

Extent of adoption of pisciculture technology in Jagatsinghpur district of Odisha

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ADM. NO.- 10EE/14



**DEPARTMENT OF EXTENSION EDUCATION
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technology in Jagatsinghpur district of Odisha**

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Jagatsinghpur district of Odisha**

**A
THESIS SUBMITTED TO THE
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**IN
AGRICULTURE (EXTENSION EDUCATION)**

**BY
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CERTIFICATE-I

This is to certify that the thesis entitled “**Extent of adoption of pisciculture technology in Jagatsinghpur district of Odisha**” submitted in partial fulfilment of requirements for the award of the degree of **Master of Science in Agriculture (Extension Education)** to the **Orissa University of Agriculture and Technology, Bhubaneswar**, is a faithful record of bonafide and original research work carried out by **Santosh Kumar Giri** under my guidance and supervision. No part of this has been submitted for any other degree/diploma.

It is further certified that the assistance and help received by him from various sources during the course of investigation has been duly acknowledged.

CHAIRMAN

ADVISORY COMMITTEE



CERTIFICATE-II

This is to certify that the thesis entitled “**Extent of adoption of pisciculture technology in Jagatsinghpur district of Odisha**” submitted by **Santosh Kumar Giritto** the **Orissa University of Agriculture and Technology, Bhubaneswar**, in partial fulfilment of the requirements for the degree of **Master of Science in Agriculture (Extension Education)** has been approved/ disapproved by the students’ advisory committee and the external examiner.

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(Santosh Kumar Giri)

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ABBREVIATIONS USED

ADF: Assistant Director of Fisheries

ATMA: Agricultural Technology Management Agency

BFDA: Brackish water Fisheries Development Agency

EUS: Epizootic Ulcerative Syndrome

f: Frequency

FAO: Food and Agriculture Organization

FEO: Fishery Extension Officer

FFDA: Fish Farmers Development Agency

Ft: Foot

GoK: Government of Kenya

GP: Gram Panchayat

ha: Hectare

KVK: Krishi Vigya Kendra

mm:Mili Meter

MT: Million Tonne

NAC: Notified Area Council

NGO: Non-Government organization

NS: Non Significant

OBC: Other Backward Class

ROR: Record Of Right

Rs.: Rupees

S.D: Standard Deviation

SC: Scheduled Caste

Sl. No.: Serial Number

Sl.: Serial

ST: Scheduled Tribe

TV: Television

VAW: Village Agriculture Worker

ABSTRACT

The study titled “Extent of adoption of pisciculture technology in Jagatsinghpur district of Odisha” was undertaken in Erasama, Sailo and Tirtol blocks of Jagatsinghpur district with the objectives of studying the socio-economic attributes, the knowledge level of farmers about pisciculture, the extent of adoption of pisciculture technology by the fish farmers, and the constraints in adoption of pisciculture and suggestions to overcome it. The number of respondents for this study were 120 fish growers. The data were collected through a pre-tested structured interview schedule with appropriate statistical measures for analysis and interpretation of the data. The major findings of the study revealed that 60.83% of the fish farmers belonged to middle age group, 49.16% of fish farmers received high school and above education, 90.83% of respondents belonged to marginal and small farmer category, 75.83% fish farmers had more than 10 years of experience in fish farming and 40% of respondents had annual income of Rs.1,20,000 and above. About 70.83% of fish growers had good knowledge on requirement of water filling to compensate the water loss due to seepage and evaporation, 71.67% fish farmers had better knowledge about desirable yield from one hectare pond in a year. About 85.83% of the respondents were having moderate level of knowledge followed by 14.17% respondents acquiring low level of knowledge on all the practices of pisciculture technology that were taken into consideration for the study; only 8.33% respondents had high level of knowledge. The extent of adoption by majority of the fish farmers was medium i.e. 73.33%. Only 5.83% respondents were high adopters indicating that they were putting all the recommended practices into action. The study revealed that farm size, house type, pond size, extension contact, information source use and knowledge level had significant and positive relationship with the adoption of various pisciculture technologies. Inadequate supply of farm publications in local language, lack of demonstration, lack of mass media, lack of training facility were the major extension constraints perceived by the respondents. The study as a whole indicated that fish farming is perceived as one of the profitable and feasible enterprise in the study area. The fish farmers were having good knowledge about fish farming and adopting recommended practices successfully.

INTRODUCTION

Fishing in India is a major industry in its coastal states, employing over 14 million people. Fish production has increased more than tenfold since independence in 1947. According to the Food and Agriculture Organization (FAO) of the United Nations, fish output in India doubled between 1990 and 2010. India has 7517 kilometres of marine coastline, 3,827 fishing villages, and 1,914 traditional fish landing centres. India's fresh water resources consist of 195,210 kilometres of rivers and canals, 2.9 million hectares of minor and major reservoirs, 2.4 million hectares of ponds and lakes, and about 0.8 million hectares of flood plain wetlands and water bodies. As of 2010, the marine and freshwater resources offered a combined sustainable catch fishing potential of over 4 million metric tonnes of fish.

Odisha is one of the major maritime states of India, offering vast scope for development of inland, brackish water and marine fisheries. The state's 480 km long coastline with 24,000 sq. km area within the continental shelf has ample potential for marine fisheries development. Freshwater resources of the state are estimated to be 6.76 lakh ha comprising 1.25 lakh ha of tanks/ponds, 2 lakh ha of reservoirs, 1.80 lakh ha of lakes, swamps & jhils and 1.71 lakh hectares of rivers and canals. The state's brackish water resources are of the order of 4.18 lakh ha with a breakup of 0.79 lakh ha of Chilika Lake, 2.98 lakh ha of estuaries, 32,587 ha of brackish water area and 8,100 ha of backwaters.

Odisha has achieved a record growth of around 13 per cent in fish production during 2014-15 with total production of 467076 MT against the total production of 413889 MT last year.

The fish farmers of Odisha are faced with low levels of literacy and relatively high levels of debt. This calls for a paradigm shift in the way fisheries is regulated and managed. The challenge, in this context, is to develop a long term strategic plan allowing for the balanced and sustainable management and development of the fishery sector.

Scope and importance of study

Pisciculture is not a new subject for the scientists, researchers, extension functionaries of the line departments but the newness is in its different components and

their adoption by the end users. The volume of information being disseminated and the information being used by fish growers, is the matter of concern. Despite the efforts made by various organisations to transfer fish culture technology, it is observed that farmers are operating mostly in subsistence level. In the district of Jagatsinghpur, a large number of individual and community owned ponds exist in each village where pisciculture is undertaken as an allied enterprise along with paddy cultivation.

As the district is bounded by 80 km coastline and has vast inland water resources of 1563.28 ha in 8 blocks, it has ample scope of development of inland, brackish water fisheries as well as marine fisheries. The Fish Farmers Development Agency (FFDA) and Brackish water Fisheries Development Agency (BFDA) have been working in the district under the chairmanship of the Collector and District Magistrate, Jagatsinghpur for development of inland and brackish water fisheries aiming at enhancement of fish and shrimp production respectively. The District Fisheries Officer, Jagatsinghpur is working as the chief executive officer of both the Agencies. The office of the Asst. Director of Fisheries (Marine) is functioning at Kujanga for enhancement of marine fish production. The Krishi Vigya Kendra (KVK) is situated at Nimakana, Manijanga, which is almost found at centre of the district. It is natural that KVK adjacent villages would adopt pisciculture technologies in an organised manner. Thus the findings of the study would be of vital help in designing the appropriate strategy for diffusion and adoption of improved pisciculture practices. Hence, the study has its own scope and importance for the farming communities of Odisha state.

Therefore, the present study titled “**Extent of adoption of pisciculture technology in Jagatsinghpur district of Odisha**” is undertaken by the researcher to record the impact of technology in augmenting the fish production in the rural areas and the gap between the technology recommendation and its ultimate adoption at farmers’ level. All possible aspects of pisciculture were taken into consideration for arriving at conclusion and recommendations. The finding can help to a great extent the policy makers, planners and the implementing agencies for development and modification of suitable pisciculture programmes and provide necessary feedback to the scientists/researchers for further refinement of the technology.

With this background, the following specific objectives were set for the research study.

Specific objectives

1. To study the socio-economic attributes of fish growers of Jagatsinghpur.
2. To assess the knowledge level of farmers about pisciculture in the district.
3. To find out the extent of adoption of pisciculture technology in the district.
4. To identify the constraints in adoption of pisciculture and suggestions to overcome it.

Limitation of the Study

The scope of the study is limited due to following constraints.

1. Since the study has been conducted in the KVK adjacent villages of the district, its findings & recommendations should not be generalized beyond the limits.
2. The study is proposed as a part of the course programme for which sufficient attention could not be given towards its soundness.
3. The findings of the study were based on the abilities of respondents to recall their memories on the verbal opinion expressed by them. Hence, the objective of the study is limited to the frank and fair opinion of the farmers of the study area in furnishing the required information.

Organisation of the Thesis

The thesis follows the normal pattern having the chapters like introduction, review of literatures, research methodology, results and discussion, summary and conclusion, references with necessary appendices.

REVIEW OF LITERATURES

Objective - 1: Socio-economic attributes of fish growers

Edwards (2000) reported that direct benefits from rural integrated aquaculture, besides increased household nutrition and income are local availability of fresh fish and the provision of employment for household members.

Saha and De (2001) observed that (i) fish farmers mostly belong to young (20.6%) and middle age category (44.1%) with average age of 45 (ii) mean size of family was found to be 7 and 62% of the farmers are having family consisting of 5-7 members.

Lalrinsanga and Shyam (2005) reported that the fisheries practices in the North-Eastern states of India continued to be traditional due to illiteracy and absence of interface with developed technologies.

Gabriel *et.al.* (2007) opined that integrated fish farming system contributes to the economic empowerment of many families especially in the rural communities, enabling the farmers to be productive all year round and to fully maximize its production.

Chenyambuga *et.al.* (2011) reported that the majority of fish farmers belong in an active working group of age between 25 to 50 years.

Smith and Yoshida (2011) stated that a further benefit of the products produced in the integrated poultry-fish farming system is the additional income, which enables the farmer to buy other foodstuffs which are not being produced by the family thus further increasing access to food, raising the standard of nutrition and ensuring a secure food supply for all members of the family.

Objective - 2: Knowledge level of farmers about pisciculture

Islam (1996) inferred that many farmers in Bangladesh were found to use kura, the red powdery coating of rice under the husk as feed. Other food sources include cow dung, poultry waste, choker (the remains of wheat grains) obtained after the extraction of aata and oil cake.

Little and Edwards (2003) stated that much of the fish manure includes manures obtained from off-farm and transported in bags, e.g. poultry manure, or as a slurry in tanks, such as for pig and large ruminant manure.

Osuji *et.al.* (2003) emphasised that cyanobacterial bloom is undesirable in aquatic ponds because they are relatively poor aquatic food base; they are poor oxygenators of pond waters with undesirable growth habits and some species produce odorous metabolites.

Anjani Kumar *et.al.* (2004) studied that technical efficiency of fish farmers in Uttar Pradesh which revealed that the large-sized fish farmers were more efficient in utilizing the resources than small ones. They also reported that experience, training and access to infrastructure affect technical efficiency significantly.

Kalitha *et.al.* (2004) indicated that application of a paste of turmeric powder and ash of hay or bamboo to control EUS has been practiced by fish farmers in Assam and some farmers even apply branches of Neem plant into fish ponds.

Saha *et.al.* (2008) reviewed that there are remarkable achievements of FFDA's in Orissa, in respect of increased fish production from tanks and ponds.

Adinya, Offem, and Ikpi (2011) reported that fish-farming requires basic as well as specialised training such as, pond management, feed production, fingerling selection and water management.

Kawarazuka & Bene (2011) found that fishes have high nutritional value (particularly small fish) in terms of micronutrients (bioavailable calcium, vitamin A, iron and zinc), and the potential effective contribution that fish can offer in principle to address multiple micronutrient deficiencies in developing countries.

Objective - 3: Extent of adoption of pisciculture technology

Swathilekshmi *et.al.* (2005) reported that variables such as information seeking behaviour, credit orientation and material possession explained 48% of the variation in the extent of adoption by shrimp farmers of Nellore, Andhra Pradesh and variables like extension contact, risk orientation, farming experience, type of ownership, annual income and material possession explained 84% of the variation in the extent of adoption by shrimp farmers of Nagapattinam, Tamil Nadu.

Nandeasha and Edwards (2007) reported that in many countries of the world, the adaptation of indigenous technologies has resulted in the development of sustainable

and environmentally friendly aquaculture practices and hence helped the farmers to increase aquaculture production during the past decade.

Ike and Onuegbu (2007) attempted to improve the aquaculture technology package for Nigerian farmers and found that the level of adoption of the technology was low because they did not have adequate funds to maintain the technology.

OBJ-4: Constraints in adoption of pisciculture

Srivastava (1999) reported that marketing is the most essential and important link in the success of aquaculture, but it is the most neglected activity.

Saha and De (2001) reported that feed related problem are the most common constraints along with non-availability of quality seed, poor technical skill, marketing, social issues and credit problems those limits adoption of scientific carp culture technology.

Olaoye (2010) reported that some of the problems faced by small scale fish producers in Nigeria were innovation adoption, inadequate research and extension, high cost of fish feed, post-harvest losses due to poor handling, processing, preservation and storage technologies, fish seed, lack of credit and insurance cover for fisheries enterprises.

Quagraine, Ngugi and Amisah (2010) found in their study about small-scale fish farmers in Kenya that the level of credit use in fish farming is very low even though the GoK encourages aquaculture development by offering credit facilities through the government agricultural finance institution, Agriculture Finance Corporation.

Ashley-Dejo (2012) mentioned that an effective extension service delivery is an essential factor for the accelerated development of agriculture in developing countries.

RESEARCH METHODOLOGY

This chapter deals with the methods and systematic procedures followed by the investigator during the course of investigation. The methodological details have been described under the following major headings:

1. Selection of problem
2. Hypothesis of study
3. Research design
4. Location of study
5. Sampling procedure
 - (i) Selection of district
 - (ii) Selection of block
 - (iii) Selection of panchayat
 - (iv) Selection of respondents
6. Tools and techniques for data collection
 - (i) Pilot study
 - (ii) Development of interview schedule
 - (iii) Pre-testing the interview schedule
 - (iv) Rapport building with farmers
 - (v) Collection of information
7. Selection of variables
8. Operationalization and measurement of variables
9. Statistical analysis of data

3.1: Selection of problem

The most important in behavioural research is selection, delineation, and conceptualization of the problem. Hence while selecting the research topic “Extent of adoption of pisciculture technology in Jagatsinghpur district of Odisha”, proper attention has been given to various factors like socio-economic profile, source of information utilization behaviour, knowledge level, adoption level, adoption gap and constraints perceived by the respondents on pisciculture technology related to the objectives. Considering the stipulated time period, area of investigation, sample size,

methods of analysis of data, pretesting of schedules etc., and a detailed plan of work was formulated at pre-survey stage.

3.2: Hypothesis of study

Null hypothesis-

H₀: There is no significant relation between the socio-economic attributes of fish farmers and adoption level of pisciculture technologies.

Alternate hypothesis-

H₁: There is a significant relation between the socio-economic attributes of fish farmers and adoption level of pisciculture technologies.

3.3: Research design

The present research study was formulated on the basis of ex-post- facto approach. Accordingly, specific objectives were formulated to provide the basis of enquiry. Multi-stage random sampling procedure was employed. The district and blocks were selected purposively while the GPs and respondents were selected basing on disproportionate random sampling method. The study was then carried out in the light of set objectives and under the framework of the adopted outline.

3.4: Location of study

3.4.1: Odisha state

The present study was conducted in the state of Odisha which lies between the latitudes 17.78⁰N and 22.73⁰N, and between longitudes 81.37⁰E and 87.53⁰E. The state has an area of 155,707 km², which is 4.87% of total area of India, and a coastline of 450 km. It is surrounded by the states of West Bengal to the north-east, Jharkhand to the north, Chhattisgarh to the west and north-west, and Andhra Pradesh to the south and south-west.

3.4.1.1: Demographics

According to the 2011 census of India, the total population of Odisha is 41,947,358, of which 21,201,678 (50.54%) are male and 20,745,680 (49.46%) are female. This represents a 13.97% increase over the population in 2001. The population density is 269 per km².

3.4.1.2: Administrative setup

The state has 30 administrative districts, 314 development blocks, 6,227 gram panchayats (GPs) covering 51,313 villages.

3.4.1.3: Climate

The climate of the state is tropical, characterized by high temperature, high humidity, medium to high rainfall and mild winters. The normal annual rainfall is 1,451.2 mm of which the south-west monsoon contributes about 80 percent. On the basis of climate, soil, rainfall and topography, the state has been delineated into 10 agro climatic zones.

Table 3.1: Production of fish in Odisha

Sl. No.	Year	Freshwater fish production in MT	Marine fish production in MT
1	2008-09	213003	135487
2	2009-10	215803	129332
3	2010-11	224956	133479
4	2011-12	237470	114296
5	2012-13	261919	118311
6	2013-14	263862	120020
7	2014-15(P)	300964	133211

(Source: Fisheries statistics Odisha 15)

3.5: Sampling procedure

3.5.1: Selection of district

The state has 30 revenue districts, out of which Ganjam, Puri, Jagatsinghpur, Kendrapara, Bhadrak, Baleswar are in the coastal belt. It has been established that these 6 districts are more progressive in fish cultivation. Out of these 6 districts, Jagatsinghpur was purposively selected as the researcher belongs to this district. The other consideration was KVK, Jagatsinghpur is situated at the heart of the district which serves as the chief source of advanced technology dissemination in the field of agriculture.

3.5.1.1: Jagatsinghpur district

3.5.1.1.1: Demographics

This district has got a total population of 11,36,604 including 577,699 male and 558,905 female as per 2011 census. The average literacy rate of the district is 79.08

percent comprising of 88.55 percent male literacy rate and 69.28 percent female literacy rate.

3.5.1.1.2: Physiography and climate:

Jagatsinghpur is situated on an elevation of 15 metres (49 feet) above mean sea level. The place lies between 86⁰3' to 86⁰45' East longitude and between 19⁰58' to 20⁰23' North latitude. It is bounded by Kendrapara district in north, Puri district in the south, Bay of Bengal in the east and Cuttack district in the west. It enjoys a temperate climate. Winter is cold, while summer is hot and humid. Four major rivers of Odisha irrigate the mainland of Jagatsinghpur. These are the Mahanadi, Kathajodi, Devi and Biluakhai.

The district is prone to cyclonic rainfalls during the monsoons. The maximum temperature of the district is 38⁰ C and minimum temperature is 12⁰ C. The average annual rainfall of the district is 1765.1mm.

Table 3.2: Administrative setup of Jagatsinghpur district

No. of Sub-Divisions	1	No. of Tehsils	8
No. of Municipalities/Corporation	2	No. of N.A.Cs	0
No. of Blocks	8	No. of Police Stations	13
No. of Gram Panchayats	194	No. of Inhabited Villages	1227
No. of Uninhabited Villages	93	No. of villages	1320

(Source: district portal Jagatsinghpur - <http://jagatsinghpur.nic.in/>)

The district is predominantly agrarian. The major food crop grown in Jagatsinghpur is paddy. Sugarcane, turmeric and cotton are the major commercial crops. The district enjoys rich fertile soil of the Mahanadi. It has been experiencing natural calamities like floods and cyclones which are major hindrance in the economic development. Apart from agriculture, trade and commerce, transport, storage and communication manufacturing, processing and repairing services engage a major chunk of population in the district. A section of people is engaged in fishing as allied activity.

Table 3.3: Fish production in Jagatsinghpur district

Sl. No.	Year	Freshwater fish production in MT	Marine fish production in MT
1	2008-09	5226.43	34388
2	2009-10	5556.20	33012
3	2010-11	5413.67	35656
4	2011-12	5900.50	28675

5	2012-13	6376.00	32971
6	2013-14	6408.55	30395

(Source: Odisha Fisheries Statistics-2014 Directorate of Fisheries, Odisha, Cuttack)

Table 3.4: Water resource profile of Jagatsinghpur district

Sl. No.	Category of Resource	Area
1	Freshwater	14739.68 hectares
2	Brackish Water	5459.10 hectares
3	Marine Coastline	67 km

(Source: Deputy Director of Fisheries & DFO-cum-CEO, FFDA, Jagatsinghpur)

3.5.2: Selection of block

Tirtol, Kujanga and Erasama blocks were selected purposively out of eight blocks of Jagatsinghpur on the basis of following reasons.

1. Closeness to KVK.
2. Opportunity for wide market of produce.
3. More efforts on transfer of technology.
4. Availability of abundant production resources.

3.5.3: Selection of panchayats

Out of 25 panchayats of Erasama Block, 27 panchayats of Kujang Block and 27 panchayats of Tirtol block, total 6 number of panchayats (2 numbers in each block) located within 10-20 km radius from KVK were selected randomly. They are Manijanga, Krushnanandapur from Tirtol ; Sailo, Zillanasi from Kujang and Ambiki, Baleipur from Erasama block.

3.5.4: Selection of respondents

Since the main focus of the study was to find the adoption of pisciculture technology, so it was considered essential to contact those farmers who were undertaking pisciculture at least for last 5 years. The Fishery Extension Officers in the block and the scientists of Krishi Vigyan Kendra were contacted and a list of fish farmers in selected 6 panchayats was prepared. With the help of the list, 20 nos. of fish farmers were selected on random basis from each panchayat, thus making the total number of respondent 120.

3.6: Tools and techniques for data collection

The present research work was formulated on the basis of ex-post-facto approach. In order to ensure maximum objectivity to the study, a number of standard tools developed by different experts of behavioural sciences, have been used. Before using these tools and techniques the implications of the application were thoroughly understood through the available literature and discussion with those who had earlier used them.

3.6.1: Pilot study

Prior to preparation of interview schedule, a pilot study was undertaken in the study area. The main objective was to collect first-hand information regarding pisciculture practices. Discussion at length were also held with various category of fish framers. A total number of 20 beneficiaries were informally contacted securing first-hand information. This facilitated in collecting information on various aspects of pisciculture practices which helped immensely in preparing interview schedule.

3.6.2: Development of interview schedule

In course of preparation of schedule, many proposals were added and discarded after judging each item with their possible linkage with specific objectives of the study. The questions having less validity and reliability were dropped due to limitation of time and resources. Proper measures were taken to avoid vague and ambiguous answer. The interview schedule consists of four parts. First part deals with the socio-economic profile and information utilization behaviour of the fish farmers, second part deals with knowledge level of farmers about different practices of pisciculture technology, third part deals with extent of adoption and fourth and final part deals with constraints of pisciculture practices perceived by the farmers.

3.6.3: Pre-testing of the interview schedule

The entire schedule, before its use, was pretested in the field on a separate sample of 10 percent fish farmers. On the basis of pre-testing, necessary modifications were made in the final schedule.

3.6.4: Rapport building with farmers

Establishing rapport with the farmers is very important for collecting accurate information. Few trips to the farmers' field and establishing informal contact with the fish farmers by the help of village agricultural workers (VAWs), progressive farmers of the locality, helped the investigator in developing friendly relationship with the farmer, which in turn, facilitated in getting the responses of the farmers.

3.6.5: Collection of information

The respondents were individually contacted in person to obtain unbiased information. The timing for interview was scheduled as per the convenience of the farmers and the duration of each interview was on an average 2 hours. The schedule was translated into local language (Odia) for easy understanding of the respondents. The information, so collected were duly recorded in the schedule for analysis.

3.7: Selection of variables

The variables used in this study were selected on the basis of extensive review of literature, discussion with fisheries scientists and preliminary research conducted in area of investigation. Only those variables which were found to have relevance with the objective of the study were selected for detail investigation. The variable selected for the study are itemised below.

Table No. 3.5: Independent variables for the study

Sl. No.	Independent variables (X)	Empirical measurement
1	Age(X_1)	Modified Trivedi(1963)
2	Caste(X_2)	Trivedi(1963)
3	Education(X_3)	Trivedi(1963)
4	Farm size(X_4)	Modified Trivedi(1963)
5	Annual income(X_5)	Schedule developed for study
6	Farming experience(X_6)	Schedule developed for study
7	Family size(X_7)	Trivedi(1963)
8	House type(X_8)	Verma(1988)
9	Type of pond(X_9)	Schedule developed for study
10	Ownership of pond(X_{10})	Schedule developed for study
11	Availability irrigation facility(X_{11})	Schedule developed for study
12	Pond size(X_{12})	Schedule developed for study
13	Extension contact(X_{13})	Schedule developed for study
14	Information source use(X_{14})	Schedule developed for study
15	Knowledge level (X_{15})	Schedule developed for study

Table No. 3.6: Dependent variable for the study

Sl. No.	Dependent variable (Y)	Empirical measurement
1	Extent of adoption (Y ₁)	Structured schedule

3.8: Operationalization and measurement of variables

The variables used in the study were quantified depending on their relative merit in qualifying the measurement. Scoring methods adopted to measure these variables are briefly explained here.

Fish farmer

Any individual who has taken pisciculture in any form, in his own or leased in pond is considered as a fish farmer.

3.8.1: Socio-economic variables

3.8.1.1: Age

Age refers to the number of years the respondent lived in since birth at the time of interview. The respondents were categorized into following three categories on the basis of their distribution over the age.

<u>Sl. No.</u>	<u>Age</u>	<u>Score</u>
i)	Up to 35 years (young age)	1
ii)	36-50 years (middle age)	2
iii)	Above 50 years (old age)	3

3.8.1.2: Caste

The term caste has been conceived as the endogamic, exclusive and functional group to which the individual respondent belongs. The score assigned to caste of the respondents were as follows.

<u>Sl. No.</u>	<u>Caste</u>	<u>Score</u>
i)	ST	1
ii)	SC	2
iii)	OBC	3
iv)	General	4

3.8.1.3: Education

Education status has been operationalised as the number of years of formal education attained by the respondents at the time of interview. The farmers were categorized into following four categories after observing their distribution over the level of education.

Sl. No.	Education	Score
i)	Illiterate	1
ii)	Primary School	2
iii)	Middle School	3
iv)	High School	4
v)	College & above	5

3.8.1.4: Farm size

Farm size is the total cultivated and uncultivated land owned by the farmer whether in singly or along with his family members. Farm size was described in 3 categories.

Sl. No.	Farm size	Category	Score
i)	Below 1 ha.	Marginal	1
ii)	1-2 ha.	Small	2
iii)	More than 2 ha.	Big	3

3.8.1.5: Annual income

It has been operationalised as the gross income received by the respondent per annum from agriculture/non-agricultural sources.

Sl. No.	Annual income	Score
i)	Upto Rs. 30,000/-	1
ii)	Rs. 30,000/- to Rs. 60,000/-	2
iii)	Rs. 60,000/-to Rs. 90,000/-	3
iv)	Rs. 90,000/-to Rs. 1,20,000	4
v)	Above Rs. 1,20,000	5

3.8.1.6: Farming experience

It was conceptualized as number of years engaged in farming activities by a respondent.

Sl. No.	Farming experience	Score
i)	5 years	1
ii)	6-10 years	2
iii)	11-15 years	3
iv)	15 years and above	4

3.8.1.7: Family size

It is conceptualized as the total number of family members of the respondents including old, adult, and children.

Sl. No.	Family size (Nos.)	Score
i.	2-5	1
ii.	5-10	2
iii.	More than 10	3

3.8.1.8: House type

House type is operationalised as the type of rooms possessed by the fanner and type of material used in its construction.

Sl. No.	House type	Score
i.	Kutcha	1
ii.	Mixed	2
iii.	Pucca	3

3.8.1.9: Type of pond

The type of pond in this study is conceptualized as seasonal and perennial basing upon the water retention period in the pond used for fish culture by the respondent.

Sl. No.	Type of pond	Score
i.	Seasonal	1
ii.	Perennial	2

3.8.1.10: Ownership of pond

It is operationalised as the possession of ownership of pond as per the record of right.

Sl. No.	Ownership of pond	Score
i.	Pond owned	1
ii.	Pond leased from other persons	2
iii.	Gram Panchayat	3
iv.	Revenue	4
v.	Others (School, endowment etc.)	5

3.8.1.11: Availability irrigation facility

It is operationalised in this study as the access to water for irrigating the pond. The responses were recorded in a 'Yes/No' format. Score 2 and 1 were given for the response 'Yes' and 'No' respectively.

3.8.1.12: Pond size

Pond size is operationalised as the total area of the pond utilized for fish culture by the respondent.

Sl. No.	Area (ha)	Score
i.	Below 0.1	1
ii.	0.1-0.2	2
iii.	0.2-0.3	3
iv.	0.3-0.4	4
v.	0.4 and above	5

3.8.1.13: Extension contact

It has been conceived as the degree to which an individual contacts different extension agents. The responses were noted on a three point continuum viz., frequently, sometimes and never and score assigned as 3, 2, and 1 respectively. The total score of respondent denotes the degree of his contact with extension agents.

3.8.1.14: Information source use

It refers to all activities performed by a respondent for acquiring the scientific and technical information from various sources. The frequency of information source use was measured in terms of frequently, sometimes, never which were assigned with score 3, 2, and 1 respectively.

3.8.1.15: Knowledge level of the respondents

In the present study, the knowledge level of the respondents on different practices related to pisciculture technology was assessed. A set of 32 statements concerning different practices of pisciculture was developed in consultation with fisheries scientists and extension officers. Further, those statements were grouped under 9 subheads containing 3 to 5 statement each. The responses of the respondents were obtained in a 3 point continuum by mentioning each statement as know, partially know and don't know.

Sl. No.	Responses on Statement	Score
i.	Know	3
ii.	Partially know	2
iii.	Don't know	1

Further, the respondent were grouped into 3 categories basing on mean of total individual scores and standard deviation as checks. The categorization was high, moderate, low knowledge level.

3.8.2: Adoption level of the respondents

In the present study adoption refers to the extent to which a practice on scientific management of pisciculture was in use by the respondents at the time of interview. A scale consisting of 33 statements concerning different practices/principles of pisciculture was developed in consultation with fisheries scientists and extension officers. Further, those statements were grouped under 6 subheads containing 5 to 6 statement each. The responses of respondents on each statement were obtained in a 3-point continuum scale by mentioning each statement as fully adopted, partially adopted and not adopted.

Sl. No.	Adoption level	Score
i.	Fully adopted	3
ii.	Partially adopted	2
iii.	Not adopted	1

Further, the respondent were grouped into 3 categories basing on mean of total individual scores and standard deviation as checks. The categorization was low, medium and high level.

Adoption gap was computed as the difference between maximum obtainable score and obtained score of a practice. This was expressed in percentage.

3.8.3: Constraints in pisciculture

An exhaustive list of various constraints relating to pisciculture were prepared in consultation with fisheries experts, extension officials, farmers and by referring literatures. The constraints are further classified in to 7 broad groups like resource constraints, technological constraints, extension constraints, financial constraints, marketing constraints, social constraints and miscellaneous constraints. Each

respondent was asked to indicate his degree of agreement to each constraint in a '5' point scale. Then the constraints were ranked on the basis of the mean score, calculated for each constraint.

<u>Sl. No.</u>	<u>Responses on constraints</u>	<u>Score</u>
i.	Strongly agree	5
ii.	Agree	4
iii.	Undecided	3
iv.	Disagree	2
v.	Strongly disagree	1

3.9: Statistical tools used for analysis

The following statistical measures have been used in this study.

3.9.1: Percentage

Percentages were used in descriptive analysis for making simple comparison between two responses.

$$\text{Percentage} = \frac{\text{No. of respondents}}{\text{Total no. of respondent}} \times 100$$

3.9.2: Mean score

It is also simple comparison which was calculated by using the formula.

$$MS = \frac{\sum fx}{N}$$

Where, M.S. = mean score

$\sum fx$ = Sum of total score obtained by the individual

N = Total no. of items / respondents

3.9.3: Rank order

On the basis of mean score rank order was made the item securing highest mean score was given first rank and then next highest was given second rank and so on.

3.9.4: Gap analysis

It is worked out by finding out difference between maximum obtainable score and actual score obtained and expressed in terms of percentage by following formula.

$$\text{Gap (\%)} = \frac{\text{Maximum Score} - \text{obtained score}}{\text{Maximum score}} \times 100$$

3.9.5: Standard deviation

Standard deviation (SD) of a set of observation is the square root of the arithmetic mean of the squares of the deviations. The deviations being measured from the arithmetic mean of the distributions. It is commonly denoted by the symbol σ (Sigma).

$$\text{S.D. (X)} = \sigma = \sqrt{\frac{1}{n} \sum_{i=1}^n (x_i - \bar{x})^2}$$

Where, n = number of respondents
 $X_i - \bar{X}$ = deviation from the mean

3.9.6: Pearson's co-efficient correlation

This test was applied to ensure the degree of association between number of variables and factors of the respondents with their level of achievement.

$$r = \frac{N \sum xy - (\sum x)(\sum y)}{\sqrt{(N \sum x^2 - (\sum x)^2)(N \sum y^2 - (\sum y)^2)}}$$

Where, r = co-efficient of correlation

$\sum XY$ = sum of product of both variable X and Y

$\sum X$ = sum of variable X

$\sum Y$ = sum of variable Y

$\sum X^2$ = sum of squares of variable X

$\sum Y^2$ = sum of squares of variable Y

N = number of respondent

3.9.7: Test of significance ('t' test)

The coefficient of correlation value has been further tested to find out its significance by using the formula, $t = \frac{r}{\sqrt{1-r^2}} \times \sqrt{N-2}$.

Where, r = value of coefficient of correlation

N = number of sample size

The 't' value has been further compared with table value. If observed value found to be more than table value, it is said to be significant (positively/negatively) either at 0.05 or 0.01 level of significance otherwise not.

RESULTS AND DISCUSSION

The study on “Extent of adoption of pisciculture technology in Jagatsinghpur district of Odisha” was conducted in Jagatsinghpur district of Odisha. A total of 120 fish farmers from 6 panchayats belonging to Erasama, Tirtol, Kujanga block of Jagatsinghpur district were personally interviewed with a structured schedule. The data obtained were processed, analysed statistically and the results have been presented in accordance with the objectives set for the study. The findings and the interpretations are cited side by side in order to have more insight to the findings.

4.1: Objective-1: To study the socio-economic attributes of fish farmers

The human beings are not free agents without being influenced by personal, social and economic background. These conditions are also the limitations in achieving good results. The socio-economic conditions are very much helpful in accepting advanced technologies. Therefore investigation was made to find out the socio-economic conditions under which the fish farmers were living and practicing pisciculture.

4.1.1: Age (X₁)

Age of the respondent very often determines the extent of involvement and use of modern technologies for the enterprises he/she is undertaking. Age distribution of the respondents undertaking fish farming is presented in table 4.1.1.

Table 4.1.1: Distribution of respondents according to age (N=120)

Sl. No.	Age group	Category	Frequency	Percentage
1.	Upto 35 years	Young	14	11.67
2.	36-50 years	Middle	73	60.83
3.	above 50years	Old	33	27.50

It was observed from the table 4.1.1 that people from all age categories were involved in the pisciculture. Among the age group, majority (60.83%) of respondents practicing pisciculture belonged to 36 to 50 years followed by young age group (27.50%) and old age group (11.67%). The study therefore concluded that majority of

the fish farmer belonged to middle age group involved in pisciculture. This findings were in agreement with the findings of Saha and De (2001).

4.1.2: Caste (X₂)

Our society is mostly caste structured which exerts considerable influence on adoption or rejection of technologies. In Odisha culture, fish farming was restricted with people belonging to fisherman by caste. With advancement in technology and profitability of the enterprise, fish farming is now being undertaken by all caste people. Caste distribution of the respondents undertaking composite fish farming in the study area was presented in table 4.1.2.

Table 4.1.2: Distribution of respondents according to caste (N=120)

Sl. No.	Caste	Frequency	Percentage
1.	General	52	43.33
2.	O.B.C	8	6.67
3.	S.C	49	40.83
4.	S.T	11	9.17

It was revealed from the table 4.1.2 that majority (43.33%) of respondents belonged to general caste followed by scheduled caste (40.83%). Only 9.17% of scheduled tribe people were involved in pisciculture. It was observed that 6.67% population belonged to other backward classes in the area under study. It might be concluded that fish culture practice was not restricted to any particular caste. By and large it was accepted and practiced by all caste people in the community.

4.1.3: Education (X₃)

Education sustains and accelerates overall development as it prepares and trains workers at all spheres of life. It also regulates exposure to pisciculture practices, acquiring necessary skill for management and analysis of the marketing opportunities for running the enterprise in profitable way. Attempts made to assess the educational status of the respondents in the study area presented in table 4.1.3.

Table 4.1.3: Distribution of respondents according to educational level (N = 120)

Sl. No.	Educational qualification	Frequency	Percentage
1.	Illiterate	5	4.17
2.	Primary School	15	12.50
3.	Middle School	41	34.17
4.	High School	28	23.33
5	College & above	31	25.83

It was observed from the table 4.1.3 that 12.50 percent, 34.17 percent and 23.33 percent respondents received primary, middle and high school education, respectively and 25.83 percent respondents had got the opportunity for higher education i.e. college level and above. However 4.17 percent respondent were found illiterate. The data revealed that the majority of fish farmers got good education.

4.1.4: Farm size (X4)

It is expected that unless a farmer has comparatively more farm area, he may not go for fish farming by sparing the limited cultivable land area for digging of pond. Therefore, attempt was made to know the farm size of the respondents in the study area which were presented in table 4.1.4.

Table 4.1.4: Distribution of respondents according to farm size possession(N=120)

Sl. No	Farm size	Category	Frequency	Percentage
1.	Upto 1 ha.	Marginal	91	75.83
2.	1 to 2 ha.	Small	18	15.00
3.	More than 2 ha.	Big	11	9.17

It was observed from the table 4.1.4 that, majority (90.83%) of the fish farmers were small and marginal farmers. Only 9.17 percent of respondents were big farmers having farming size more than 2 hectares. It can be concluded here that, pisciculture is definitely a profitable enterprise for which marginal and small farmers were adopting the same in more number as one of the income generating vocation.

4.1.5: Annual income(X_5)

Income of a family directly influence the decision making process of an individual. Information were collected and analysed to get an idea about the approximate annual income of the fish farmers in the study area. The results so obtained were presented in table 4.1.5.

Table 4.1.5: Distribution of respondents according to annual income (N = 120)

Sl. No.	Annual income	Frequency	Percentage
1.	Upto Rs. 30,000/-	2	1.67
2.	Rs. 30,000/- to 60,000/-	4	3.33
3.	Rs. 60,000/- to 90,000/-	32	26.67
4.	Rs. 90,000/- to 1,20,000/-	34	28.33
5.	Above Rs. 1,20,000	48	40.00

It was revealed from the table 4.1.5 that majority (40.00%) of respondents had better annual income as only 1.67 per cent of the respondent had up to Rs.30,000/- annual income. Since the fish farmers in the study area had good financial position, it was expected that the fish farmers might prefer to undertake pisciculture if properly guided.

4.1.6: Farming experience (X_6)

Farming experience helps the individuals in adoption, utilization and skilful management of various practices and resources pertaining to any enterprise. It also enables them to counter some of the problems faced during farming operation at their own level. The farming experience of the sample respondents were assessed and presented in table 4.1.6.

Table 4.1.6: Distribution of respondents according to farming experience (N = 120)

Sl. No.	Experience in farming	Frequency	Percentage
1.	5 years	11	9.17
2.	6-10 years	18	15.00
3.	11-15 years	48	40.00
4.	More than 15 years	43	35.83

The data from the table 4.1.6 revealed that majority (40.00 percent) of the respondents were having farming experience 11-15 years followed by 35.83 percent having experience of above 15 years. Only 9.17 percent respondents had 5 years of experience in fish farming. This indicated that the fish farmers in the study area had good experience in pisciculture.

4.1.7: Family size (X₇)

The family plays an important role in regulating the labour requirement, accumulating and distributing the material goods produced or earned. Information were collected on family size of the respondents which were analysed and presented in table 4.1.7.

Table 4.1.7: Distribution of respondents according to family size (N = 120)

Sl. No.	Family size	Frequency	Percentage
1.	Up to 5	47	39.17
2.	6-10	47	39.17
3.	More than 10	26	21.66

It was found from the table 4.1.7 that majority (78.34%) of respondents had a family size up to 10. Only 21.66 percent respondents had a family size of more than 10. It may be concluded that fish farmers having more than 10 family members were practising pisciculture in lesser extent.

4.1.8: House type (X₈)

Housing comprises one of the basic human needs and ranks next to food and clothing in importance. It is expected that better living condition helps in providing favourable attitude for undertaking any enterprise. Therefore, attempt was made to know about the house type of the fish farmers in the study area. The result were presented in table 4.1.8.

Table 4.1.8: Distribution of respondents according to house type (N = 120)

Sl. No.	House type	Frequency	Percentage
1.	Pucca	48	40.00
2.	Kutchha	28	23.33
3.	Mixed	44	36.67

It was found from the table 4.1.8 that majority (40.50%) of the respondents were having pucca houses followed by mixed houses (36.67%). 23.33 percent respondents were having kutchha houses. It can be concluded that, the fish farmers had good housing facilities.

4.1.9: Type of Ponds (X₉)

The type of pond determines the total duration of fish culture in a pond and influence the various management practices as well as production thereof. The type of ponds utilized by the sample respondents for fish culture were assessed and the result presented in table 4.1.9.

Table 4.1.9. Type of ponds utilized for fish culture (N = 120)

Sl. No.	Types of ponds	Frequency	Percentage
1.	Seasonal	21	17.50
2.	Perennial	99	82.50

It was revealed from the table 4.1.9 that most of the ponds utilized for fish culture purpose by the respondents in the study area were of perennial type (82.50%) and only 17.50 percent ponds were seasonal. As perennial pond is a pre-requisite for undertaking fish culture, it may be concluded that the fish farmers possessed suitable production resources in terms of perennial ponds.

4.1.10: Ownership of pond (X₁₀)

Possession of record of right (ROR) of land motivates the individual to maintain it properly and adopt suitable farming practices according to own choice. Therefore, an attempt was made to investigate the ROR status of the ponds in the study area, the result of which was presented in table 4.1.10.

Table 4.1.10: Distribution of respondents according to ownership of the pond (N=120)

Sl. No.	Ownership of ponds	Frequency	Percentage
1.	Pond owned	69	57.50
2.	Pond leased form others	34	28.33
3.	Grampanchayat pond	0	0.00
4.	Revenue pond	17	14.17
5.	Others	0	0.00

It was revealed from the table 4.1.10 that majority (57.50%) of the fish farmer possessed the record of right of ponds. About 28.33 percent of fish farmers were practicing pisciculture in leased-in ponds taken from other persons. Only 14.17 percent fish farmers were practising pisciculture in revenue ponds.

It may be concluded that pisciculture in the study area was practised in owned ponds, leased ponds, revenue ponds in descending order of importance.

4.1.11: Availability of irrigation facility (X₁₁)

Like any other crop enterprise, irrigation of the fish culture ponds is considered as an important practice to maintain the water level and minimize pollution of pond water. Therefore, attempt was made to know the availability of irrigation facilities in the study area and the results were presented in table 4.1.11.

Table 4.1.11: Availability of irrigation facility (N = 120)

Sl. No.	Availability of irrigation facility	Frequency	Percentage
1.	Yes	115	95.83
2.	No	5	4.17

The table 4.1.11 indicated that irrigation facilities were available to majority (95.83%) of respondents and only 4.17 percent of the respondents were deprived of getting any irrigation facilities. It is concluded that most of the ponds retained water throughout year which is a good sign for farmers practising pisciculture.

4.1.12: Pond size (X₁₂)

As the size of pond is linked with the production and adoption of different management practices, therefore, attempt was made to investigate the average pond area utilized for fish culture by the respondents, in the study area. The information collected were analysed and reflected in table 4.1.12.

Table 4.1.12: Distribution of respondents according to pond size (N=120)

Sl. No.	Pond size (in ha.)	Frequency	Percentage
1.	Below 0.1	21	17.50
2.	0.1-0.2	21	17.50
3.	0.2-0.3	15	12.50
4.	0.3-0.4	26	21.67
5.	0.4 and above	37	30.83

A look in to the table 4.1.12 indicated that majority (30.83%) of fish farmers were utilizing a pond area of 0.4 ha and above for pisciculture. About 21.67 % of fish farmers were managing pond area of 0.2-0.3 ha. About 35.00 % of respondents were operating in below ideal size ponds recommended for fish culture. It is concluded that almost two-third of respondents were lacking sufficient size of pond required for practising pisciculture.

4.1.13: Extension contact (X₁₃)

There is a well-structured extension network for the development of pisciculture in the state. There is also regular transfer of technology to the farmers by the Krishi Vigyan Kendra, Jagatsinghpur, FFDA and Fisheries Extension Officers at block level. There is no doubt that an individual undertaking pisciculture will get required information at any time, if he desires. As contact with extension agency accelerate flow of information and adoption of improved practices; therefore, an attempt was made in the study to assess the extent of change agent contact which were presented in table 4.1.13.

Table 4.1.13: Extension contact of respondents (N=120)

Sl. No	Extension contacts	Frequency of contact						Mean score	Rank
		Frequently		Sometimes		Never			
		f	%	f	%	f	%		
1.	Fishery Extension Officer	31	25.83	76	63.33	13	10.83	2.15	I
2.	Asst. Director of Fisheries	9	7.50	46	38.33	65	54.17	1.53	III
3.	NGO personnel	5	4.17	22	18.33	93	77.50	1.27	V
4.	FFDA personnel	9	7.50	47	39.17	64	53.33	1.54	II
5.	Bank personnel	5	4.17	27	22.50	88	73.33	1.31	IV

(FEO- Fishery Extension Officer, ADF= Assistant Director of Fisheries, FFDA- Fish Farmer Development Agency, NGO= Non-Government organization)

As revealed from the table 4.1.13, majority of the fish farmers were coming in contact with Fishery Extension Officer followed by Fish Farmer Development Agency and Assistant Director of Fisheries than other Extension personnel. On analysis, it was found that the farmers were mostly contacting with the Fishery Extension Officer for farm lay out & pond construction, fish seed, soil and water analysis, manuring and fertilizer schedule, disease diagnosis and treatment and package of practices of pisciculture in general. It was also observed that the fish farmers did not have good contact with NGO and bank personnel.

4.1.14: Information source use (X₁₄)

Information sources play major role for dissemination of improved pisciculture practices to the farming community. Now-a-days, farm information are changing very fast. Unless the individual is exposed to the latest development, progress can't be much experienced. Electronic media has been developed in a sophisticated way and provide latest information within a short period. Farm publications are also readily available and supplied to the users in free of cost or at best with subsidized price. Efforts are also made by the extension agency to disseminate the information regarding pisciculture to the fish farmers. The farmers usually make use of the information obtained through the

above sources. For the study, the sources from which the farmer generally obtained information were categorized into:

a) Mass media and other methods i.e. newspaper, television, radio, literature, training and demonstration

b) Personal localities i.e. progressive farmers, friends & relatives, local leaders and neighbours

Table 4.1.14: Information source use by the respondents (N=120)

(a)	Mass media & other methods	Frequency of contact						Mean score	Rank
		Frequently		Sometimes		Never			
		f	%	f	%	f	%		
1.	New paper	47	39.17	58	48.33	15	12.50	2.27	II
2.	Television	48	40.00	66	55.00	6	5.00	2.35	I
3.	Radio	14	11.67	64	53.33	42	35.00	1.77	IV
4.	Literatures	10	8.33	54	45.00	56	46.67	1.62	V
5.	Training	3	2.50	88	73.33	29	24.17	1.78	III
6.	Demonstrations	0	0.00	18	15.00	102	85.00	1.15	VI

(b)	Personal localities	Frequency of use						Mean score	Rank
		Frequently		Sometime s		Never			
		f	%	f	%	f	%		
1.	Progressive farmer	80	66.67	40	33.33	0	0.00	2.67	I
2.	Friends and relatives	33	27.50	81	67.50	6	5.00	2.23	II
3.	Local leader	9	7.50	54	45.00	57	47.50	1.6	III
4.	Neighbours	8	6.67	48	40.00	64	53.33	1.53	IV

It was observed from the table 4.1.14 that the fish farmers were mostly using the information obtained through television and newspaper among mass media. Progressive farmers, friends and relatives, local leaders and neighbours were the important information sources in the personal localities category in descending order of importance for the fish growers. It may be concluded that the farmers were mostly using the information obtained through television, progressive farmers, newspaper and friends and relatives in decreasing order of importance.

4.2: Objective: 2 - To study the knowledge level of farmers about pisciculture in the district.

Knowledge level

The knowledge level of a respondent was conceptualized as the awareness of the respondent about pisciculture. Fish farming is usually considered as a profitable and income generating enterprise particularly for the resource poor farmers. To make the enterprise a profitable business, it is essential that a farmer should know the recent developments in pisciculture and acquire all the necessary skills involved in its management. Level of knowledge is a pre-requisite to acceptance of technology. The results are presented in the following table.

4.2.1: Knowledge about general pond requirement

Pond is the basic resource requirement to undertake pisciculture. The shape, location, period of water retention and depth of silt deposited in the pond influence various management practices as well as fish production. An attempt was made to ascertain the knowledge of fish farmers about pond requirements which was presented in table 4.2.1.

Table 4.2.1: Knowledge about general pond requirement (N= 120)

Sl. No	Statements	Know		Partially know		Don't know		Mean score	Rank	Gap %
		f	%	f	%	f	%			
1.	Pond should be located in an open space receiving ample sunlight.	68	56.67	46	38.33	6	5.00	2.52	II	16.00
2.	Rectangular shape of pond is ideal for fish culture.	78	65.00	35	29.17	7	5.83	2.59	I	13.67
3.	The pond should be perennial	62	51.67	43	35.83	15	12.50	2.39	IV	20.33
4.	Fish growth is retarded due to excessive silt deposition.	64	53.33	49	40.83	7	5.83	2.48	III	17.33

It was observed from the table 4.2.1 that 65% fish growers knew that rectangular shape of the pond was ideal for pisciculture and the knowledge gap was only 13.67%. About 56.67% of fish farmers knew that the pond should be located in an open space receiving ample sunlight whereas 38.33% fish farmers had partial knowledge about this technology.

A knowledge gap of 20% was found regarding fish cultivation in perennial pond followed by 17.33% in retardation of fish growth due to silt deposition, 16% in location of pond in an open space receiving ample sunlight. It may be concluded that all of the fishermen under study had better knowledge about general pond requirement for pisciculture.

4.2.2: Knowledge about weed control

The aquatic weeds and grasses in the pond utilizes the nutrients, deplete oxygen, restrict movement of fishes and may pollute water as well as hinder harvesting operation. An attempt was made to assess the knowledge of the respondents about weed eradication and control in the culture ponds, which was presented in table 4.2.2.

Table 4.2.2: Knowledge of the respondents about weed control (N= 120)

Sl. No	Statements	Know		Partially know		Don't know		Mean score	Rank	Gap %
		f	%	f	%	f	%			
1.	Presence of aquatic weeds and grasses in pond is harmful for fish culture.	66	55.00	51	42.50	3	2.50	2.53	II	15.67
2.	The aquatic weeds can be controlled manually.	62	51.67	42	35.00	16	13.33	2.38	III	20.67
3.	Glyphosate is a chemical herbicide control aquatic weeds.	80	66.67	38	31.67	2	1.67	2.65	I	11.67
4.	The grasscarp feeds on aquatic weeds	47	39.17	64	53.33	9	7.50	2.32	IV	22.67

From table 4.2.2, it was revealed that 66.67% fish farmers had sound knowledge about control of aquatic weeds using glyphosate while 55% fish farmers possessed adequate knowledge about the interference of aquatic weeds in pond.

The knowledge gap of fish farmers about grasscarp feeding on aquatic weeds was 22.67% followed by 20.67% in manual control of aquatic weeds. This may be concluded that they were less aware about control of aquatic weeds by grasscarp and manual control of aquatic weeds.

4.2.3: Knowledge about predatory and weed fish eradication

The predatory and weed fishes are undesirable in culture pond as they compete for food and oxygen and also feeds on the fry/fingerlings of the cultivated carp species. An attempt was made to investigate the knowledge of the respondents about predatory and weed fish eradication control from culture pond which was presented in table 4.2.3.

Table 4.2.3: Knowledge about predatory and weed fish eradication (N= 120)

Sl. No	Statements	Know		Partially know		Don't know		Mean score	Rank	Gap %
		f	%	f	%	f	%			
1.	Predatory and weed fishes needs to be eradicated from the culture ponds before stocking.	71	59.17	29	24.17	20	16.67	2.43	I	19.00
2.	The pond is generally dried out to control the predatory and weed fishes.	61	50.83	35	29.17	24	20.00	2.31	II	23.00
3.	In case of perennial ponds, Bleaching powder is used for poisoning and killing the predatory and weed fishes.	43	35.83	28	23.33	49	40.83	1.95	III	35.00

It was revealed from the table 4.2.3 that majority (59.17%) of fish farmers agreed upon the eradication of predatory and weed fishes from culture ponds before stocking. It was also observed 50.83% of respondents knew that the pond is generally dried out to control the predatory and weed fishes.

Fish growers had no adequate knowledge about the methods of predatory and weed fish control, particularly use of bleaching powder which is evident from the gap percentage of 35.00. Following this, the knowledge gap in drying out the pond to control the predatory and weed fishes and their eradication were 23% and 19% respectively. This concludes that the fish farmers need adequate training on control of predatory and weed fishes.

4.2.4: Knowledge about manuring and fertilization

The productivity of the pond can be enhanced through application of organic manure and lime. Sufficient knowledge about manuring and fertilization helps the growers to sustain the natural fish food organism (plankton) in the pond and the soil and water pH of the pond which in turn affects the fish production. An attempt was

made to assess the knowledge of the respondents about manuring and fertilization and the results are presented in table 4.2.4.

4.2.4: Knowledge about manuring and fertilization (N= 120)

Sl No.	Statements	Know		Partially know		Don't know		Mean score	Rank	Gap %
		f	%	f	%	f	%			
1.	Cow-dung is applied to raise the plankton population in the pond.	80	66.67	39	32.50	1	0.83	2.66	I	11.33
2.	Liming corrects soil and water pH.	83	69.17	17	14.17	20	16.67	2.53	III	15.67
3.	Liming helps in disinfecting the pond.	64	53.33	34	28.33	22	18.33	2.35	IV	21.67
4.	Poultry litter used as alternative source of organic manure.	83	69.17	22	18.33	15	12.50	2.57	II	14.33

Table 4.2.4 indicated that 69.17 percent fish farmers knew that poultry litter can be used as alternative source of organic manure and liming corrects soil and water pH. 66.67% respondents reported that cow-dung is applied to raise the plankton population in the pond whereas 53.33% fish farmers had good knowledge about disinfecting pond with use of lime.

The knowledge gap about effect of lime in disinfecting the pond was 21.67%. It may be concluded that training on use and effect of lime in disinfecting pond should be provided by the fishery extension officers.

4.2.5: Knowledge about stocking

The fingerlings of Indian major carps (indigenous), exotic carps, prawn etc. are stocked in the pond in particular ratio for their optimum growth and production. Attempts were made to know the knowledge of the respondents about pond stocking, presented in table 4.2.5.

Table 4.2.5: Knowledge about stocking (N= 120)

Sl No	Statements	Know		Partially know		Don't know		Mean score	Rank	Gap %
		f	%	f	%	f	%			
1.	Catla, Rohu, Mrigal are indigenous and Grasscarp, Silvervarp, Common carp are the exotic carps.	81	67.50	33	27.50	6	5.00	2.63	I	12.33
2.	Indigenous and exotic carps can be reared together in the pond.	76	63.33	19	15.83	25	20.83	2.43	III	19.00
3.	Stocking with fingerlings enhances fish production.	70	58.33	42	35.00	8	6.67	2.52	II	16.00

It was observed from the table 4.2.5 that the 67.50% fish farmers had good knowledge about different indigenous and exotic species of fishes followed by 63.33% fish farmers having good knowledge about stocking of fingerlings.

The knowledge gap in rearing indigenous and exotic carps together was found to be 19%. It may be concluded that 20.83% of the fish growers were not aware about this and they were of orthodox type.

4.2.6: Knowledge about supplementary feeding

Supplementary feeding is provided in the pond for quick growth of fishes and optimizing the fish production. The quantity of supplementary feed is generally increased along with the months of rearing and standing biomass of fish in the pond. The information of the knowledge of respondents about supplementary feeding were analysed and presented in table 4.2.6.

Table 4.2.6: Knowledge of the respondents about supplementary feeding (N=120)

Sl No.	Statements	Know		Partially know		Don't know		Mean score	Rank	Gap %
		f	%	f	%	f	%			
1.	Groundnut oilcake and rice bran are the common supplementary feed.	81	67.50	32	26.67	7	5.83	2.62	I	12.67
2.	Quantity of supplementary feed increases along with increase in the age of fishes.	80	66.67	25	20.83	15	12.50	2.55	II	15.00
3.	Supplementary feeding is given at fixed places and time during day time in the pond.	78	65.00	29	24.17	13	10.83	2.54	III	15.33

Table 4.2.6 revealed that majority (67.50%) of fish farmers were possessing better knowledge about the supplementary feed groundnut oilcake and rice bran for fishes. Following this, 66.67% and 65% respondents had good knowledge about increasing the supplementary feed with increase in age of fishes and supplying feed at fixed places & time during the day time.

The knowledge gap in increasing the supplementary feed with increase in age of fishes and supplying feed at fixed places & time during the day time were 15.33% and 15% respectively. It is concluded that more than two-third fish growers had adequate knowledge about supplementary feeding of fishes.

4.2.7: Knowledge about aeration and water exchange

Oxygen content in pond water is a critical factor fish survival. Periodical aeration of pond water is provided to prevent oxygen depletion in pond water, if required. An attempt was made to record the knowledge of fish growers about the aeration and water exchange and the findings were presented in table 4.2.7.

Table 4.2.7: Knowledge of the respondents about aeration and water exchange (N=120)

Sl. No.	Statements	Know		Partially know		Don't know		Mean score	Rank	Gap %
		f	%	f	%	f	%			
1.	Fishes comes to water surface for breathing, due to oxygen depletion in pond water.	26	21.67	65	54.17	29	24.17	1.98	II	34.00
2.	Aeration can be done manually or by aerator.	20	16.67	66	55.00	34	28.33	1.88	III	37.33
3.	Water filling is required to compensate the water loss due to seepage and evaporation.	85	70.83	15	12.50	20	16.67	2.54	I	15.33

A look into the table 4.2.7 revealed that 70.83% fish growers had good knowledge about requirement of water filling to compensate the water loss due to seepage and evaporation followed by 21.67% fish farmers having good knowledge about the coming of fishes to water surface for breathing. Only 16.67% respondents were fully aware about manual aeration.

The knowledge gap about manual aeration with use of aerator was 37.33% followed by a 34% knowledge gap about the coming of fishes to water surface for breathing. It is concluded that fish growers need proper training on aeration and water exchange in pond.

4.2.8: Knowledge about pond environment monitoring and health management

Periodical analysis of pond soil and water for correcting pH, deciding the extent of fertilization and sampling of fish stock at regular interval, is carried out to maintain desirable condition for the fish in pond and assess the survival, growth and health of the fishes. The information collected on the knowledge level of fish farmers on pond environment monitoring and health management were analysed and presented in table 4.2.8.

Table 4.2.8: Knowledge of the respondents about pond environment monitoring and health management (N=120)

Sl. No.	Statements	Know		Partially know		Don't know		Mean score	Rank	Gap %
		f	%	f	%	f	%			
1.	Pond soil and water analysis is prerequisite.	68	56.67	43	35.83	9	7.50	2.49	IV	17.00
2.	Sample netting at regular interval for checking fish growth, health and number.	81	67.50	27	22.50	12	10.00	2.58	III	14.00
3.	“CIFAX”* is a medicine for EUS treatment.	77	64.17	41	34.17	2	1.67	2.63	I	12.33
4.	Lime also applied to control EUS** in the pond.	14	11.67	25	20.83	81	67.50	1.44	V	52.00
5.	Fishes are treated with potassium permanganate as preventive measure against fish diseases.	80	66.67	33	27.50	7	5.83	2.61	II	13.00

(*CIFAX= A medicine for fish used to treat EUS)

(**EUS= Epizootic Ulcerative Syndrome)

It was observed from the table 4.2.8 that about 67% fish farmers were having better knowledge about use of CIFAX for EUS treatment and treatment of fishes with potassium permanganate as prevention against EUS. 64.17% respondents knew that CIFAX is used for EUS treatment.

The knowledge gap of fish growers about use of lime to control EUS was a huge 52% indicates that they were lacking adequate knowledge in the use of lime for EUS control. The study therefore suggested that emphasis on transmitting knowledge based

information regarding application of lime, pond soil and water analysis through training, demonstrations etc. should be given by the line departments and extension agencies.

4.2.9: Knowledge about harvesting

Harvesting of fishes above 500 gm body weight facilitates the growth of other small fishes in the pond. Harvesting is done by repeated netting or by dewatering the pond. An attempt was made to know the knowledge of fish farmers about harvesting of fishes, was presented in table 4.2.9.

Table 4.2.9: Knowledge of the respondents about harvesting (N=120)

Sl. No	Statements	Know		Partially know		Don't know		Mean score	Rank	Gap %
		f	%	f	%	f	%			
1.	Fishes above 500 gm. body weight can be harvested from the pond.	70	58.33	38	31.67	12	10.00	2.48	II	17.33
2.	Harvesting can be done by netting or draining out the pond.	64	53.33	41	34.17	15	12.50	2.41	III	19.67
3.	40-70 qtls. of fishes can be produced/ha/yr	86	71.67	19	15.83	15	12.50	2.59	I	13.67

It was observed from the above table 4.2.9 that 71.67% fish farmers had better knowledge about desirable yield from one hectare pond in a year followed by 58.33% fish farmers having good knowledge about average attainable body weight of fishes required for harvesting.

However, the fish growers had comparatively less knowledge about methods of harvesting which was evident from the 19.67% knowledge gap about harvesting of fishes by netting or draining out the pond. Therefore, the study concluded that the fish farmers should be made aware of particularly about the methods of harvesting.

All the respondents were grouped in to three categories basing on their knowledge level about all the above aspects of pisciculture which was reflected in table 5.2.10.

Table 4.2.10. Categorisation of respondents basing on knowledge level (N=120)

SI. No.	Category	Knowledge (Score)	Frequency	Percentage
1.	High	90 and above	10	8.33
2.	Moderate	63-90	103	85.83
3.	Low	Up to 63	17	14.17

(Calculated on basis of mean of total individual score 76.38 & S.D \pm 13.62)

It was found from the table 5.2.10 that majority 85.83% of the respondents were having moderate level of knowledge followed by 14.17% respondents acquiring low level of knowledge on the practices of pisciculture technology. Only 8.33% respondents had high level of knowledge. This may be due to frequent change agent contact, exposure to various extension activities.

Objective: 3 - To find out the extent of adoption of pisciculture technology in the district.

4.3: Adoption of pisciculture technology

Adoption of the technology by the fish growers 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.

4.3.1: Adoption of pond requirement

Pond is the first and foremost resource needed for practising pisciculture technology. Therefore an attempt was made to find out adoption of various technologies regarding pond requirement and the findings were presented in table 4.3.1.

Table 4.3.1: Adoption of pond requirement (N=120)

Sl. No	Statements	Fully adopted		Partially adopted		Not adopted		Mean	Rank	Gap %
		f	%	f	%	f	%			
1.	Having pond size of 0.2 to 2 ha.	85	70.83	5	4.17	30	25.00	2.46	IV	18.00
2.	Maintaining depth of water not more than 5 ft.	85	70.83	34	28.33	1	0.83	2.70	II	10.00
3.	Making bottom of pond sloppy for better drainage	90	75.00	27	22.50	3	2.50	2.73	I	9.00
4.	Restricting inflow of water from outside	85	70.83	30	25.00	5	4.17	2.67	III	11.00
5.	Keeping pond in good hygienic condition	39	32.50	69	57.50	12	10.00	2.23	V	25.67

Data from the table 4.3.1 revealed that the practice of making bottom of pond sloppy for better drainage was fully adopted by 75% fish growers. Next to this, the practices such as maintaining depth of water not more than 5 ft., restricting inflow of water from outside and maintaining pond size of 0.2 to 2 ha were fully adopted by 70.83% fish farmers.

An adoption gap of 25.67% in keeping pond in good hygienic condition was found. This may 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.

4.3.2: Adoption of cultivable fish species

Success of fish culture often depends upon the choice of fish species. Suitable species of fish must be adopted for getting better yield as well as profit. Therefore the adoption of different cultivable fish species by the fish growers were analysed and presented in table 4.3.2.

Table 4.3.2: Adoption of cultivable fish species (N=120)

Sl. No	Statements	Fully adopted		Partially adopted		Not adopted		Mean	Rank	Gap %
		f	%	f	%	f	%			
1.	Using Catla-Rohu-Mrigal at 4:3:3 proportion	85	70.83	35	29.17	0	0.00	2.71	I	9.67
2.	Practising composite fish culture	32	26.67	87	72.50	1	0.83	2.26	II	24.67
3.	Cultivating Grass carp and Silver carp with Common carp	1	0.83	77	64.17	42	35.00	2.16	III	28.00
4.	Cultivating prawn with fish	2	1.67	88	73.33	30	25.00	1.77	IV	41.00
5.	Pearl cultivation with fish	1	0.83	58	48.33	61	50.83	1.50	V	50.00
6.	Keeping air breathing fish species with carps	1	0.83	37	30.83	82	68.33	1.33	VI	55.67

Table 4.3.2 indicated that 70.83% of the fish growers had fully adopted culture of catla-rohu-mrigal at 4:3:3 proportion. Next to this, 26.67% fish farmers had fully adopted composite fish culture. The percentage of non-adopters in cultivating prawn with fish, pearl cultivation with fish and keeping air breathing fish species with carps were 25.00, 50.83 and 68.33 respectively.

The adoption gap of air breathing fish species with carps and pearl cultivation with fish were 55.67% and 50.00% respectively. This was due to complexity of the technology and lack of acquaintance of the technology.

4.3.3: Adoption of pre-stocking management

The pond environment provides optimum condition for growth of fish. Hence the pond should be free from predators, aquatic weeds and weed fish. The fingerlings

are only then safely released into the pond. An attempt was made to analyse adoption of different practices of pre-stocking management. The findings were presented in table 4.3.3.

Table 4.3.3: Adoption of pre-stocking management (N=120)

Sl. No	Statements	Fully adopted		Partially adopted		Not adopted		Mean	Rank	Gap %
		f	%	f	%	f	%			
1.	Using Mahua oil cake to kill unwanted species	35	29.17	79	65.83	6	5.00	2.24	V	25.33
2.	Using lime @ 2.5 qt/ha per annum.	77	64.17	39	32.50	4	3.33	2.61	III	13.00
3.	Using cow-dung as organic manure	81	67.50	31	25.83	8	6.67	2.61	III	13.00
4.	Growing Dhanicha for manures	48	40.00	54	45.00	18	15.00	2.25	IV	25.00
5.	Eradicating predators and unwanted species	88	73.33	24	20.00	8	6.67	2.67	II	11.00
6.	Releasing fingerlings at proper time	86	71.67	30	25.00	4	3.33	2.68	I	10.67

The data from the table 4.3.3 revealed that the practice of releasing fingerlings at proper time and the practice of eradicating predators and unwanted fish species was fully adopted by 73.33% and 71.67% of fish growers 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 dhanicha for manures were 25.33% and 25.00% respectively. Knowledge and skill development about use of these locally available materials can decrease the adoption gap.

4.3.4: Adoption of pond management

Pond management includes pond amelioration, fertilizer application, manuring, application of lime, checking fish movements etc. It is of due importance since it is the dwelling place for fishes and have direct impact on growth and yield of fish. So, adoption of some pond management practises were studied in the table 4.3.4.

Table 4.3.4: Adoption of pond management (N=120)

Sl. No	Statements	Fully adopted		Partially adopted		Not adopted		Mean	Rank	Gap %
		f	%	f	%	f	%			
1.	Maintaining stocking density of 2000 fingerlings/ac of pond.	56	46.67	57	47.50	7	5.83	2.40	V	20.00
2.	Applying cow dung and fertilizers	84	70.00	24	20.00	12	10.00	2.60	III	13.33
3.	Intermediary netting to clear water and regulate fish movement	84	70.00	27	22.50	9	7.50	2.62	I	12.67
4.	Applying lime at proper time and dose	83	69.17	27	22.50	10	8.33	2.61	II	13.00
5.	Giving supplementary feeds as recommended	76	63.33	40	33.33	4	3.33	2.60	III	13.33
6.	Application of recommended fertilizers	77	64.17	36	30.00	7	5.83	2.58	IV	14.00

It was observed from the table 4.3.4 that most of the fish farmers were adopting all the pond management practices such as intermediary netting, lime application, supplementary feeding to fishes, application of recommended fertilizers and maintenance of stocking density of 2000/acre of pond . An adoption gap of 20% was observed in maintaining stocking density of 2000 fingerlings/ac of pond. This may be due to lack of knowledge about stocking of fingerlings and unavailability of suitable pond conditions.

4.3.5: Adoption of disease management

Prevention and management of fish diseases is one of the most important part of pisciculture. Proper care of disease attack, control measures in disease attack, pond hygiene are the essential practices to consider. Hence, an attempt was made to discover adoption of disease management practices which was analysed and presented in table 4.3.5.

Table 4.3.5: Adoption of disease management (N=120)

Sl. No	Statements	Fully adopted		Partially adopted		Not adopted		Mean	Rank	Gap %
		f	%	f	%	f	%			
1.	Application of recommended dose of lime	61	50.83	45	37.50	14	11.67	2.39	IV	20.33
2.	Proper care for disease attack	74	61.67	31	25.83	15	12.50	2.49	III	17.00
3.	Preventing cattle and human bathing	5	4.17	97	80.83	18	15.00	1.89	V	37.00

4.	Keeping pond always clean and in hygienic condition	76	63.33	36	30.00	8	6.67	2.56	II	14.67
5.	Applying proper control measures in disease attack	80	66.67	32	26.67	8	6.67	2.60	I	13.33

A look in to the table 4.3.5 indicated that 66.67% of fish growers were fully adopting the practice of applying proper control measures in disease attack. The practice of keeping pond always clean and in hygienic condition and proper care for disease attack was fully adopted by 63.33% and 61.67% respectively.

However, only 4.17% of fish growers were successful in fully preventing cattle and human bathing in their ponds indicating 37% adoption gap. This happened solely due to social problems. The analysis of adoption gap suggest that the fish growers need comprehensive trainings on application of lime and care of disease attack.

4.3.6: Adoption of harvesting and Post-harvesting management

Harvesting is equally important with post-harvesting practices. Harvesting of fishes at proper stage using suitable methods and disposal of fishes are some of the critical factors which are discussed below in table 4.3.6.

Table 4.3.6: Adoption of harvesting and post-harvesting management (N=120)

Sl. No	Statements	Fully adopted		Partially adopted		Not adopted		Mean	Rank	Gap %
		f	%	f	%	f	%			
1.	Harvesting of fish by netting only	60	50.00	60	50.00	0	0.00	2.50	IV	16.67
2.	Harvesting at proper stage	65	54.17	55	45.83	0	0.00	2.54	III	15.33
3.	Freezing the fish after harvest if required	1	0.83	83	69.17	36	30.00	1.70	V	43.33
4.	Not harvest the fish by completely draining the water	96	80.00	23	19.17	1	0.83	2.79	II	7.00
5.	Disposing fish immediately after harvest	114	95.00	6	5.00	0	0.00	2.95	I	1.67

Data from the table 4.3.6 disclosed that 95% of fish growers were disposing fish immediately after harvest. 80% of fish growers were not draining the water from the pond during harvesting of fish. The two practices had high adoption rate because of sound knowledge about the technology. 54.17% and 50% of fish growers had fully adopted the practice of harvesting at proper stage and harvesting of fish by netting only.

About 43.33% gap in adoption of freezing the fish was seen. This was due to easy disposal of harvested fish, proper freezing equipment and high cost of the technology.

Further, the respondents were categorized basing on their adoption behaviour relating to all the above mentioned recommended practices which was presented in table 4.3.7.

Table 4.3.7: Categorisation of respondents basing on adoption level (N=120)

SI. No.	Category	Adoption (Score)	Frequency	Percentage
1.	High	90 and above	7	5.83
2.	Medium	67-90	91	73.33
3.	Low	Up to 67	22	20.83

(Calculated on the basis of mean of individual score 78.85 & S.D \pm 11.15)

It is observed from the table 4.3.7 that adoption behaviour of farmers followed the same trend as knowledge level. About 73.33% respondents were found to be partial adopters. This indicated that they were adopting different recommended practices of composite fish culture to varying degrees. Only 5.83% respondents were high adopters which indicated that they were putting into practice all the recommended practices. 20.83% of respondents were not following the recommended practices which indicated that this group of farmers were practicing traditional fish farming.

Table 4.3.8: Correlation of independent variables with adoption level of respondents

Sl. No.	Variables	r- value	Remarks
1	Age(X ₁)	-.058	NS
2	Caste(X ₂)	.193	*
3	Education(X ₃)	.058	NS
4	Farm size(X ₄)	.261	**
5	Annual income(X ₅)	.215	*
6	Farming experience(X ₆)	-.153	NS
7	Family size(X ₇)	-.181	*
8	House type(X ₈)	.388	**
9	Type of pond(X ₉)	-.023	NS
10	Ownership of pond(X ₁₀)	.143	NS
11	Availability irrigation facility(X ₁₁)	.088	NS

12	Pond size(X_{12})	.399	**
13	Extension contact(X_{13})	.371	**
14	Information source use(X_{14})	.241	**
15	Knowledge level (X_{15})	.532	**

** . Correlation is significant at the 0.01 level (2-tailed)

*. Correlation is significant at the 0.05 level (2-tailed)

NS. Correlation is not significant

The data reported in the table 4.3.8 revealed that farm size, house type, pond size, extension contact, information source use and knowledge level were significantly and positively correlated with the adoption of various pisciculture technologies. Family size was significantly and negatively correlated with adoption whereas age and farming experience were not correlated.

Hypothesis testing:

Caste, education, farm size, annual income, house type, pond size, extension contact, information source use and knowledge level can directly influence the outlook of an individual in a social system. Therefore these variables had positive and significant effect on the adoption level of respondents. Farm size and annual income indicated the socio-economic image of the people; it exerts influence on the respondents to adopt improved technologies. This category of respondents possessed high risk bearing ability and were copious with improved practices.

The data from the table 4.3.8 revealed that there is significant relation between the socio-economic attributes of fish farmers and adoption level of pisciculture technologies.

Hence, the null hypothesis H_0 was rejected and the alternate hypothesis H_1 was accepted.

4.4: Objective: 4- To identify the constraints in adoption of pisciculture and suggestions to overcome it.

Like any other enterprises, pisciculture is associated with a number of constraints at different levels. Here the investigator has tried to find out those constraints as perceived by the farmers as important problems which inhibit and influence acceptance and adoption of different management practices as well as pisciculture as a whole. Information on the constraints faced by the respondent on various fields of pisciculture were collected, analysed and presented under different sub-heads below:

4.4.1: Resource constraints

Fish farmers often face problems with resource availability and resource use. This in turn affects the adoption of technology. Therefore, resource constraints faced by fish growers are analysed and presented in table 4.4.1.

Table 4.4.1: Resource constraints (N=120)

Sl. No.	Constraints	Mean	Rank
1.	Unavailability of suitable pond	2.72	IV
2.	Poor water retention capacity of pond.	2.21	VIII
3.	Excessive silt deposition in the pond	2.43	V
4.	Non-availability of herbicides	2.22	VII
5.	Non-availability of fingerlings	2.19	IX
6.	Non-availability of fish disease medicines	2.25	VI
7.	Lack of irrigation source	2.01	X
8.	High cost of balanced fish feed.	3.03	III
9.	Lack of modern fish culture tools and implements	3.31	II
10.	Lack of nursery pond.	4.61	I

From the table 4.4.1, it was observed that lack of nursery pond, lack of modern fish culture tools and implements, high cost of balanced fish feed and unavailability of suitable pond were the major resource constraints faced by the respondents. The study therefore, suggested that nursery ponds should be created, modern fish culture tools and implements, production inputs like weedicides and fish disease medicines should be procured through fishermen cooperative societies or line department and provided to the fish growers at subsidized price.

4.4.2: Technological constraints

Adoption of pisciculture technology requires a detailed knowledge about the various practices involved in the pre stocking, stocking and post-stocking stage. Complexity of the technology and high expenditure for its management sometimes limits its adoption by the end users. Attempts were made to record the technological constraints faced by the fish farmers which were analysed and presented in table 4.4.2.

Table 4.4.2: Technological constraints (N=120)

Sl. No.	Constraints	Mean	Rank
1	Complexity of technology	2.63	V
2	High expenditure on technology management	2.64	IV
3	Lack of knowledge about technological know-how	2.76	III
4	Lack of pond soil and water testing facility	3.43	II
5	Algal bloom and oxygen management in pond	4.60	I

A look into the table 4.4.2 revealed that algal bloom and oxygen management was the most common technological constraint encountered by respondents followed by lack of pond soil and water testing facility and lack of knowledge about technological know-how respectively. The findings therefore, suggested that efforts by line department staffs for providing sufficient operational procedures for algal bloom and oxygen management in pond.

4.4.3: Extension constraints

It is the extension system which employs a number of methods and techniques for effective dissemination of the technology at various levels with the ultimate aim of its adoption. Therefore, information were collected to assess the extension constraints faced by the respondents which were analysed and presented in table 4.4.3.

Table 4.4.3: Extension constraints (N=120)

Sl. No.	Constraints	Mean	Rank
1	Lack of training facility	3.41	IV
2	Lack of demonstration	4.62	II
3	Inadequate and untimely technical advice by extension functionaries.	2.86	V
4	Lack of mass media and other sources of information.	3.73	III
5	Inadequate supply of farm publications in local language.	4.69	I

The Table 4.4.3 indicated that inadequate supply of farm publications in local language was the most common extension constraints as perceived by majority respondents and ranked 'I' with a mean score of 4.69. Inadequate and untimely technical advice by extension functionaries was of comparatively less important constraints for the fish farmers. It was suggested from the findings that provisions for supplying of easy to understand type farm publications in local language and conducting a good number of demonstrations on different aspects of pisciculture involving community approach should be tailor made into the plan of work of the related extension organization, particularly Krishi Vigyan Kendras, FFDAs, ATMA and the State Department of Fisheries.

4.4.4: Financial constraints

Finance is the most important factor which eases the adoption of different new technologies. Therefore, an attempt was made to analyse the financial constraints of the fish growers.

Table 4.4.4: Financial constraints (N=120)

Sl. No.	Constraints	Mean	Rank
1	Lack of sufficient funds.	3.18	IV
2	High expenditure in fish farming.	3.10	V
3	Credit for fish farming not available as per requirement and in time.	3.70	III
4	Complicated procedure to avail loan from banks.	4.05	II
5	Stringent recovery procedure.	4.17	I

The table 4.4.4 indicated that stringent recovery procedure was the most important constraint faced by the fish farmers followed by complicated procedure to avail loan from banks and non-availability of credit in time as per requirement. The study therefore, suggested that the recovery procedure should be modified and complicated procedure for getting bank loan should be made simpler and easier. The fish growers should be provided with adequate credit at the time of need to overcome the financial problems in management of pisciculture practices.

4.4.5: Marketing constraints

Good marketing network, market demand, sale price of the produce, availability of transporting facility etc. are some of the factors which influence the production decision of fish farmers. Attempt was made to ascertain the marketing constraints faced by the respondents and the findings were presented in table 4.4.5.

Table 4.4.5: Marketing constraints (N=120)

Sl. No.	Constraints	Mean	Rank
1	Lack of adequate marketing network	2.15	IV
2	Less market demand for exotic carps	2.57	II
3	Low price for the fishes in the local market.	2.31	III
4	Transporting of fishes to distant market.	1.78	V
5	Preservation of the undisposed fishes.	4.59	I

Table 4.4.5 indicated that the problem for preservation of undisposed fishes was ranked 'I' by majority of the respondent followed by less market demand of exotic carp. Other constraints in this category in decreasing order of importance were low price for the fishes in local market, lack of marketing network and transporting of fishes to distant market. The study therefore, suggested that adequate efforts should be made by concerned research organizations for development of suitable post-harvest processing technologies from farmers' perspective.

4.4.6: Social Constraints

Every society plays an important role in diffusion and adoption of a technology or practice. Positive attitude and awareness about the technology and its components enhance the rate of adoption. Attempt was made to assess the social problems faced by the fish farmers which was presented in table 4.4.6.

Table 4.4.6: Social Constraints (N=120)

Sl. No.	Constraints	Mean	Rank
1	Poaching and illegal fishing.	3.17	I
2	Poisoning of the culture pond.	2.58	II
3	Groupism and political interference.	2.54	III
4	Multiple ownership of pond	2.43	IV
5	Protest for application of organic manure in community ponds	1.87	V

It was revealed from table 4.4.6 that poaching and illegal fishing was the most important problem faced by majority of the respondents followed by poisoning of the culture pond, groupism & political interference. Protest for application of organic manure in community ponds was not an important constraints as indicated by the indents in the study area.

4.4.7: Miscellaneous constraints

The problems like lack of linkage among farmers, extension personnel and scientists, short-term leasing policy of Government of revenue and grampanchayat ponds and loss due to birds and animals were grouped and studied under miscellaneous constraints. The information on these constraints were collected, analysed and presented in table 4.4.7.

Table 4.4.7: Miscellaneous constraints (N=120)

Sl. No.	Constraints	Mean	Rank
1	Lack of co-operation and co-ordination among farmer, extension personnel and scientists.	4.32	I
2	Short-term leasing policy of Govt. for revenue and Grampanchayat ponds.	4.28	II
3	Loss due to birds and animals	2.62	III

It was revealed from the table 4.4.7 that lack of co-operation and co-ordination among farmer, extension personnel and scientists were the most common problems faced by majority of respondents which was evident from the mean score of 4.32 and rank I. A proper planning should be prepared to link the farmers, extension personnel and the scientists. Short term leasing policy of government for revenue and grampanchayat owned ponds was indicated as the second ranked problem by the respondents. Necessary government policy may be framed for leasing out the Pond for a longer period. Loss due to birds and animals was not so important problem as perceived by respondents.

SUMMARY AND CONCLUSION

Nature has endowed Orissa with opulent water resources suitable for immediate use in fish culture. The fishery sector has been a recognized as one of the important allied activities in the agriculture sector in the state of Orissa. The state has a well-structured extension network for the development of fisheries sector. Though sufficient efforts are being made by the state and central Government to boost the freshwater fish production still the farmers of Orissa are mostly operating at subsistence level. The fish production as well as the productivity is not up to expectation. With this background the present study “Extent of adoption of pisciculture technology in Jagatsinghpur district of Odisha” was designed with the following specific objectives.

1. To study the socio-economic attributes of fish growers of Jagatsinghpur.
2. To assess the knowledge level of farmers about pisciculture in the district.
3. To find out the extent of adoption of pisciculture technology in the district.
4. To identify the constraints in adoption of pisciculture and suggestions to overcome it.

For this propose, the study was undertaken at Tirtol, Kujanga and Erasama blocks in Jagatsinghpur district of Odisha. The study areas were located within 10-20 km radius from KVK. Hundred and twenty fish farmers were sampled randomly in six gramanchayats of the three blocks and information were collected through pre-tested structured interview schedule. After processing analysis of the information, the key findings are presented below.

5.1: Key research findings

5.1.1: Socio-economic profile of fish growers

- Socio-economic profile of the fish farmers reflected that all age categories of people were doing fish cultivation although the majority of respondents i.e. 60.83% were in the age group of 36-50 years. Similarly pisciculture was not restricted with particular community as all caste people were practicing with majority belonged to general caste (43.33%).
- The respondents had good educational background where around 49.16 percent were educated at high school and above level and majority (90.83%) of respondents belonged to marginal and small farmer category.

- The study revealed that majority i.e. 40% of respondents had annual income more than Rs.1,20,000.
- About 75.83% of fish farmers had good experience of more than 10 years in fish farming and 78.34% respondents had a family size of 5-10.
- Housing pattern of fish growers revealed that 40%, 36.67%, 23.33% of respondents had pucca, mixed and kutcha houses respectively.
- Among the ponds used for fish culture, 82.50% were perennial and majority (57.50%) fish farmers had their own ponds for pisciculture.
- Irrigation facilities were available to majority of respondents (95.83%).
- Majority of fish farmers (30.83%) were utilizing a pond area of 0.4 ha and above for pisciculture and 21.67 percent fish farmers were managing pond area of 0.2-0.3 ha. Whereas 35% respondents were operating in below ideal size ponds recommended for fish culture.
- Regarding the extension contact, fishery extension officer, fish farmer development agency and assistant director of fisheries were amongst the most sought contact persons.
- Analysis on information source use discovered that TV and newspaper were the most common mass media methods and progressive farmers, friends and relatives were the most pursued persons for information source use.

5.1.2: Knowledge level of fish farmers

- Most of the fish farmers had better knowledge about general pond requirement for pisciculture i.e. shape of the pond, location of the pond. However, a knowledge gap of 20% was found regarding fish cultivation in perennial pond.
- It was revealed that 66.67% fish farmers had sound knowledge about control of aquatic weeds using glyphosate while 55% fish farmers possessed adequate knowledge about the interference of aquatic weeds in pond.
- Majority (59.17%) of fish farmers agreed upon the eradication of predatory and weed fishes from culture ponds before stocking while a gap percentage of 35.00 was found regarding weed fish control with use of bleaching powder.
- About 69.17% of fish farmers had better knowledge on use of poultry litter as alternative source of organic manure however 21.67% knowledge gap was found on effect of lime in disinfecting the pond.

- About 67.50% of fish farmers had good knowledge about different indigenous and exotic species of fishes and the knowledge gap in rearing indigenous and exotic carps together was found to be 19%.
- Majority (67.50%) of fish farmers were possessing better knowledge about the supplementary feed groundnut oilcake and rice bran for fishes.
- The knowledge gap in increasing the supplementary feed with increase in age of fishes and supplying feed at fixed places & time during the day time were 15.33% and 15% respectively.
- The study revealed that 70.83% fish growers had good knowledge about requirement of water filling to compensate the water loss due to seepage and evaporation.
- The knowledge gap about manual aeration with use of aerator was 37.33% followed by a 34% knowledge gap about the coming of fishes to water surface for breathing.
- About 67% of fish farmers were having better knowledge about use of CIFAX for EUS treatment and treatment of fishes with potassium permanganate as prevention against EUS.
- About 71.67% of fish farmers had better knowledge about desirable yield from one hectare pond in a year. However, the fish growers had comparatively less knowledge about methods of harvesting which was evident from the 19.67% knowledge gap about harvesting of fishes by netting or draining out the pond.
- Majority (85.83%) of the respondents were having moderate level of knowledge followed by 14.17% respondents acquiring low level of knowledge on the practices of pisciculture technology. Only 8.33% respondents had high level of knowledge.

5.1.3: Extent of adoption of pisciculture technology by the fish farmers

- Regarding adoption of pond requirement practices, making bottom of pond sloppy for better drainage was fully adopted by 75% fish growers however an adoption gap of 25.67% in keeping pond in good hygienic condition was found.
- The study indicated that 70.83% of the fish growers had fully adopted culture of catla-rohu-mrigal at 4:3:3 proportion. Next to this, 26.67% fish farmers had fully adopted composite fish culture. The adoption gap of air breathing fish

species with carps and pearl cultivation with fish were 55.67% and 50.00% respectively.

- The study also revealed that the practice of releasing fingerlings at proper time and the practice of eradicating predators and unwanted fish species was fully adopted by 73.33% and 71.67% of fish growers respectively.
- The study showed that most of the fish farmers were adopting all the pond management practices such as intermediary netting, lime application, supplementary feeding to fishes, application of recommended fertilizers and maintenance of stocking density of 2000/acre of pond .
- The practice of keeping pond always clean and in hygienic condition and proper care for disease attack was fully adopted by 63.33% and 61.67% respectively, whereas only 4.17% of fish growers were successful in fully preventing cattle and human bathing in their ponds.
- About 95% of fish growers were disposing fish immediately after harvest and 80% of fish growers were not draining the water from the pond during harvesting of fish. 43.33% gap in adoption of freezing the fish was seen.
- About 73.33% of respondents were found to be partial adopters. This indicated that they were adopting different recommended practices of composite fish culture to varying degrees. Only 5.83% respondents were high adopters which indicated that they were putting into practice all the recommended practices. 20.83% of respondents were not following the recommended practices which indicated that this group of farmers were practicing traditional fish farming.
- The study revealed that farm size, house type, pond size, extension contact, information source use and knowledge level had significant and positive relationship with the adoption of various pisciculture technologies.
- Family size had negative relationship with adoption whereas age and farming experience were not related.

5.1.4: Constraints perceived by fish farmers

- It was observed that lack of nursery pond, lack of modern fish culture tools and implements, high cost of balanced fish feed and unavailability of suitable pond were the major resource constraints faced by the respondents.

- Algal bloom and oxygen management was the most common technological constraint encountered by respondents followed by lack of pond soil and water testing facility and lack of knowledge about technological know-how.
- Inadequate supply of farm publications in local language, lack of demonstration, lack of mass media and other of information, lack of training facility were the major extension constraints perceived by the respondents.
- Among the financial constraints faced by the respondents stringent recovery procedure, complicated procedure to avail loan from banks, non-availability of credit in time as per requirement were the top-listed constraints.
- Preservation of undisposed fishes, less market demand of exotic carp, low price for the fishes in local market, lack of marketing network, transporting of fishes to distant market were the marketing constraints reported by respondents in decreasing order of importance.
- Poaching and illegal fishing, poisoning of the culture pond, groupism & political interference, multiple ownership of pond were important social constraints confronted by fish growers.
- Lack of co-operation and co-ordination among farmer, extension personnel and scientists were the most common problems faced by majority of respondents.

5.2: Conclusion

The study as a whole indicated that fish farming is perceived as one of profitable and feasible enterprise in the study area. The fish farmers had also good knowledge about fish farming and adopting recommended practices satisfactorily. But some of the constraints particularly leasing policy, insurance against calamities, preservation and the immediate marketing restricted them for use of recommended practices. They also need regular visit of the technical personnel, exposure for developing confidence, training and demonstrations for skill competency, literatures for reference and other advisory services particularly for manuring, feeding and disease management.

It is therefore concluded that these aspects may be taken care of by the policy makers, scientist, extension agencies working in the area, so that the fish farmers will adopt recommended practices and harvest desirable quantity of fish not only to increase their standard of living but also make the area as well as the state self-sufficient in fish production, to fulfil at least internal requirements.

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INTERVIEW SCHEDULE

A study is being conducted on the “Extent of adoption of pisciculture technology in Jagatsinghpur district of Odisha”. It is purely for educational purpose. As a farmer, please give your valuable opinion for arriving at conclusion on the study.

Sl. No. _____ **Date:** _____

Name of the respondent: _____

Village : _____ Grampanchayat : _____

Block : _____ District : _____

PART – I

(To study the socio-economic attributes of fish growers of Jagatsinghpur)

1. **Age** :
 - (a) upto 35 years
 - (b) 36-50 years
 - (c) above 50years

2. **Caste** :
 - (a) General
 - (b) O.B.C
 - (c) S.C
 - (d) S.T

3. **Educational qualification** :
 - (a) Illiterate
 - (b) Primary School
 - (c) Middle School
 - (d) High School
 - (e) College & above

4. **Farm size** :
 - (a) Upto 1 ha.
 - (b) 1 to 2 ha.
 - (c) More than 2 ha.

5. **Annual income** :
 - (a) Upto Rs. 30,000/-
 - (b) Rs. 30,000/- to 60,000/-
 - (c) Rs. 60,000/- to 90,000/-
 - (d) Rs. 90,000/- to 1,20,000/-
 - (e) Above Rs. 1,20,000

6. **Experience in farming** :

- (a) 5 years
- (b) 6-10 years
- (c) 11-15 years
- (d) More than 15 years

7. **Family size** :

- (a) Up to 5
- (b) 6-10
- (c) More than 10

8. **House type** :

- (a) Pucca
- (b) Kutchha
- (c) Mixed

9. **Types of ponds** :

- (a) Seasonal
- (b) Perennial

10. **Ownership of ponds** :

- (a) Pond owned
- (b) Pond leased form others
- (c) Grampanchayat pond
- (d) Revenue pond
- (e) Others

11. **Availability of irrigation facility** :

- (a) Yes
- (b) No

12. **Pond size (in ha.)** :

- (a) Below 0.1
- (b) 0.1-0.2
- (c) 0.2-0.3
- (d) 0.3-0.4
- (e) 0.4 and above

13. **Extension contact** :

Please indicate from which of the following sources you obtain technical information about pisciculture and how often you use.

	Extension contacts	Frequency of contact		
		Frequently	Sometimes	Never
(i)	Fishery Extension Officer			
(ii)	Asst. Director of Fisheries			
(iii)	NGO personnel			
(iv)	FFDA personnel			
(v)	Bank personnel			

14. **Information source use:**

(a)	Mass media & other methods	Frequency of contact		
		Frequently	Sometimes	Never
(i)	New paper			
(ii)	Television			
(iii)	Radio			
(iv)	Literatures			
(v)	Training			
(vi)	Demonstrations			

(b)	Personal localite	Frequency of use		
		Frequently	Sometimes	Never
(i)	Progressive farmer			
(ii)	Friends and relatives			
(iii)	Local leader			
(iv)	Neighbours			

PART-II

(To assess the knowledge level of farmers about pisciculture in the district)

- Please state your reaction towards pisciculture by giving your views on the statements mentioned below.

(a) General pond requirement:

Sl. No.	Statements	Opinion		
		Know	Partially know	Don't know
(i)	Pond should be located in an open space receiving ample sunlight.			
(ii)	Rectangular shape of pond is ideal for fish culture.			
(iii)	The pond should be perennial			
(iv)	Fish growth is retarded due to excessive silt deposition.			

(b) **Weed control:**

SI No.	Statements	Opinion		
		Know	Partially know	Don't know
(i)	Presence of aquatic weeds and grasses in pond is harmful for fish culture.			
(ii)	The aquatic weeds can be controlled manually.			
(iii)	Glyphosate is a chemical herbicide control aquatic weeds.			
(iv)	The grass carp feeds on aquatic weeds			

(c) **Predatory and weed fish eradication:**

SI No.	Statements	Opinion		
		Know	Partially know	Don't know
(i)	Predatory and weed fishes needs to be eradicated from the culture ponds before stocking.			
(ii)	The pond is generally dried out to control the predatory and weed fishes.			
(iii)	In case of perennial ponds, Bleaching powder is used for poisoning and killing the predatory and weed fishes.			

(d) **Manuring and fertilization of pond :**

SI No.	Statements	Opinion		
		Know	Partially know	Don't know
(i)	Cow-dung is applied to raise the plankton population In the pond.			
(ii)	Liming corrects soil and water pH.			
(iii)	Liming helps in disinfecting the pond.			
(iv)	Poultry litter used as alternative source of organic manure.			

(e) **Stocking:**

SI No.	Statements	Opinion		
		Know	Partially know	Don't know
(i)	Catla, Rohu, Mrigal are indigenous and Grass carp, Silver carp, Common carp are the exotic carps.			
(ii)	Indigenous and exotic carps are reared together in the pond.			
(iii)	The indigenous and exotic carps are stocked in a particular proportion and number.			
(iv)	Stocking with fingerlings enhances fish production.			

(f) Supplementary Feeding

Sl No.	Statements	Opinion		
		Know	Partially know	Don't know
(i)	Groundnut oilcake and rice bran are the common supplementary feed.			
(ii)	Quantity of supplementary feed is increasing along with increase in the age of fishes.			
(iii)	Supplementary feeding is given at fixed places and time during day time in the pond.			

(g) Aeration and water exchange :

Sl. No.	Statements	Opinion		
		Know	Partially know	Don't know
(i)	Fishes comes to water surface for breathing, due to oxygen depletion in pond water.			
(ii)	Aeration can be done manually or by aerator.			
(iii)	Water filling is required to compensate the water loss due to seepage and evaporation.			

(h) Pond environment monitoring and Health Management:

Sl. No.	Statements	Opinion		
		Know	Partially know	Don't know
(i)	Pond soil and water analysis is prerequisite.			
(ii)	Sample netting at regular interval for checking fish growth, health and number.			
(iii)	“CIFAX* is a medicine for EUS treatment.			
(iv)	Lime also applied to control EUS in the pond.			
(v)	Fishes are treated with potassium permanganate as preventive measure against fish diseases.			

(i) Harvesting:

Sl No.	Statements	Opinion		
		Know	Partially know	Don't know
(i)	Fishes above 500 gm. body weight can be harvested from the pond.			
(ii)	The fishes are reared for a period of one year only in the pond.			
(iii)	Harvesting can be done by netting or draining out the pond.			
(v)	40-70 qtls. of fishes can be produced/ha/yr			

PART-III

(To find out the extent of adoption of pisciculture technology in the district)
You are doing fish farming. Please state the technologies you have adopted so far.

1. Pond requirement:

Sl No.	Statements	Fully adopted	Partially adopted	Not adopted
(i)	Having pond size of 0.2 to 2 ha			
(ii)	Maintaining depth of water not more than 5ft			
(iii)	Making bottom of pond sloppy for better drainage			
(iv)	Restricting inflow of water from outside			
(v)	Keeping pond in good hygienic condition			

2. Cultivable fish species:

Sl No.	Statements	Fully adopted	Partially adopted	Not adopted
(i)	Using Catla-Rohu-Mrigal at 4:3:3 proportion			
(ii)	Cultivating Grass carp and Silver carp with Common carp			
(iii)	Cultivating prawn with fish			
(iv)	Pearl cultivation with fish			
(v)	Keeping air breathing fish species with carps			

3. Pre-stocking management

Sl No.	Statements	Fully adopted	Partially adopted	Not adopted
(i)	Using Mahua oil cake to kill unwanted species			
(ii)	Using lime @ 2.5 qt/ha per annum.			
(iii)	Using cow-dung as organic manure			
(iv)	Growing Dhanicha for manures			
(v)	Eradicating predators and unwanted species			
(vi)	Releasing fingerlings at proper time			

4. Pond management:

Sl No.	Statements	Fully adopted	Partially adopted	Not adopted
(i)	Maintaining stocking density of 2000 fingerlings/ac of pond.			
(ii)	Applying cow dung and fertilizers			
(iii)	Intermediary netting to clear water and regulate fish movement			
(iv)	Applying lime at proper time and dose			
(v)	Giving supplementary feeds as recommended			
(vi)	Application of recommended fertilizers			

5. Disease management :

Sl No.	Statements	Fully adopted	Partially adopted	Not adopted
(i)	Application of recommended dose of lime			
(ii)	Proper care for disease attack			
(iii)	Preventing cattle and human bathing			
(iv)	Keeping pond always clean and in hygienic condition			
(v)	Applying proper control measures in disease attack			

6. Harvesting and Post-harvesting management:

Sl No.	Statements	Fully adopted	Partially adopted	Not adopted
(i)	Harvesting of fish by netting only			
(ii)	Harvesting at proper stage			
(iii)	Freezing the fish after harvest if required			
(iv)	Not harvest the fish by completely draining the water			
(v)	Disposing fish immediately after harvest			

PART-IV

(To identify the constraints in adoption of pisciculture and suggestions to overcome it)

- You might have faced problems in fish farming, please give your views about the problems given below.

(a) Resource constraints:

Sl No.	Constraints	Views				
		Strongly Agree	Agree	Undecided	Disagree	Strongly disagree
(i)	Unavailability of suitable pond					
(ii)	Poor water retention capacity of pond.					
(iii)	Excessive silt deposition in the pond					
(iv)	Non-availability of herbicides					
(v)	Non-availability of fingerlings					
(vi)	Non-availability of fish disease medicines					
(vii)	Lack of irrigation source					
(viii)	High cost of balanced fish feed.					
(ix)	Lack of modern fish culture tools and implements					
(x)	Lack of nursery pond.					

(b) Technological constraints:

Sl No.	Constraints	Views				
		Strongly Agree	Agree	Undecided	Disagree	Strongly disagree
(i)	Complexity of technology					
(ii)	High expenditure on technology management					
(iii)	Lack of knowledge about technological know-how					
(iv)	Lack of pond soil and water testing facility					
(v)	Algal bloom and oxygen management in pond					

(c) Extension constraints:

Sl No.	Constraints	Views				
		Strongly Agree	Agree	Undecided	Disagree	Strongly disagree
(i)	Lack of training facility					
(ii)	Lack of demonstration					
(iii)	Inadequate and untimely technical advice by extension functionaries.					
(iv)	Lack of mass media and other sources of information.					
(v)	Inadequate supply of farm publications in local language.					

(d) Financial constraints:

Sl No.	Constraints	Views				
		Strongly Agree	Agree	Undecided	Disagree	Strongly disagree
(i)	Lack of sufficient funds.					
(ii)	High expenditure in fish farming.					
(iii)	Credit for fish farming not available as per requirement and in time.					
(iv)	Complicated procedure to avail loan from banks.					
(v)	Stringent recovery procedure.					

(e) Marketing constraints:

Sl no.	Constraints	Views				
		Strongly Agree	Agree	Undecided	Disagree	Strongly disagree
(i)	Lack of adequate marketing network					
(ii)	Less market demand for exotic carps.					
(iii)	Low price for the fishes in the local market.					
(iv)	Transporting of fishes to distant market.					
(v)	Preservation of the undisposed fishes.					

(f) Social constraints:

Sl No.	Constraints	Views				
		Strongly Agree	Agree	Undecided	Disagree	Strongly disagree
(i)	Poaching and illegal fishing.					
(ii)	Poisoning of the culture pond.					
(iii)	Groupism and political interference.					
(iv)	Multiple ownership of pond					
(v)	Protest for application of organic manure in community ponds					

(j) Miscellaneous constraints:

Sl No.	Constraints	Views				
		Strongly Agree	Agree	Undecided	Disagree	Strongly disagree
(i)	Lack of co-operation and co-ordination among farmer, extension personnel and scientists.					
(ii)	Short-term leasing policy of Govt. for revenue and Grampanchayat ponds.					
(iii)	Loss due to birds and animals					