The Pharma Innovation Journal 2023; SP-12(9): 2265-2269

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; SP-12(9): 2265-2269

www.thepharmajournal.com
Received: 10-06-2023
Accepted: 14-07-2023

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# Socio-economic profile, management practices and economic analysis of village pond aquaculture in Anand district of Gujarat

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**Abstract**
**Background:** India contributes 7.96 percent of the world's total fish production, ranking it as the third-largest fish producer in the world. The fisheries sector plays a vital role in the Indian economy, contributing significantly to foreign exchange earnings. In the financial year 2020-21, India's total fish production reached an estimated 14.73 million metric tonnes (MMT). The marine sector contributed 3.48 MMT, while the inland sector contributed 11.25 MMT. India also ranks second globally in aquaculture, after China.
**Methodology:** The research paper focuses on the descriptive analysis of the status of village pond aquaculture in the Anand district. The objective of the study is to socio-economic profile of fish farmers, the cost of production in fish farming and the problem faced by farmers during fish farming. The research adopts a non-probability convenient sampling method to gather data from 80 farmers in the target area. The data was collected and analysed by using various analytical tools, including tabular analysis, and Garrett's Ranking Technique.
**Results:** The results explored that the most of respondents were middle-aged with education up to SSC. Majority of farmer's ponds holding sizes of 0 to 2 ha and fishing experience was 11 to 20 years. The total cost per ha was estimated at ₹ 1,00,216 and the net income per ha was estimated at ₹61,934. Majority of farmers do not test the pH of pond water and add lime for water filtration. Most of the farmers add two to three inches size fish seeds and harvesting was done after 12 months through contractors. Rice bran and ground nut oil cake were given as fish feeds at every 7-day interval. Majority of farmers faced the poaching problem in the pond and followed by the bad water quality of the pond due to village sewage water and scarcity of water in the dry season.

**Keywords:** Dragnet, fingerlings, fish farmers, poaching, management

## 1. Introduction
Fisheries and aquaculture are one of the fastest-growing sectors in the World [12] and playing an important role in economic development, national income, employment opportunities food and nutritional security, as well as generating livelihood options [8] that's why most traded food items globally is fish [9]. Also, the demand for fish is rising continuously in current times due to more awareness about the health benefits of fish consumption [4].
India currently produces 7.96 percent of the world's fish production, placing it as the third-largest producer in the world [7] due to its potential and the stagnation of fish production in the inland sector as well as capture fisheries in the marine sector [1]. India is second in the world after China in terms of the amount of fish production through aquaculture. The majority (about 75%) of the nation's fish production comes from the inland sector [6].
Gujarat is mostly known for producing marine fish, as indicated by its 1600 km of coastline. The state also covered 3,865 km of rivers and canals, 3.48 lakh ha of reservoirs, 0.22 lakh ha of additional ponds and tanks, 0.22 lakh ha of estuary region, and 3.76 lakh ha of brackish water [5]. In Gujarat, Freshwater aquaculture is mainly focused on village ponds. The state has 6860 village ponds comprising an area of 0.22 lakh ha and accounting up to 9 percent of the inland fish production of the state [2] and producing an average of less than 1 ton of fish/ ha of village ponds [3].
Anand district of Gujarati state is a hub for fish farming and presently ranks first in terms of village pond fish production. In the district, village ponds fishing activity occurred in 329 ponds of 166 villages [10].

## 2. Materials and Methods

### 2. Methodology

The study entitled "Status of village pond aquaculture in Anand district" includes interviewing respondents using a Semi-Structured schedule and analyzing their responses with the help of Analytical tools. The research covered all the taluka of the Anand district of Gujarat.

### 2.1 Source of data

- Primary data were collected from respondents using the help of a Semi-Structured schedule to meet the objective of the study.
- Secondary data were collected from different websites, annual reports and government sources.

**Table 1:** Source of data

| Type of Research | Descriptive research |
|---|---|
| Sampling method | Non-Probability sampling |
| Sampling technique | Purposive Sampling Technique |
| Sampling unit | Fish farmer |
| Sampling size | 80 |
| Sampling area | Anand district |
| Research instrument | Semi-Structured schedule |
| Analytical tools | Average, Frequency, Percentage, Tabular analysis, Garrett Ranking |

#### 2.1.1 Cost of Production

The cost incurred for fingerling, feed, water pump fuel, labour, lime, pest or disease control and harvesting were considered variable costs. Whereas the expenses on the pond leased, water pump, boat, dragnet cost, pond repairing, and security were included under fixed cost. The total cost (TC) of production was calculated by summing the total variable cost (TVC) and total fixed cost (TFC) incurred in the production process. Gross return (GR) was calculated by multiplying the Quantity of fish produced with Price per unit. Net return (NR) was calculated by deducting total cost (TC) from gross return (GR). [11]

#### 2.1.2 Garret Ranking Technique

Garrett's Ranking technique was applied to study the problem faced by fish farmers. The main benefit of this method over the simple frequency distribution is that issues are classified according to respondents' perceptions of their severity. The orders of merit given by the respondents were converted into a rank by using a formula. To find out the most significant factor which influence the respondents, Garrett's Ranking technique was used. According to this method, respondents were asked to rate all of the problems, and the results of their rankings were translated into score values using the following formula:

Percent position = 100 (Rij – 0.5)/ Nj

Where,

$R_{ij}$ = Rank given for the $i^{th}$ variable by $j^{th}$ respondents.

$N_j$ = Number of variables ranked by $j^{th}$ respondents.

### 2.2 Objectives

- To study the socio-economic profile of farmers
- To study the economics of village pond aquaculture
- To identify management practices followed by fish farmers
- To identify problems faced by fish farmers

## 3. Result and Discussions

**Objective 1:** To study the socio-economic profile of farmers

### 3.1 Age of Fish Farmers

**Table 2:** Age of Fish Farmers

| Sr. No. | Age (Year) | Frequency (n) | Percentage (%) |
|---|---|---|---|
| 1. | 30-40 Years | 13 | 16.25 |
| 2. | 41-50 Years | 33 | 41.25 |
| 3. | Above 50 Years | 34 | 42.50 |
| | Total | 80 | 100 |

Age of the farmer plays important role in any decision-making process, method of farming and use of inputs in fish farming. Table 2 shows that 16.25 percent farmers were between the age group of 30-40 years, 41.25 percent farmers were between the age group of 41-50 years and 42.50 percent farmers were between the age group of above 50 years. The results revealed that majority of the farmers belongs to above 50 years age group indicating that older age farmers prefer fish farming as compared to middle and young age farmers.

### 3.2 Education Qualification of Fish Farmers

**Table 3:** Education Qualifications of Fish Farmers

| Sr. No. | Qualification | Frequency (n) | Percentage (%) |
|---|---|---|---|
| 1 | Below SSC | 49 | 61.25 |
| 2 | SSC | 21 | 26.25 |
| 3 | HSC | 6 | 7.50 |
| 4 | Graduate | 4 | 5.00 |
| | Total | 80 | 100 |

Table 3 shows the education status of fish farmers. The table presents that 61.25 percent farmers were having below SSC level education followed by 26.25 percent farmers having SSC level education, 7.50 percent farmers having HSC level education and 5.00 percent farmers were graduate. This implies that most of the fish farmers were having low level of education.

### 3.3 Size of Pond Holding

**Table 4:** Size of Pond Holding

| Sr. No. | Pond Size (Ha) | No. of Farmers (n) | Percentage (%) |
|---|---|---|---|
| 1 | 0.00-2.00 | 36 | 45.00 |
| 2 | 2.01-4.00 | 19 | 23.75 |
| 3 | 4.01-6.00 | 13 | 16.25 |
| 4 | 6.01-10.00 | 8 | 10.00 |
| 5 | Above 10.00 | 4 | 5.00 |
| | Total | 80 | 100 |

Table 4 exhibits that 45 percent farmers have pond sizes of 0.00 to 2.00 ha, followed by 23.75 percent farmers have pond sizes of 2.01 to 4.00 ha, 16.25 percent farmers have pond sizes of 4.01 to 6.00 ha, 10.00 percent farmers have pond sizes of 6.01 to 10.00 ha and 5.00 percent farmers have pond size of above 10 ha. This indicates that majority of the farmers having lower size of pond holding. The reason might be that due to lower availability and lack of credit availability majority of the farmers might not bear the initial fixed investment cost.

### 3.4 Fish Farming Experience of Farmers

**Table 5:** Fish Farming Experience of Farmers

| Sr. No. | Fishing Experience (years) | Frequency | Percentage (%) |
|---|---|---|---|
| 1 | 0-10 Years | 20 | 25.00 |
| 2 | 11-20 Years | 30 | 37.50 |
| 3 | 21-30 Years | 12 | 15.00 |
| 4 | Above 30 Years | 18 | 22.50 |
| | Total | 80 | 100 |

Table 5 reveals that 25.00 percent farmers had 0 to 10 years of fishing experience, however, 37.50 percent farmers had 11 to 20 years, 15.00 farmers had 21 to 30 years, and 22.50 percent farmers have more than 30 years of fishing experience in the study area. The results revealed that majority of the farmers in the study area were having 11 to 20 years of experience. This might be reason the majority of the farmers are of higher age group so ultimately they were having more (more than 10 years) experience.

### 3.5 Gender Distribution of the Fish Farmers

**Table 6:** Gender Distribution

| Sr. No. | Gender | Frequency | Percentage (%) |
|---|---|---|---|
| 1 | Male | 65 | 81.25 |
| 2 | Female | 15 | 18.75 |
| | Total | 80 | 100 |

Table 6 reveals that 65 farmers belong to the male category while 15 farmers belong to the female category.

**Objective 2:** To study the economics of village pond aquaculture

### 3.6 Economic Analysis of Fish Production in Study Area

**Table 7:** Cost of Fish Production

| Particulars | Cost/ha/year | Percentage (%) |
|---|---|---|
| **Fixed Cost item** | | |
| Leased | 23,845 | 23.79 |
| Water pump (Depreciation) | 25 | 0.03 |
| Boat (Depreciation) | 538 | 0.54 |
| Dragnet (Depreciation) | 65 | 0.06 |
| Security | 8,714 | 8.70 |
| Pond repairing | 3,454 | 3.45 |
| **TFC** | 36,641 | 36.56 |
| **Variable Cost item** | | |
| Fingerlings | 39252 | 39.17 |
| Feed | 11770 | 11.74 |
| Manuring | 898 | 0.90 |
| Water pump fuel | 3949 | 3.94 |
| Labour | 114 | 0.11 |
| Lime | 1138 | 1.14 |
| Pest/Disease Control | 2924 | 2.92 |
| Harvesting | 3530 | 3.52 |
| TVC | 63,575 | 63.44 |
| Total Cost | 1,00,216 | 100 |

Table 7 shows the estimate of cost and net income from fish farming using the total cost (fixed and variable cost) and yield data obtained from the survey. The cost analysis revealed that the fixed cost account for the smallest proportion (36.56%) of the total cost. The fixed cost of production consists of leased, water pump, boat, dragnet, security, and pond repairing. Among all the fixed cost, leased value of pond was highest (23.79%) followed by security cost which accounts 8.70 percent of total cost and pond repairing cost which account 3.45 percent of total cost. The variable cost of production consists of fingerlings, feed, manuring, water pump fuel, labour, lime, pest/disease control and harvesting, which accounted for the largest proportion (63.44%) of the total cost. Fingerlings cost was higher among all the variable cost accounting 39.17 percent of total cost followed by feed cost (11.74%), water pump fuel cost (3.94%) and harvesting cost (3.52%). This implies that among all cost's fingerlings cost and leased in cost was higher.

**Table 8:** Return of Fish Production

| Particulars | Cost |
|---|---|
| Average yield (kg/ha) | 1410 |
| Average price (₹/ha) | 115 |
| Gross income (₹/ha) | 1,62,150 |
| Cost of cultivation (₹/ha) | 1,00,216 |
| Net income (₹/ha) | 61,934 |

Table 8 shows that the overall yield recorded was 1410 kg/ha and the average price of fish was found to be ₹ 115 per kg. The overall gross income was ₹ 1,62,150 per ha, while the net income was ₹ 61,934 per ha. This implies that fish farming gave the higher return as compared to others so there is need to encourage the fish farming and spread awareness regarding it so more farmers can be benefited from it.

**Objective 3:** To identify management practices followed by fish farmers

### 3.7 Parameter Used for Water Quality Management

**Table 9:** Parameter used for Water quality management

| Particulars | Frequency | Percentage (%) |
|---|---|---|
| pH | 16 | 20.00 |
| None of this | 64 | 80.00 |
| Total | 80 | 100 |

Water quality management is important aspect in fish farming as quality of the water directly affect the fish production. Table 9 indicates that 20.00 percent farmers test the water pH for water quality management and 80.00 percent farmers did not use any parameter for water quality management. Here, the results revealed that majority of the farmers were not testing pH of water for their water quality aspects. The reason might be that farmers were not aware about the water testing or they might not have facility for water testing or they might using other product for water quality management.

### 3.8 Add Lime for Water Quality Management

**Table 10:** Add lime for Water quality management

| Particulars | Frequency | Percentage (%) |
|---|---|---|
| Add lime | 66 | 82.50 |
| Not add lime | 14 | 17.50 |
| Total | 80 | 100 |

Table 11 reveals that 82.50 percent farmers were adding lime for water quality improvement while 17.50 percent farmers do not use lime for water quality improvement. As mentioned above that water quality is the important parameter, but majority of the farmers were not testing pH of their water so

the reason might be that majority of the farmers of study area add lime for water quality management so they are not performing water testing.

### 3.9 Different Sizes of Fish Seed Used by Farmers

**Table 12:** Different sizes of fish seed used by farmers

| Fish seed size | Frequency | Percentage (%) |
|---|---|---|
| 2 inches | 25 | 32.25 |
| 3 inches | 30 | 37.50 |
| 50 gm | 19 | 23.75 |
| 100 gm | 6 | 7.50 |
| Total | 80 | 100 |

Table 12 shows that 32.25 percent farmers used 2-inches size fingerling while 37.50 percent farmers used 3-inches size fingerling, 23.75 percent farmers used 50 gm size fingerling and 7.50 percent farmers used 100 gm size fingerling. The results revealed that majority of the farmers were using 3 inches seed.

### 3.10 Different Fish Feeds Used by Farmers

**Table 13:** Different Fish feeds used by Farmers

| Fish feeds | Frequency | Percentage (%) |
|---|---|---|
| Rice bran & Ground nut oilcake | 41 | 51.25 |
| Rice bran & food wastage | 28 | 35.00 |
| Sorghum flour | 5 | 6.25 |
| Phytoplankton & Zooplankton micro-organisms | 2 | 2.50 |
| None of this | 4 | 5.00 |
| Total | 80 | 100 |

Table 13 indicates that 51.25 percent farmers were using rice bran & ground nut oil cake as fish feed while 35.00 percent farmers were using rice bran & food wastage, 6.25 percent farmers were using sorghum flour, 2.50 percent farmers were using Phytoplankton & Zooplankton micro-organisms and 5.00 percent farmers hadn't used any fish feed. This implies that majority of the farmers were using rice bran and ground nut oil cake as fish feed.

### 3.11 Frequency of Fish Feed Application

**Table 14:** Frequency of fish feed application

| Particulars | Frequency | Percentage (%) |
|---|---|---|
| 7 days | 46 | 57.50 |
| 10 days | 28 | 35.00 |
| 15 days | 2 | 2.50 |
| Not using feeds | 4 | 5.00 |
| Total | 80 | 100 |

Table 14 exhibits that 57.50 percent farmers gave fish feed at 7-days intervals while 35.00 percent farmers gave fish feed at 10-days intervals, 2.50 percent farmers gave fish feed at 15-days intervals and 5.00 percent farmers were not giving any feed.

### 3.12 Production Cycle Followed by Farmers

**Table 15:** Production cycle followed by farmers

| Production cycle | Frequency | Percentage (%) |
|---|---|---|
| 12 months | 62 | 77.50 |
| 11 months | 9 | 11.25 |
| 10 months | 6 | 7.50 |
| 7 months | 3 | 3.75 |
| Total | 80 | 100 |

Table 15 indicates that 62 farmers followed 12 months production cycle, 9 farmers followed 11 months production cycle, 6 farmers followed 10 months production cycle and 3 farmers followed 7 months production cycle.

### 3.13 Harvesting Arrangement by Farmers

**Table 16:** Harvesting arrangement by farmers

| Particulars | Frequency | Percentage (%) |
|---|---|---|
| Contractor | 78 | 97.50 |
| Own | 1 | 1.25 |
| Labour | 1 | 1.25 |
| Total | 80 | 100 |

Table 16 shows that 78 farmers completed their harvesting by contractor, 1 farmer completed their fish harvesting by labour and 1 farmer harvested their fish by himself.

### 3.14 Different Modes of Fish Marketing

**Table 17:** Different mode of fish marketing

| Particulars | Frequency | Percentage (%) |
|---|---|---|
| Wholesaler | 54 | 67.50 |
| Retailer | 24 | 30.00 |
| Local level | 2 | 2.50 |
| Total | 80 | 100 |

Table 17 indicates that 54 farmers sold their fish to wholesalers followed by 24 farmers sold their fish to retailers and 2 farmers sold their fish at local level.

**Objective 4:** To identify problems faced by fish farmers

### 3.15 Problems Faced by Fish Farmers

**Table 18:** Problems Faced by fish farmers

| Particulars | Mean score | Rank |
|---|---|---|
| Poaching | 80.36 | 1 |
| Bad water quality | 58.31 | 2 |
| Scarcity of water in the dry season | 57.14 | 3 |
| Diseases | 46.30 | 4 |
| Lack of technical knowledge | 45.60 | 5 |
| High cost of feed | 45.18 | 6 |
| Inadequate supply of quality fish seed | 44.14 | 7 |
| Labour shortage | 42.71 | 8 |
| Lack of training | 38.54 | 9 |
| Higher interest on a loan | 37.73 | 10 |

Table 18 presents that 80.36 percent of the sampled fish farmers in the survey area were facing the problem of poaching, while 56.31 percent were facing problems of bad water quality of the pond due to sewage. The analysis also revealed that 57.14 percent of the respondents were facing a problem of scarcity of culture water in the dry season. The table also indicates that 46.30 percent of the respondents were facing diseases problem in ponds and 45.60 percent of farmers had problems of lack of technical knowledge in village pond fish farming. The respondents were also facing a problem of the high cost of feed, Inadequate supply of quality fish seed, labour shortage, lack of training, and a higher rate of interest on loans.

## 4. Conclusions

The study concluded that the majority of fish farmers' respondents were middle-aged with no education or with up to SSC. The majority of fish farmers have experience of 11 to 20 years in fish farming and with pond sizes of 0 to 2 ha. The analysis of costs and return per hectare indicates that fish farming yields a net income was ₹61,934. The majority of farmers didn't test the pH of pond water and added lime for water filtration. Furthermore, variations were observed in fingerling size and fish feed types used by farmers. Most of the farmers followed a 12-month production cycle and sold their fish to wholesalers. Problems faced by farmers include poaching, water quality issues, scarcity of water, diseases, and inadequate technical knowledge.

## 5. Suggestions

- Water quality management: Create awareness among farmers for regularly testing the pH of pond water for better management
- Fingerling selection: Promote the use of larger-sized fingerlings (3 inches or above) for better growth and survival rates.
- Fish feed optimization: Encourage farmers to diversify fish feed sources, provide information on balanced feeding practices, and explore the use of natural feed sources like phytoplankton or zooplankton microorganisms.

## 6. Acknowledgement

The authors are thankfully acknowledging IWMI-TATA Water Policy Research Program (ITP) and all others who have directly and indirectly contributed to conducting this study.

**7. Funding Information:** Authors have no known competing financial interests OR non-financial interests OR personal relationships that could have appeared to influence the work reported in this paper.

**8. Ethical Approval:** No there is no any kind of ethical issues involved like etiquette, fraudulent publication, plagiarism, duplicate publication, author- ship, and potential for conflict of interest.

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