significant, suggesting that larger water bodies correlate with improved results (Milstein, 1992). Conversely, variables such as age, family type, family size, occupation status, caste, possession of fishing equipment, land holding size, annual income, economic performance, risk orientation, innovative tendencies, contact with extension agencies, distance from the water body to residence, duration of water availability, water source, and extent of weed infestation exhibited no significant impact (Rico et al., 2012; Boyd & Tucker, 2012; Poojari, et al, 2014; Mamidala et al, 2020).

## Competing interests:

The authors declare that they have no competing interests

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