

**Knowledge and adoption level of fish farming practices of
district Baramulla and Bandipora**

Umar Farooq Ahmed Khan
(2016-F-51-M)



Faculty of Fisheries
**Sher-e-Kashmir University of Agricultural Sciences &
Technology of Kashmir**

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Thesis

Submitted to

Faculty of Fisheries
Sher-e-Kashmir University of Agricultural Sciences & Technology
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in partial fulfilment of requirement for the award of the degree of

Master of Fisheries Science
(Fisheries Resource Management)
2019



*Dedicated
To my beloved Mother*





Sher-e-Kashmir
University of Agricultural Sciences & Technology of Kashmir
Faculty of Fisheries, Rangil, Ganderbal

Certificate – I

This is to certify that the thesis entitled, “**Knowledge and adoption level of fish farming practices of district Baramulla and Bandipora**” submitted in partial fulfilment of the requirements for the award of the degree of **Master of Fisheries Science (Fisheries Resource Management)**, to the **Faculty of Fisheries, Sher-e-Kashmir University of Agricultural Sciences & Technology of Kashmir** is a record of bona fide research work carried out by **Mr. Umar Farooq Ahmed Khan (Reg. No. 2016-F-51-M)** under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.

It is further certified that information received during the course of investigation has duly been acknowledged.

(Dr. Gohar Bilal Wani)
Chairman
Advisory Committee

Endorsed

Dean,
Faculty of Fisheries



Sher-e-Kashmir
University of Agricultural Sciences & Technology of Kashmir
Faculty of Fisheries, Rangil, Ganderbal

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We, the members of the Advisory Committee of **Mr. Umar Farooq Ahmed Khan (Reg. No. 2016-F-51-M)**, a candidate for the degree of **Master of Fisheries Science (Fisheries Resource Management)** have gone through the manuscript of the thesis entitled, **“Knowledge and adoption level of fish farming practices of district Baramulla and Bandipora”** and recommend that it may be submitted by the student in partial fulfilment of the requirements for the award of the degree.

Advisory Committee

Chairman

Dr. Gohar Bilal Wani
Associate Professor
(Aquaculture Engineering)
Faculty of Fisheries, SKUAST-Kashmir

Members

Prof. M. H. Balkhi
Dean,
Faculty of Fisheries,
SKUAST-Kashmir

Dr. Anayitullah Chesti
Assistant Professor
(Aquaculture)
Faculty of Fisheries,
SKUAST-Kashmir

Dr. Bilal Ahmad Bhat
Associate Professor
(Statistics)
Faculty of Fisheries,
SKUAST-Kashmir

Dr. Tariq Hussain Bhat
Assistant Professor
(Post Harvest Technology)
Faculty of Fisheries,
SKUAST-Kashmir (**Dean’s Nominee**)

Sher-e-Kashmir
University of Agricultural Sciences & Technology of Kashmir
Faculty of Fisheries, Rangil, Ganderbal

Certificate – III

This is to certify that the thesis entitled, “**Knowledge and adoption level of fish farming practices of district Baramulla and Bandipora**” submitted by **Mr. Umar Farooq Ahmed Khan (Reg. No. 2016-F-51-M)** to the **Faculty of Fisheries, Sher-e-Kashmir University of Agricultural Sciences & Technology of Kashmir** in partial fulfilment of the requirements for the award of the degree of **Master of Fisheries Science (Fisheries Resource Management)** was examined and approved by the Advisory Committee and External Examiner on

Chairman
Advisory Committee

External Examiner

Dean
Faculty of Fisheries
SKUAST-Kashmir

Sher-e-Kashmir
University of Agricultural Sciences & Technology of Kashmir
Faculty of Fisheries, Rangil, Ganderbal
-::0::-

Name of the student : **Umar Farooq Ahmed Khan**

Registration No. : 2016-F-51-M

Major Subject : Fisheries Resource Management

Minor Subject : Aquaculture/Fish Nutrition and Biochemistry

Major Advisor : **Dr. Gohar Bilal Wani**
Associate Professor
(Aquaculture Engineering)
Faculty of Fisheries, SKUAST-Kashmir

Title of the Thesis : **“Knowledge and adoption level of fish farming practices of district Baramulla and Bandipora”**

ABSTRACT

A total number of 91 fish farmers from two districts *viz.*, Bandipora & Baramulla were selected for determination of their knowledge & adoption levels for fish farming practices. Data was collected through structured interview schedule. One aspect of the study also covered the socio-economic status of fish farmers of the study area. In both the districts majority of fish farmers belonged to 36-50 age groups. All fish farmers were educated in which maximum had primary level of education. All fish farmers practiced fish farming on their own land. Knowledge about site selection of carp farmers of Bandipora district were low as compare to carp farmers of Baramulla district. Carp farmers had no knowledge about farm design and pond construction. Carp farmers of both the districts had low knowledge and adoption level in seed management. Adoption level of feed management was

also low in carp farmers. All the farmers of both the districts had not adopted recommendations with regard to health management

Key words: Fish farming, Knowledge, Adoption, Bandipora, Baramulla, Kashmir valley

Signature of Student

Dated: _____

Signature of Major Advisor

Dated: _____

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UMAR FAROOQ AHMED KHAN

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Chapter – 1

INTRODUCTION

Fishing is one of the oldest means of livelihood and is regarded as a sustainable income and employment generator besides offering the cheap and nutritious food. It has developed into an occupation to a large number of people and occupies a very important place in the socio-economic development of the country. Fish is considered as a valuable healthy diet, because it is highly proteinacious and contains unsaturated fatty acids (Razvi, 2006).

According to the Food and Agriculture Organization (FAO) of the United Nations, global fish production peaked at about 171 million tons in 2016, with aquaculture representing 47% of the total (FAO, 2018). In India, the history of fisheries have its origin in the Koutilya's 'Arthasastra' (320BC), where there is an indication of fish culture in reservoirs (Barman *et al*, 2007). With the passage of time, fishing in India has become a major industry employing over 14 million people in the country (NFDB, 2018). Fisheries and aquaculture sector has been growing at a faster rate than crop and livestock asit contributed over 1 percent of India's annual gross domestic product in 2008. India has about 1.6 million hectares of freshwater lakes, ponds, and swamps and nearly 64,000 kilometres of rivers and streams, total fish production of 10.07 million metric tons presently has nearly 65% contribution from inland sector and nearly same from culture fisheries, freshwater aquaculture showed an overwhelming ten-fold growth from 0.37 million tonnes (NFDB,2018).

In J&K, fisheries sector was developed and got popularized as a sport for the tourists and later got re-oriented to boost up the fish production thereby acting as a major food resource of our state, the present annual fish production of Jammu and Kashmir from all sources is about 20.70 thousand tons (J&K Fisheries Dept, 2018). The state with its network of rivers, canals, reservoirs, tanks & ponds, lakes/derelict waters and total inland water bodies offers an immense potential for

the development & promotion of fisheries in the state. To boost up fish production on one hand and to make fullest use of available water resources on the other hand the government has taken various steps especially in the private sector by way of providing technical knowhow in addition to increase the scientific knowledge for establishment of rational fisheries in the state.

In order to strategize a comprehensive mechanism for the betterment of fish farming community and preparation of any development strategy to improve the adoption of fish production technology, the baseline information such as assessment of socio-economic status of fish farmers and constraints faced by them in fish farming is necessary. It is also important to assess the level of knowledge and adoption of fish farmers which they have perceived through different agencies. In spite of such potential, large quantities of fishes are still being imported from neighboring states to meet the demand, which thus signify a big gap between the demand and supply. The main factors that have influenced this are the non expansion of culture fisheries, use of inefficient and outdated techniques, poor technical know-how, poor adoption and inefficient marketing leading to lack of commercial success. Furthermore, fish farmers are not aware of various recent technological advancements in the field along with the schemes sponsored by the government for promotion of fisheries. Another reason could be that fisheries related innovations are not adopted on a mass scale resulting low yield. It goes without saying that adequate technical knowledge is necessary for acceptance and adoption of new idea. An understanding from all aspects as to how fish farmers are involving themselves in fish enterprise is most important to design appropriate fish production strategies in order to make fish enterprise more meaningful and profitable to rural population. The development in fish farming thus requires a serious attention towards these factors. It is essential to ascertain the adoption status of modern aquaculture technologies along with their constraints at farm level for necessary remedies. Initially farmers are trying to adopt different techniques at various degrees which are not enough for optimum

production. It is essential to adopt the appropriate modern aquaculture technologies for optimum production.

The reason for the selection of this was the non availability of data on the aspects like knowledge and adoption in these districts. The present study is thus a unique attempt in the field of socio-economic and related aspects of knowledge and adoption of fish farmers in these districts. This will bridge the gap and the constraints for economic development of fish farmers. Further with particular reference to the present study, the credit policies of the financial institutions could be planned for increasing fish production as well as socio-economic development of the fish farmers. Therefore the present study was conducted with the following main objectives:

- 1) To investigate knowledge level of fish farmers of the study area regarding fish farming practices.
- 2) To investigate the adoption of fish farming practices by fish farmers of the study area
- 3) To study the socio-economic status of fish farmers of the study area.

Chapter- 2

REVIEW OF LITERATURE

2.1 Work done in abroad

Sevelleja (2000) studied adoption and economics of tilapia farming technology in the Philippines. The data was collected from two sites, viz. Southern Tagalog and Central *Luzon* region in the island of Luzon. Two groups of farmers were selected through stratified sampling. Data were collected by personal interview and through participant observation technique. The study revealed that economic variable like profitability and social variable such as compatibility influenced the adoption behaviour of farmer. Also the high profit and more income generation were the motivational factors for the adoption. The bigger landholding farmer adopted the technology ahead of the small farmer and it was found that the farms of small farmer were more productivity as compare to the larger. Also, farms owned by individuals were found to be more profitable than the leased farms.

Saengnore and Label (2003) observed experience, knowledge and technology choices of shrimp farmers. They had not only worked on effect of decision behaviour but also on effect of age, experience and education on dependent variables such as knowledge and technology choices. The study was mainly based on field level survey as well as detail interview of farmers, in which sample of 827 numbers were randomly selected in five regions of Vietnam and Thailand. The technology adoption found to be highly related with farmers decision behaviour in which knowledge and experience played an important role. Study revealed that the educational level of farmers was varied widely in the regions, Vietnam farmers and Thailand farmer had average experience of 8.5 and 9.5 years respectively. The major role in generation of income was due to knowledge level as well as technology choices by farmers. Education was directly

affected both by ecological- and economic-sustainability. The results of study suggested that development and adoption of sustainable practices should require co-operation of government and farmers.

Ofuoku *et al.*(2008) studied the determinants of improved fish production technologies in Delta State, Nigeria. Data were collected from a sample population of 250 fish farmers from ten randomly selected Local Government Areas of Delta State. The data were elicited from respondents with the use of structured interview schedule while descriptive statistics and multiple regression analysis were used to analyze the data. The study revealed that the level of adoption was low. The grand mean adoption score and adoption index are 1.02 and 0.10, respectively. The low level of adoption was attributed to cost of the technologies, their complexities and lack of extension contact. The level of education, age of farmers, farm size, farm income and extension contact were the major determinants of fish production technologies adoption at 0.05 level of significance.

Olaoye and Oloruntoba (2010) conducted a study to assess the determinant of aquaculture technologies adoption among fish farmers in Obafemi – Owode local government area of Ogun State, Nigeria. Primary data was obtained from 224 fish farmers with an interview-schedule guide and field observation using simple random sampling and snow-balling sampling techniques during 2008 culture period. The study revealed that majority of the respondents were male (78.6%) within active age group of 41-50 years (47.0%), had primary education (51.0%), with household size of 7-8 persons (35.7%), farming as primary occupation (71.4%), fish farming experience of 3-4 years (40.0%) and belonged to fish farmers organization (51.4%). The major constraints in aquaculture were lack of access to appropriate land (31.4%), non-availability of micro-credits (97.1%), lateness in the supply of technological packages (75%), lack of infrastructural facilities (75%) and spatial factors to extension services and inputs (67.1%). The result of chi-square analysis showed that only sex (0.672,

p<0.01) and extension agents (0.060; p<0.01) had significant association between socio-economic information variables and aquaculture technologies adoption.

Okunlola *et al.* (2011) investigated the adoption of new technologies by fish farmers in Ondo State, Nigeria. Purposive sampling technique was used to select five communities and 50 fish farmers by observation technique to obtain information on farmer's production and confirmed some of the facts earlier stated by the respondents. The result showed significant association between age, level of education and adoption of new technologies while sex, religion and marital status were not significantly associated with adoption of new technologies. The average output of fish farmers before adoption was 2653.57 and after adoption were 3,465.63. The cost of input before adoption was \$ 3718.62 and after adoption was \$11861.11, while the quality of stock before adoption of Innovation was 5,950.0 and after adoption of innovation was 25,360.

Apata (2012) studied awareness and adoption of fish production technologies In South-Western, Nigeria .The research was designed to ascertain the socio-economic characteristics of the farmers to determine available technologies on fish production, determine awareness and adoption of the available technologies. Purposive sampling procedure was used to select 160 respondents for the study. Data was analyzed using frequency count, percentages, standard deviation and correlation analysis. The finding revealed that mean age of the respondents was found to be 43.1 years with standard deviation 6.532, 40.6 % have post secondary school certificate and 65.8% of them claimed that they use more than sources of information. Most of the respondents also adopt the technologies. Result of regression analysis showed that of all socio-economic characteristics considered, gender (0.591, P = 0.016), educational level (0.349, p = 0.037), level of fish production (0.467, p = 0.052) at 5% level of significance and other income generating activities (0.650, p = 0.095) at 10% level of significance and adoption of technologies.

Adesoji and Kerere (2013) conducted a study to assess the knowledge level of fisheries operators in Nigeria. It specifically examined the socio-

economic characteristics, information sources and potential occupational and environmental challenges of respondents. Ten fishing communities with prevalence fish farming and artisanal fisheries were used. Data was collected from 240 respondents using structured interview schedule. The study revealed that the both fishers and fish farmers had low knowledge level in fishing activities ($t = 3.978$), no extension contacts and source information from colleagues. Inadequate finance and water pollution were common challenges to both operators.

Sakib and Afrad (2014) studied the adoption of modern aquaculture technologies by the fish farmers in Kahaloo and Sherpurupazilas of Bogra district. Respondent fish farmer was selected using proportionate random sampling technique. Quantitative data were collected using predesigned interview schedule. The study revealed that the overall mean adoption scores of 11 modern aquaculture technologies by the farmers indicate that 58 % of the respondent fish farmers had medium adoption of “modern aquaculture technologies” compared to 25% having high adoption and 17% low adoption. Age, education, use of information sources, farm size, fish farming area, annual family income, commercialization, social participation, innovativeness and knowledge on fish culture of the farmers had positive and significant relationship with their overall mean adoption of modern aquaculture technologies.

Olatunji and Ogunremi (2016) studied assessed farmers awareness and adoption of fish farming technologies in Obi-Akpor local government area of rivers state, Nigeria . A sample of 87 fish farmers was selected from the population of about 570 through multistage random sampling technique. Structured interview schedule was used to collect relevant research data. Data were analyzed with descriptive statistics (percentage and ranking). It was found that cat fish was cultured by more than 81% of the respondents. More than 72% of the farmers were aware of the eight fish farming technologies under study. More than 71% adopted aerator, flow through system, float fish feed and ova-prim but adoption of pituitary gland and re-circulatory system were at very low ebbs.

Olaoye *et al.* (2016) conducted a study to assess the adoption of improved aquaculture technologies among fish farmers in Lagos State, Nigeria. A total of 90 fish farmers were sampled through the multistage sampling technique. A validated and pretested interview schedule was used to obtain primary information from the fish farmers. Result revealed that more than half and about one-third of the fish farmers sourced credit facilities from cooperative societies and Esusu, respectively, while almost all sold their fishes as smoked fish. Higher proportions of the fish farmers were aware, tried and adopted most of the improved aquaculture technologies with some of the fish farmers also discontinuing most of the previously adopted technologies. The Findings of the study also reported that the fish farmers had positive attitude towards the adoption of improved aquaculture technologies. Results of regression analysis revealed that secondary occupation of the fish farmers ($\beta=-0.324$, $p<0.01$), annual income level ($\beta =-0.471$, $p<0.05$), cost of pond construction ($\beta =0.477$, $p<0.05$) and total profit realized ($\beta =-0.466$, $p<0.05$) were significant predictors of the adoption of improved technologies by the fish farmers with an R^2 implying that 46.0% of the variability in the fish farmers' adoption of improved aquaculture technologies is explained by the socio-economic and production characteristics of the fish farmers. The study concluded that the adoption of improved aquaculture technologies is dynamic and highly influenced by the socio-economic characteristics of the fish farmers which also change with time.

Sancley and Bose (2017) conducted a study to assess the adoption of improved fish farming practices in Ri-bhoi district of Meghalaya. A total of 106 respondents were selected for this study. Selection of respondents was done by random sampling, operationalisation of variables of both independent and dependent variables was used. Collection of data was done by interview schedule and appropriate statistical tools were used for interpretation of the data. The study revealed that the age, education, occupation, annual income and fish farming

experience of the fish farmers showed positive significant relationship with the adoption behaviour of the respondents.

Alam *et al.* (2017) studied on existing technology and knowledge on aquaculture by fish farmers in Gomastapur Upazila of Chapai Nawabgonj district, Bangladesh. A total of 150 farmers from three unions in Gomastapurupazila under Chapai Nawabgonj district were selected. In this study, 83% of the fish farmers were adopted with extensive technology and rest 17% with semi-intensive technology. The study further revealed that most of the fish farmers belonged to low knowledge category. A few portion of the fish farmers had high knowledge. Most of the fish farmers had relatively better score on the first two levels (remembering and understanding) of knowledge. The farmers had low score on the analyzing, synthesizing, evaluating and creating component of knowledge.

2.2 Work done in India

Haque (1981) studied adoption of recommended species of fish in composite fish culture in West Bengal. Data were collected from 200 fish farmers. Study investigated relationship of some situational, socio-personal, socio-psychological and communication variables along with adoption. Results indicated that minimum depth of water in the pond had positive and direct effect on adoption of recommended species of fish.

Das *et al.* (1988) had studied some variables which were contributing to the adoption of innovations in composite fish culture in Howrah district of West Bengal. This study was designed to find out the relationship of the fourteen selected independent variables in relation to the dependent variable i.e. adoption of composite fish culture innovations. These selected independent variables were grouped as situational, socio-personnel, socio-psychological and communication variables. The study concluded that the fourteen independent variables together played a significant role in management of modern composite fish culture.

Balasubramaniam and Perumal (1990) tested adoption behaviour and impact of technology transfer among fish farmers. The extent of adoption of

eleven improved fish farming practices was studied among eighty fish farmers, who were randomly selected from six Fish Farmers Development Agencies of Tamil Nadu state. The adoption quotient scores obtained by the fish farmers ranged from 34.54 % to 84.09 % with mean adoption quotient of 56.31%. In this study the fish farmers had not adopted the practices such as testing of soil and water (65%), control of weed fishes/predators (23.75%) and application of urea (42.5%), super phosphate (45%) and muriate of potash (71.25%). Quite high partial adoption was observed in control of aquatic weeds (98.75%), application of manures and fertilisers (82.5%) and supplementary feeds (83.75%). The twenty-one independent characteristics considered for the study accounted for 57.18% of the variation in the adoption behaviour of fish farmers.

Bhaumik *et al.* (1992) studied adoption behaviour of fish farmers towards composite fish culture in West Bengal. For this study, 264 randomly selected fish farmers were personally interviewed. On the basis of scores, the respondents were grouped into four categories i.e. high- (66.67 to 100), medium- (33.34 to 66.66), low- (1 to 33.33) and non-adopter (Zero). Dependency of adoption on socio-economic status, age and education level, caste, degree of contact was tested separately. The study revealed that 28.57% farmers were low, and the medium and high adopters were 60.89% and 10.56% respectively. Non-availability of finance was the major reason for non-adoption of the composite fish culture followed by inadequate security.

Misra, (1996) studied transfer of technology on pisciculture along with socio-economic constraints in Birbhum district of West Bengal. For the study, 130 farmers were selected from all the villages within the district. Data related to yield, type and extent of water resources, physical characteristics, ownership, adoption behaviour and other details were collected by using pre-designed structured questionnaires. In the study it was observed that fish culture was practiced on traditional lines. Main constraints in adoption of techniques were lack of finance, non-assurance of supply of quality fish seed at reasonable price,

multiple ownership, high price spread, poaching, non-retention of water throughout the year.

Shrinath (1996) studied the extent of adoption of recommended practice in scientific shrimp farming and the constraints faced by eighty shrimp farmers in the Ernakulum district of Kerela. Study revealed that the improved farming technique could create positive impact on the socio-economic conditions of the farmers through increase in knowledge, favorable attitude and increased production. Level of adoption was found to be very low in areas where the traditional filtration systems were practiced. Wild seed was preferred by small scale farmers due to low cost, whereas use of hatchery seed was to limited extent. Major factors that affected adoption were cost of farming, lack of technical knowledge, inadequate finance and risk due to mortality.

Kalavathi *et al.* (1997) studied relative cost-effectiveness and constraints in adoption of rice-cum-fish farming systems in Kerala. The study showed that farmers who adopted rice-cum-fish farming had high capital investment, cosmopoliteness and social participation with institutions and mass media contact. It was also found that knowledge level, risk bearing capacity and favorable attitude towards innovation played a significant and positive role in the adoption of rice-cum-fish farming. The major constraint found in adoption was high labour cost.

Meeran (2000) conducted study on the influence of socio- personal, socio-psychological characteristics on the adoption behaviour of shrimp farmers. Relationship between fifteen selected characteristics of shrimp farmers and their adoption behaviour was studied in the composite Thanjavur and South Arcot districts in Tamil Nadu, by taking a random sample of fifty shrimp farmers. The results indicate that all the fifteen independent variable studied altogether contributed 71.56% variation in the dependent variable, adoption. The study suggested that the attributes, viz. education, experience, farm size, material possession, extension agency contact, consultancy services, mass media exposure,

scientific orientation and risk orientation played a significant role in adoption of the shrimp farming practices.

Nayak *et al.* (2001) studied constraints in the adoption of shrimp farming. This study was conducted by interviewing twenty-five brackish water shrimp farmers with pre-tested questionnaire in the Balasore district of Orrisa. The major constraints encountered were white spot disease (75%) and lack of financial support (55%). The suggestions made by farmers were the immediate control of white spot disease, adequate financial support at right time and early resolution of legal problems for the sustainable development of brackish water aquaculture in the area.

Ponnusamy *et al.* (2001) studied constraint in the adoption of shrimp farming in the Ramanthapuram district of Tamil Nadu. Study revealed that farmers took much care in periodical monitoring of pH and salinity rather than of dissolved oxygen, transparency, temperature and other physico-chemical parameters. Major problem faced was the lack of remedial measure for white spot disease (60%) followed by lack of technical guidance (30%), poor co-operation among farmers (55%), exploitation of farmers by input and marketing middlemen (50%), lack of credit support (43%), lack of instant information about shrimp produce (40%), high cost of seed, feed and other inputs (40%), inadequate power supply (30%) and difficulty in obtaining license (25%).

Kumaran *et al.* (2003) carried out a study to understand the diffusion and adoption of shrimp farming technology in the Nagapattinam district of Tamil Nadu. A sample of thirty farmers was proportionally selected from three creeks in the study area. Seventeen farming practices were included covering all aspects of shrimp farming as suggested by subject matter specialists to study adoption. The percentage of high adopters of the recommended practices was 86.66 while it was 6.67 each for low and medium adopters.

Gawade (2004) studied adoption level of improved aquaculture practices and constraints faced by shrimp farmers in the South Konkan region. Data was collected from forty-five shrimp farmers by using interview schedule method.

Results revealed that 60% farmers were adopting practices at high adoption level and rest all were medium adopters. Cent percent farmers had adopted PCR-testing whereas practices such as check trays and adjustment of feed accordingly (95.0%), use of feed probiotics (80%), adjustment of feed during to lunar cycle or moulting period (80%) and maintenance of bloom (77.5%) were highly adopted by farmers.

Lekshmi *et al.* (2005) studied influence of socio-economic factors on the extent of adoption of shrimp culture technologies of 60 shrimp farmers in Nellore district of Andhra Pradesh and 60 shrimp farmers in Nagapattinam district of Tamil Nadu. Total seventeen independent variables were measured and relationship of these variables with the adoption of shrimp farming practices was studied. Out of that, educational status, family size, farm size, ownership type, marketing behaviour, material possession, social participation, information seeking behaviour, extension contact, economic motivation, risk orientation, risk orientation and credit orientation were observed to influence adoption. It was observed that practices such as feed management, health management, soil management, acclimatisation and stocking of pond, liming the pond and harvesting were highly adopted by farmers.

Goswami *et al.* (2010) conducted a study on adoption behaviour of fish farmers in relation to scientific fish culture practices in West Bengal. The data was gathered using a structured and pre tested interview schedule from 120 randomly selected fish farmers. The findings revealed that majority (74%) of fish farmers belonged to medium to high adoption category. The adoption behaviour of fish farmers towards scientific fish culture practices was positively and significantly influenced by the factors like, occupation, annual income, land holding, extent of weed infestation, social participation, mass media participation, extension agency contact, cosmopolitaness, innovative proneness, value orientation, risk orientation, economic motivation, knowledge about scientific fish culture practices and negatively by their age.

Biswarup Saha (2011) conducted a study on knowledge level of the fish farmers in Tripura regarding scientific fish production practices. Ten fish farmers were selected randomly from each village. Thus, total 200 fish farmers were the respondents for the study. The knowledge index was found 54.25. Maximum knowledge gap was found in water exchange and quality monitoring followed by fish handling, storage, transportation, liming and feeding management.

Pandey and Upadhyay (2012) conducted a study socio-economic profile of fish farmers of an adopted model aquaculture village Kulubari, West Tripura. The findings of the study showed that the majority of fish farmers are in middle age group, education up to middle level, larger family size, in general categories, with sufficient experience in aquaculture, medium level of social participation, smaller pond area with single ownership and very low level of family income.

Kumar *et al.* (2014) studied constraints faced by fish farmers in adoption of scientific aquaculture Practices in East Champaran and West Champaran districts of Bihar. Information from 144 respondents was collected and analysed by calculating the Rank Based Quotient (RBQ) values. RBQ value for constraint faced by farmers were extreme climatic conditions (84.03), less extension programs and technical support (78.47), lack of contact with extension personnel's (71.33), lack of awareness about scientific culture practices (65.28), inadequate credit facility (60.42), labour scarcity (57.64) and higher cost of material input (52.08).

Sen and Roy (2015) studied socio-economic status of fish farmers in Tripura, India. The study revealed that fish farmers in the income (Rs. 24,940/ whole (Rs. 69,705/ good (90%) but overall level of education is found to be very poor with majority having only secondary level of education. Majority of the farmers (55%) is found to be residing in the houses of kachha found to be reasonably good. The study, after examining all the indicators, comes to the conclusion that overall situation of the fish farmer stakeholders of the state is miserable which needs to be improved.

Gupta and Dey (2015) studied socio economic and cultural profile of fish farmers in and around the Lumding town, Nagaon district of Assam. Data were collected from 110 respondents randomly sampled, through questionnaire survey and a structured interview schedule. Most of the farmers belonged to scheduled caste (54.5%) and 51% elders were engaged in fish farming. Majority of the fish farmers had their own land and practiced fish farming as primary occupation from many decades. Majority of their family size was large. The study revealed that their income from fish farming was too low (60% earned Rs. 20,000-30,000/year).

Chapter-3

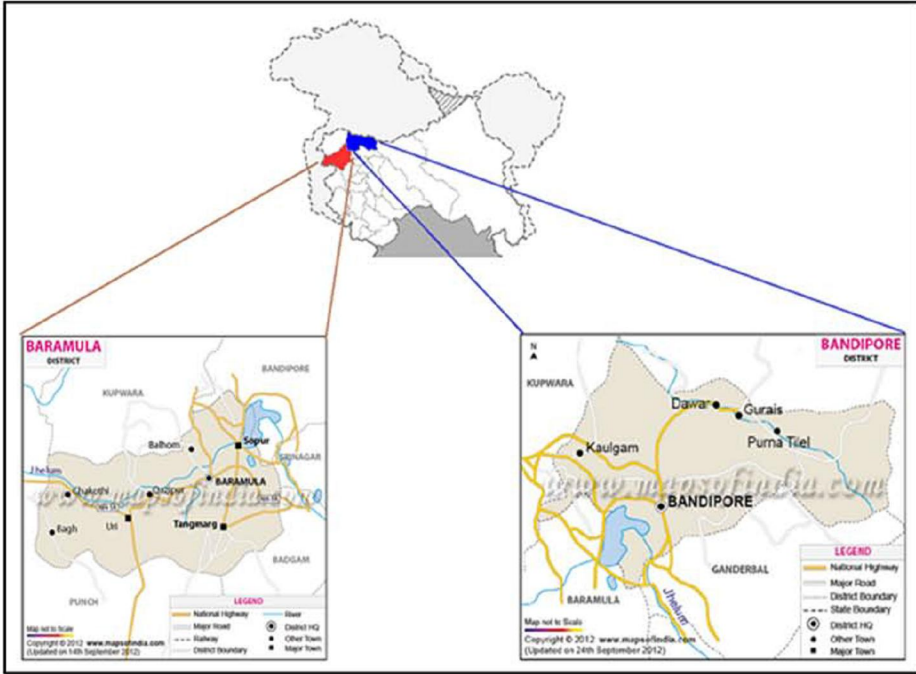
MATERIALS AND METHODS

This chapter outlines the research design and methodology. It presents the study design, sample selection and sample size. The work was based on the field survey where primary data was collected from the fish farmers through well structured pre-tested questionnaire.

3.1 Location of Study

The study was conducted in two districts of Kashmir i.e. Baramulla and Bandipora. Baramulla is situated on the banks of river Jhelum downstream from Srinagar. The district is situated at 34.1980° N Longitude and 74.3636° E Latitude, extending over an area of 4190 km², comprises of 524 villages (Anonymous, 2011). It is beyond doubt that Wular Lake being the biggest water body is very rich in food fishery (carp fish). Baramullah comprises 16 tehsils namely, Pattan, Uri, Kreeri, Boniyar, Tangmarg, Sopore, Watergam, Rafiabad, Rohama, Dangi wacha, Bomai, Dangerpoora, Khoie, Wagoora, Kunzer, Kwarhama and Baramulla. The district consists 26 blocks: Uri, Rohama, Rafiabad, Zaingeer, Sopore, Boniyar, Baramulla, Tangmarg, Singhpora, Pattan, Wagoora, Kunzer, Parantillan, Bijhama, Norkhah, Narwav, Nadihal, Kandi Rafiabad, Hardchanum, Tujjar Sharief, Sangrama, Sherabad Khore, Lalpora, Wailoo, Khaipora and Chandil Wanigam.

For present study the study area also include district Bandipora. It is located in the foothills of the snow clad peaks of Harmukh overlooking the shores of Wular district in the west, Baramulla district in the south and Kargil, Srinagar and Ganderbal districts in the east. The district is bounded by Kupwara. This district occupies an area of 398 km². The district has a population of 392,232 as per 2011 census. The district comprises three tehsils: Bandipora, Sumbal Sonawari and Gurez. The district has three vidhansaba constituencies: Gurez,



Map of study area.

Bandipora and Sonawari. All of these are part of Baramulla Lok Sabha constituency. The district is situated at 34.25°12' N Longitude and 74.39°00' E Latitude, extending over an area of 398 km², comprises of 41 villages (Anon. 2011).

3.2 Sampling Unit

The data for the study was collected from 91 fish farmers. In district Baramulla, there were about 21 trout and 38 carp farms which were functional and in district Bandipora there were about 6 trout and 26 carp farms in operation.

3.3 Interview Schedule

The interview schedule is a method of collecting data in a face to face situation, where the researcher puts a set of pre-determined questions to the respondent so as to get information pertaining to a particular technique. Interview was the chief means of collecting data in the present study. Schedule was prepared after collecting the required information from the primary and secondary sources. The recommended practices were selected from scientific literatures on trout and carp farming from Ayyapan (2008), Khanna (2006), Sultan (2012) and FAO (2011). The questions for interview were formulated on the basis of recommended fish farming practices and were categorised into two sections *viz*: general information, technical information.

General information

Socio-economic profile of fish farmers

The personal information of the fish farmers such as age, education, family size, family type, ownership pattern and occupation were collected during the present study.

Age of farmers

Age is referred to the chronological age of the respondent in completed years at the time of the investigation. Fish farmers were classified

according to age and their expected number in different age groups were calculated by constructing normal distribution. The respondents were also categorized into three groups as detailed below for the use in descriptive analysis of data.

Age Group (years)	Group
18-35	I
36-50	II
>50	III

Level of education

This was operationally defined as the number of years of formal education acquired by a respondent. Education of a respondent was quantified using procedure followed similarly to Sundaraswamy (1987). One score was assigned according to educational level of respondents classified into 5 groups of educational level as detailed above, for analyzing the characteristics of respondents.

Categories	Scores
Primary	1
Secondary	2
Higher secondary	3
Graduation level	4

Family size

Fish farmer's families were classified into two groups *viz.* family with five or less than five members and family with more than five members. Number of families according to classification on the basis of family size is given in table.

Family size	Scores
≤ 5	1
> 5	2

Technical information

Recommendations about trout and carp fish farming given by various literatures such as Ayyapan, 2008; Khana, 2006; Sultan, 2012 and FAO, 2011 were selected for the present study. The questions were formulated on the basis of these recommended practices and were categorised into subsections like Carp/Trout site selection, raceways construction, farm design and pond construction, carp/trout seed management, pond preparation and pre-stocking management, carp/trout water quality management, carp/trout feed management and carp/trout health management.

3.4 Statistical Analysis

A list of trout/carp farmers of Baramulla and Bandipora district were procured from the concerned fisheries department of the district. Thus, the sample selection was done through randomly selection method.

The appropriate statistical tools were employed wherever required (Snedecor and Cochran, 1967). Frequency distribution tables were constructed from the observed data. The statistical analysis of the data was carried out by using Microsoft Excel and SPSS v 16.0 software. Percentage analysis was used to analyze the socio-economic, knowledge level and adoption level of trout / carp farmers.

Chapter – 4

EXPERIMENTAL FINDINGS

4.1 Socio-economic profile of trout farmers

4.1.1 Age of trout farmers

Farmers were classified according to age and their expected number in different age groups were calculated by constructing normal distribution. Numbers of farmers observed and expected according to age groups are presented in Table 1 and same is depicted in Figure 1. In district Bandipora, highest percentage number of farmers (50.00%) belonged to 36-50 age groups. Whole in older age group, >50 age group dominated with 16.67% of farmers. The number of farmer's in between 18-35 age accounted for 33.33%.

While as in district Baramulla highest percentage number of farmers (61.91%) belonged to 36-50 age group. The number of farmer's 18-35 age accounted for 23.80% with 14.29% of the farmer in category of >50 age group.

Table 1: Age group of trout farmers of district Bandipora and Baramulla

S.No	Age group	Trout fish farmers			
		Bandipora		Baramulla	
		Frequency	%	Frequency	%
1	18-35	2	33.33	5	23.80
2	36-50	3	50	13	61.91
3	>50	1	16.67	3	14.29
Total		6	100	21	100

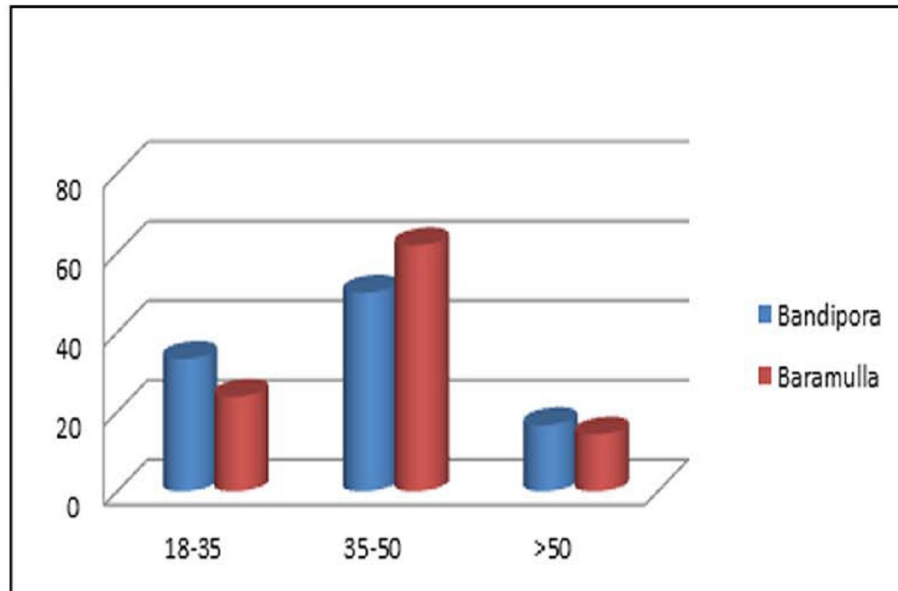


Fig 1: Age group of trout farmers of district Bandipora and Baramulla

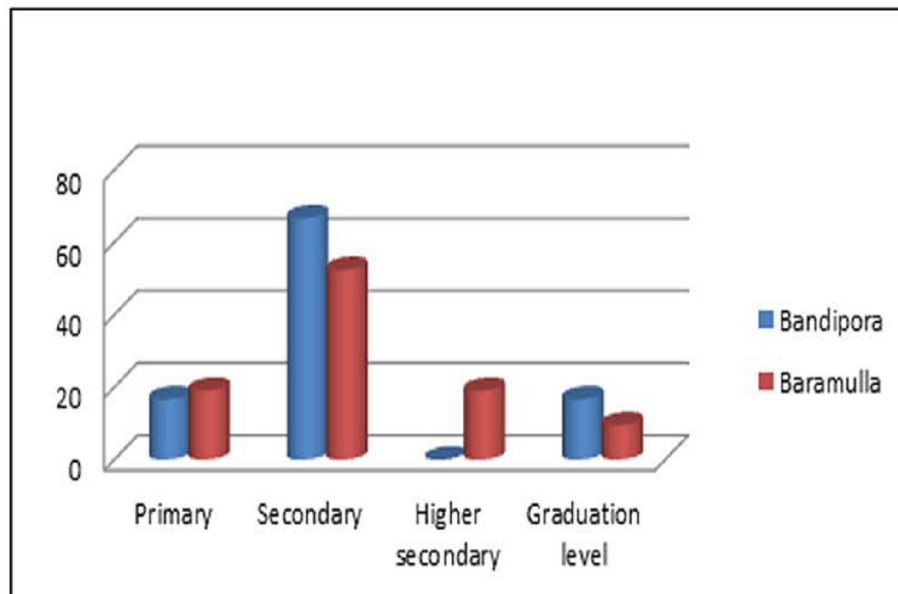


Fig. 2: Educational level of trout farmers of district Bandipora and Baramulla

4.1.2 Level of education

Number of farmers observed according to level of education is given in Table 2 and depicted in Fig. 2. In district Bandipora the highest numbers of farmers (66.66%) were observed to have secondary education level followed by higher primary level (16.67%), and graduation level (16.67%). While as in district Baramulla the highest numbers of farmers (52.38%) were observed to have secondary level followed by primary and higher secondary level (19.04%) and Graduation level (9.53%).

Table 2: Educational level of trout farmers of district Bandipora and Baramulla

S.No	Education status	Trout fish farmers			
		Bandipora		Baramulla	
		Frequency	%	Frequency	%
1	Primary	1	16.67	4	19.04
2	Secondary	4	66.66	11	52.38
3	Higher secondary	0	0	4	19.05
4	Graduation level	1	16.67	2	9.53
Total		6	100	21	100

4.1.3 Family size

Fish farmers families were classified into two groups viz. family with five or less than five members and family with more than five members. Number of families according to classification on the basis of family size is given in Table 3. In district Bandipora farmers with five or less than five members in family were 33.33% while farmers with more than five members in family were 66.67%. While as in district Bandipora farmers with five or less than five members in family were 57.14% while farmers with more than five members in family were 42.86%

Table 3: Family sizes of trout farmers of district Bandipora and Baramulla

S.No	Size of family	Trout fish farmers			
		Bandipora		Baramulla	
		Frequency	%	Frequency	%
1	<5	2	33.33	12	57.14
2	>5	4	66.67	9	42.86
Total		6	100	21	100

4.1.4 Type of family

Fish farmers were classified as per type of family and same is given in the Table 4. The results revealed that in district Bandipora the majority were divided families with the percentage value of 66.67% while joint families were 33.33%. While as in district Baramulla the majority were divided families with the percentage value of 71.43% while joint families were 28.57%.

Table 4: Type of family of trout farmers of district Bandipora and Baramulla

S.No	Type of family	Trout fish farmers			
		Bandipora		Baramulla	
		Frequency	%	Frequency	%
1	Nuclear	4	66.67	15	71.43
2	Joint	2	33.33	6	28.57
Total		6	100	21	100

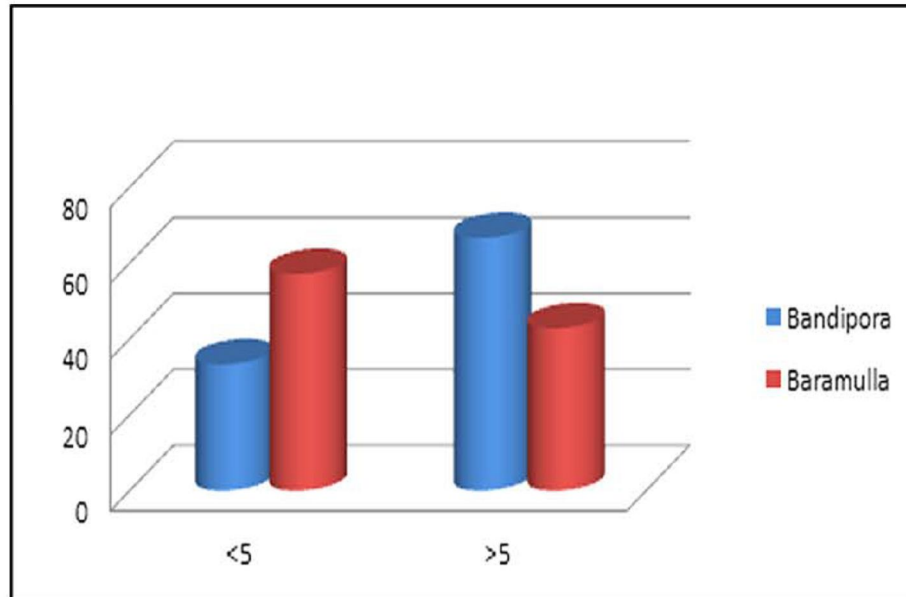


Fig. 3 Family size of of trout farmers of district Bandipora and Baramulla

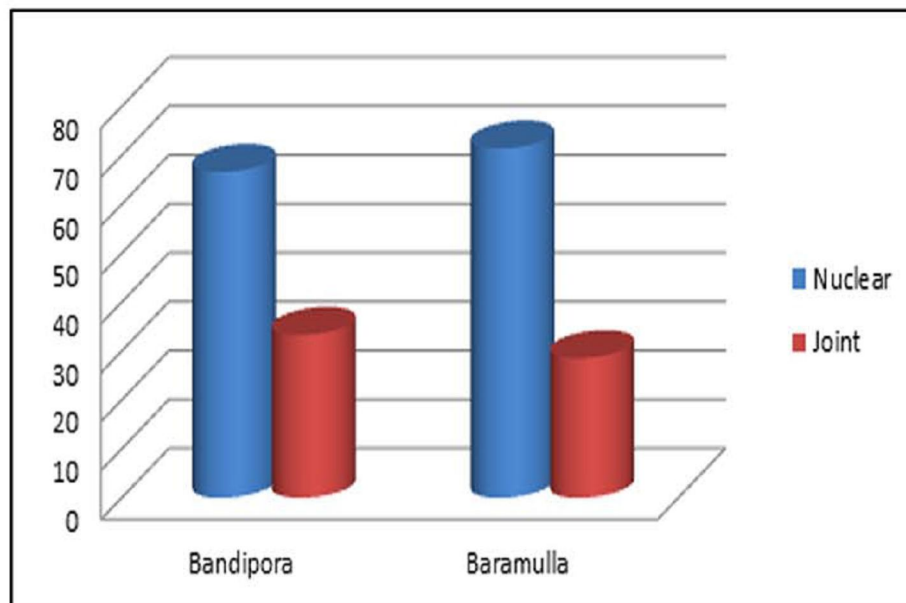


Fig. 4 Type of family of trout farmers of district Bandipora and Baramulla

4.1.5 Ownership pattern

Farmers were classified according to land ownership pattern. The classified data is given in the Table 5 and is presented in Fig. 5. In district Bandipora trout fish farming was carried out by majority of farmers in own land with percentage value of 100% of which 0% were sole entrepreneurs and 0% farmers were doing farming in partnership. While in district Baramulla trout fish farming was carried out by majority of farmers in own land with percentage value of 100% of which 0% were sole entrepreneurs and 0% farmers were doing farming in partnership.

Table 5: Ownership pattern of trout farmers of district Bandipora and Baramulla

S.No	Ownership	Trout fish farmers			
		Bandipora		Baramulla	
		Frequency	%	Frequency	%
1	Lease	0	0	0	0
2	Partnership	0	0	0	0
3	Own land	6	100	21	100
Total		6	100	21	100

4.1.6 Farming experience

The farming experience of the trout fish farmers is given in Table 6 and presented in Fig. 6. In district Bandipora maximum numbers of farmers were new entrant in the field of trout fish farming with percentage of 83.33% while as in district Baramulla, 57.14% farmers were new entrants.

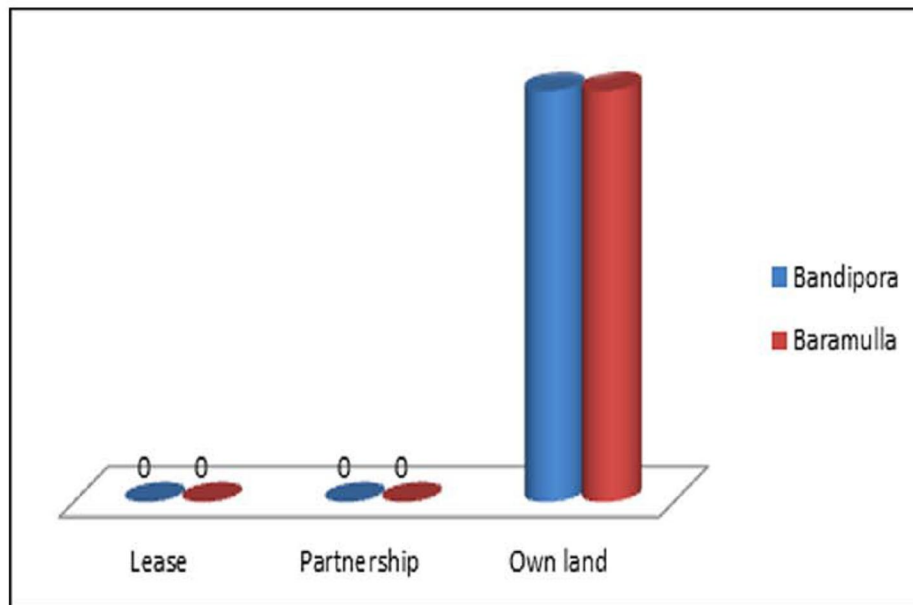


Fig. 5: Ownership pattern of trout farmers of district Bandipora and Baramulla

Table 6: Fish farming experience before starting farm in district Bandipora and Baramulla

S.No	Experience	Trout fish farmers			
		Bandipora		Baramulla	
		Frequency	%	Frequency	%
1	0-1 year	5	83.33	12	57.14
2	1-2 years	1	16.67	6	28.57
3	2-4 years	0	0	3	14.29
Total		6	100	21	100

4.1.7 Depth of water

It can be seen from the Table 7 and Fig.7 that in district Bandipora maximum (83.33%) depth of farms was 3 feet. Only 16.67% farms were 3 ½ feet while as in district Baramulla 66.67% depth of farms was 3 feet and 33.33% farms are 3 ½ feet.

Table 7: Depth of water in District Bandipora and Baramulla

S.No	Depth	Trout fish farmers			
		Bandipora		Baramulla	
		Frequency	%	Frequency	%
1	3 feet	5	83.33	14	66.67
2	3 ½ feet	1	16.67	7	33.33
3	5 feet	0	0	0	0
Total		6	100	21	100

4.1.8 Occupation

It was observed from the table 8 and fig. 8 that in district Bandipora maximum (83.33%) occupation of a farmer was fish farming, 16.67%

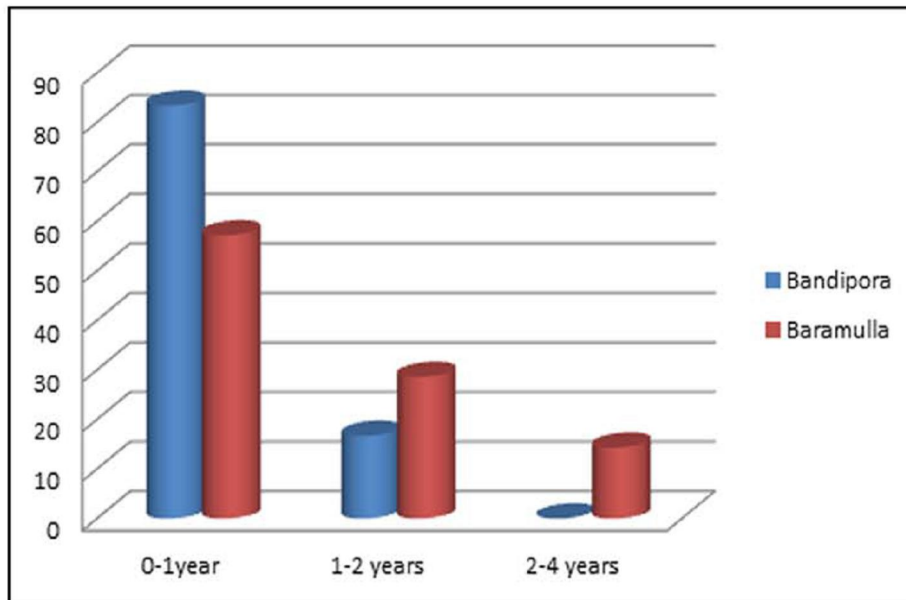


Fig. 6: Fish farming experience of trout farmers of district Bandipora and Baramulla

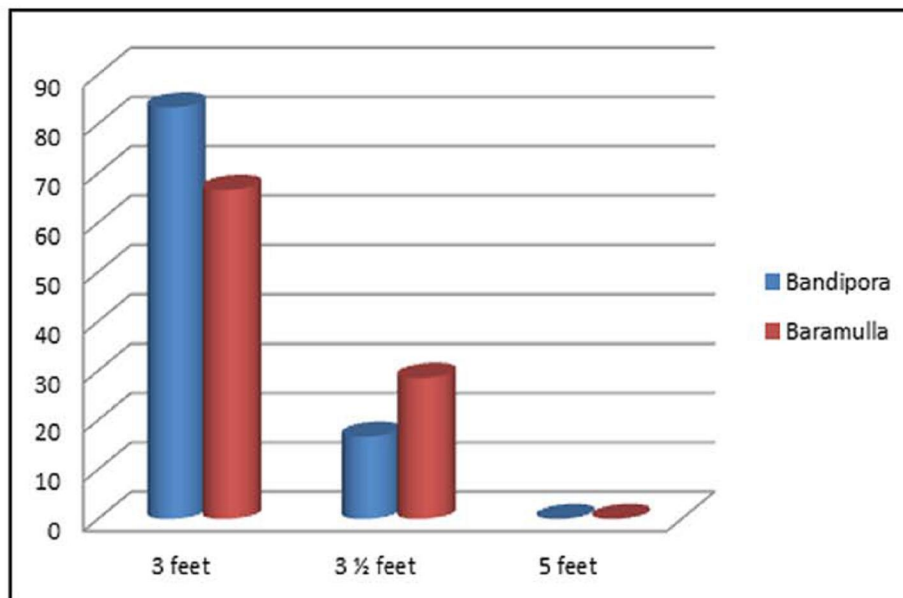


Fig. 7: Depth of water of trout farmers of district Bandipora and Baramulla

farmers occupation was other than fish farming while as in district Baramulla maximum (66.67%) occupation of a farmer was fish farming, 33.33% farmers occupation was other than fish farming.

Table 8: Occupation of fish farmer in district Bandipora and Baramulla

S.No	Occupation	Trout fish farmers			
		Bandipora		Baramulla	
		Frequency	%	Frequency	%
1	Fish farming	5	83.33	14	66.67
2	Other than fish farming	1	16.67	7	33.33
Total		6	100	21	100

4.2 Knowledge of trout farming practices

4.2.1 Site selection

Knowledge level related to site selection is given in Table 9 and Fig.9. The knowledge of farmers regarding temperature of water, flow of water and source of water suitable for trout culture was high in District Bandipora. On the other hand, Knowledge about flow of water and source of water suitable for trout culture was high in district Baramulla.

4.2.2 Raceway construction

Number of farmers according to knowledge level with regard to farm design and construction is tabulated in Table 10 and Fig.10. This group of practices included certain practices, such as size of raceways, raceways made of, position of inlet and outlet, slope of raceways, raceways constructed for taking natural benefit of wind direction and shape of raceways. The farmers from district Bandipora and Baramulla had no knowledge about the slope of raceways (100%). Majority of the farmers had 100% knowledge about building materials of raceways, position of inlet and outlet (100%).

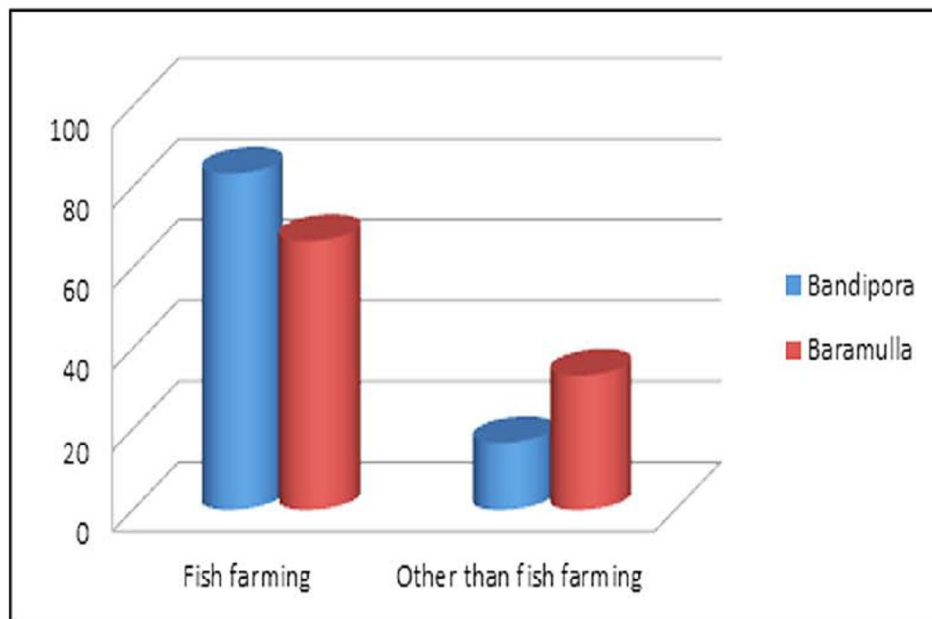


Fig. 8: Occupation of trout farmers of district Bandipora and Baramulla

Table 9: Knowledge level of site selection of trout farmers in district Bandipora and Baramulla

S.no	Site selection	Bandipora			Baramulla		
		Complete (%)	Partial (%)	No (%)	Complete (%)	Partial (%)	No (%)
1	Which water source should be suitable for trout culture?	6 (100)	0 (0)	0 (0)	21 (100)	0 (0)	0 (0)
2	Which water characteristics should be checked?	0 (0)	3 (50)	3 (50)	0 (0)	4 (19.04)	17 (80.96)
3	What should be the temperature of water?	4 (66.67)	2 (33.33)	0 (0)	8 (38.09)	8 (38.09)	5 (23.82)
4	What should be flow of water?	0 (0)	0 (0)	6 (100)	0 (0)	0 (0)	21 (100)
5	Which is the ideal site for construction of raceway?	0 (0)	6 (100)	0 (0)	10 (47.62)	11 (52.38)	0 (0)
	Overall knowledge	33.33%	36.67%	30%	37.14%	21.91%	40.95%

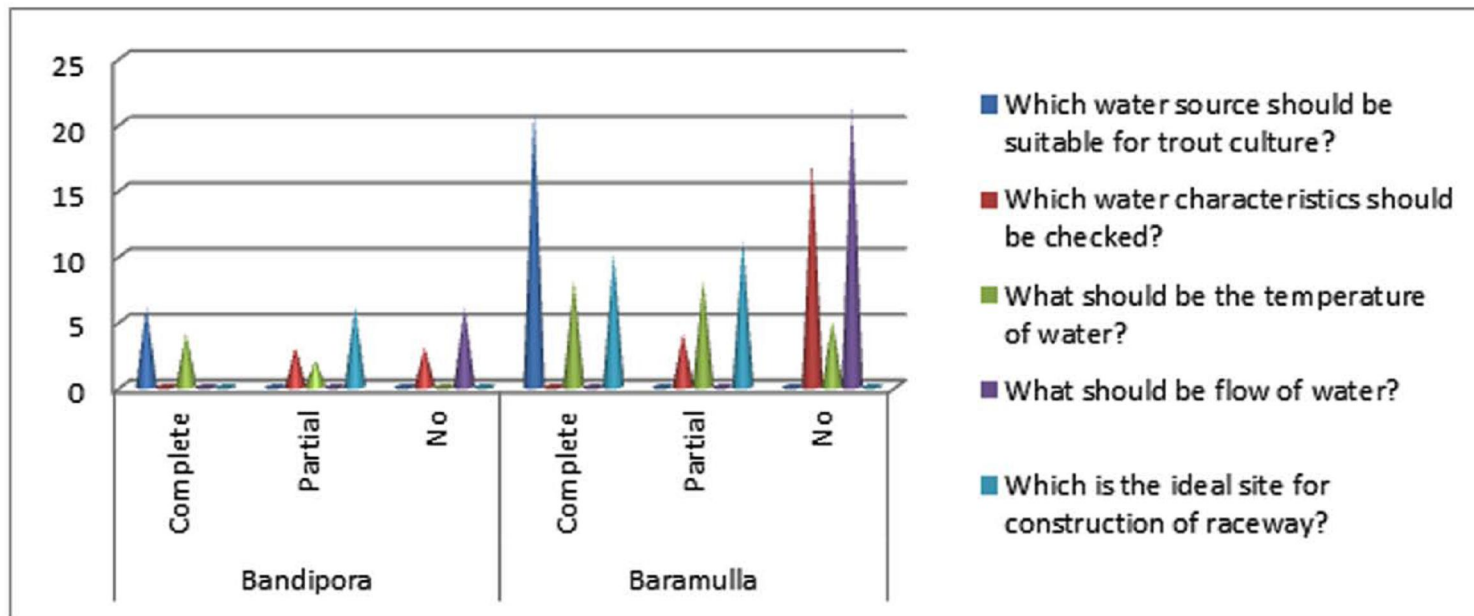


Fig.9:..Knowledge level of site selection of trout farmers in district Bandipora and Baramalla

Table 10: Knowledge level of raceways construction of trout farmers in district Bandipora and Baramulla

S.no	Raceway construction	Bandipora			Baramulla		
		Complete (%)	Partial (%)	No (%)	Complete (%)	Partial (%)	No (%)
1	What should be the size of raceways?	4 (66.67)	2 (33.33)	0 (0)	18 (85.71)	3 (14.29)	0 (0)
2	What are raceways made of?	6 (100)	0 (0)	0 (0)	21 (100)	0 (0)	0 (0)
3	What should be the position of inlet and outlet?	6 (100)	0 (0)	0 (0)	21 (100)	0 (0)	0 (0)
4	What should be the slope of raceways?	0 (0)	0 (0)	6 (100)	0 (0)	0 (0)	21 (100)
5	What should be the shape of raceways?	6 (100)	0 (0)	0 (0)	21 (100)	0 (0)	0 (0)
	Overall knowledge	73.34%	6.66%	20%	77.14%	2.86%	20%

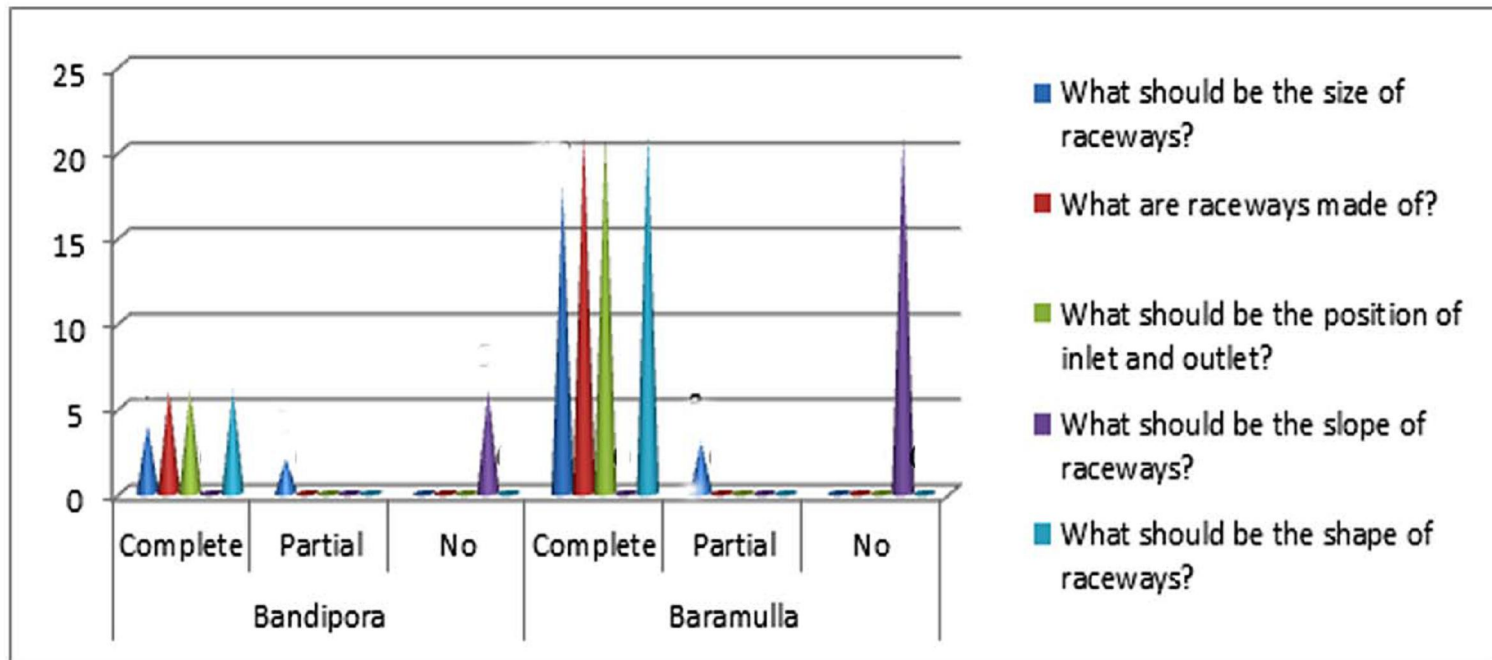


Fig.10: Knowledge level of raceways construction of trout farmers in district Bandipora and Baramulla

4.2.3 Seed management

Knowledge of trout fish farmers in Bandipora district about seed management practices is given in Table 11 and Fig.11. Results revealed that majority of the farmers (100%) in District Bandipora had no knowledge about the prior stocking of seed/testing the quality of seed. About 33.33% farmers had no Knowledge regarding the precautions needed within transportation of seed and also no partial Knowledge with respect to various precautions needed prior stocking of feed (16.67%).

On the other hand results also depict that farmers in district Baramulla (33.33%) had no knowledge regarding the prior stocking of seed/testing the quality of seed and precautions needed within transportation of seed.

4.2.4 Water quality management

In district Bandipora and Baramulla knowledge of farmers about water quality management category of practices is presented in Table 12 and Fig.12. The results in the below given table depicts that majority of the respondents in district Bandipora had no knowledge about the things to be done in order to maintain the Do level in pond and also had low knowledge (66.67%) with respect to the type of parameters to be checked frequently within the culture.

The results in the given table also indicate that the majority of the respondents in district Baramulla had no knowledge about the things to be done in order to maintain the Do level in pond and with respect to the parameters to be checked frequently within the culture the farmers (4.76%) had complete knowledge about the same.

Table 11: Knowledge level of trout seed management in district Bandipora and Baramulla

S.no	Seed management	Bandipora			Baramulla		
		Complete (%)	Partial (%)	No (%)	Complete (%)	Partial (%)	No (%)
1	Which precautions should be needed within transportation of seed?	0 (0)	4 (66.67)	2 (33.33)	0 (0)	8 (38.09)	13 (61.90)
2	What precautions should be needed prior stocking of seed?	0 (0)	5 (83.33)	1 (16.67)	0 (0)	14 (66.67)	7 (33.33)
3	What should be the stocking rate of seed?	6 (100)	0 (0)	0 (0)	21 (100)	0 (0)	0 (0)
	Overall knowledge	33.33%	50%	16.67%	33.33%	34.93%	31.74%

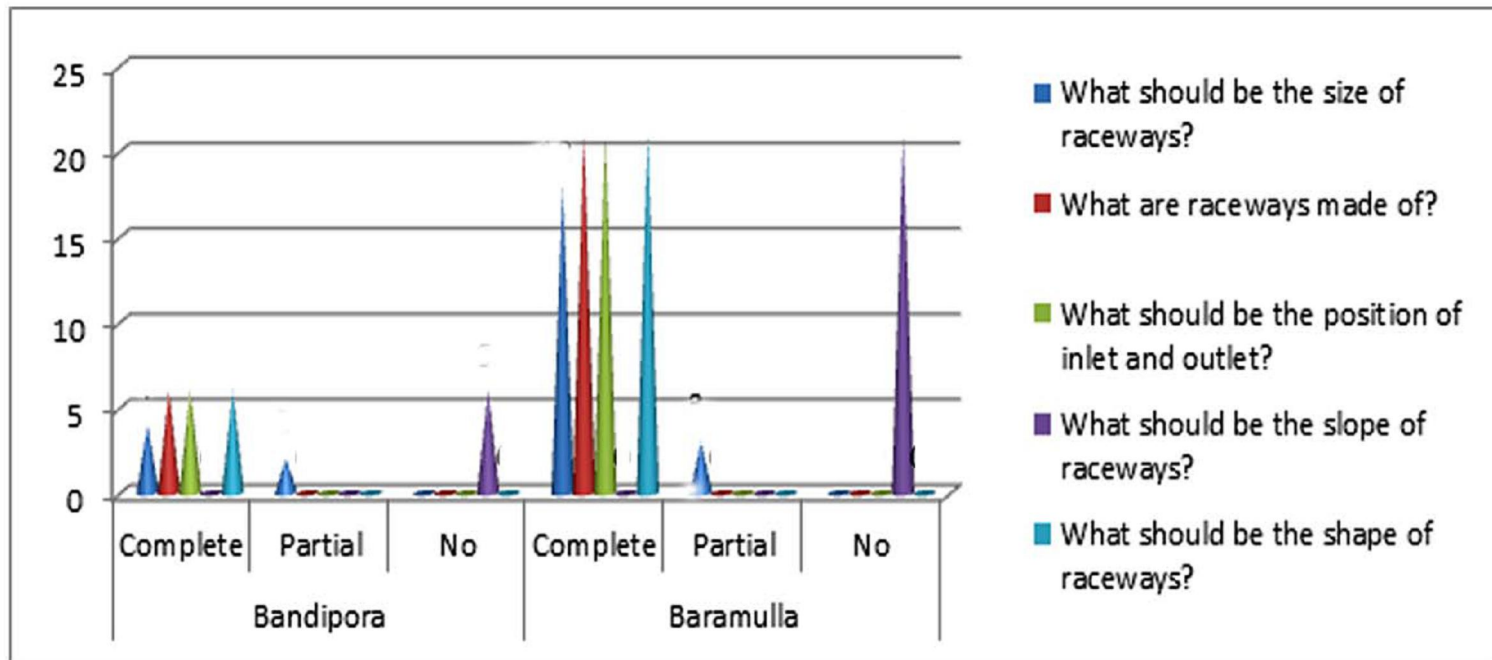


Fig.10: Knowledge level of raceways construction of trout farmers in district Bandipora and Baramulla

Table 12: Knowledge level of water quality management for trout farming in district Bandipora and Baramulla

S.no	Water quality management	Bandipora			Baramulla		
		Complete (%)	Partial (%)	No (%)	Complete (%)	Partial (%)	No (%)
1	What should be done to maintain Do level in pond?	0 (0)	4 (66.67)	2 (33.33)	0 (0)	18 (85.71)	3 (14.28)
2	Which parameters should be checked frequently within the culture?	0 (0)	2 (33.33)	4 (66.67)	2 (9.52)	16 (76.19)	3 (14.29)
	Overall knowledge	0%	50%	50%	4.76%	80.95%	14.29%

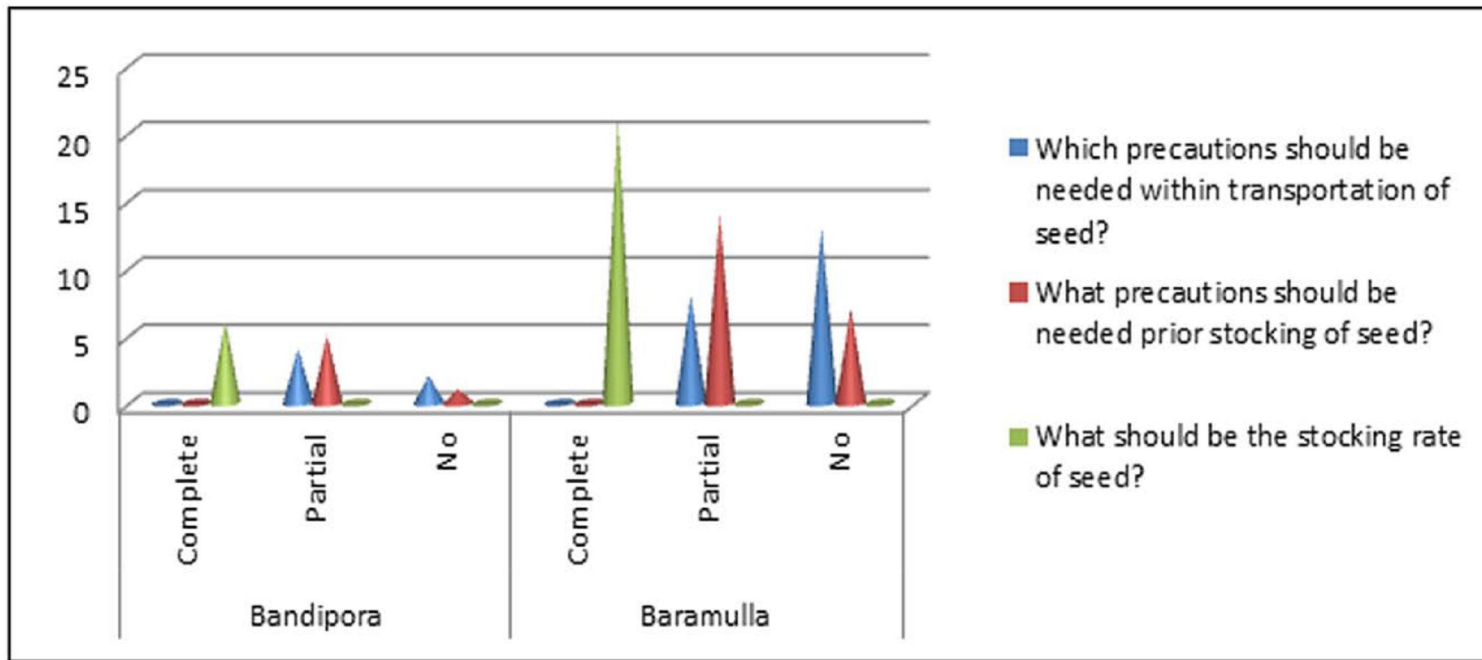


Fig.11: Knowledge level of trout seed management in district Bandipora and Baramulla

4.2.5 Feed management

In district Bandipora and Baramulla farmers' knowledge about package of feed management practices is given in Table 13 and Fig.13. The results depict that majority of the respondents in district Bandipora (100%) had no knowledge about the method used for estimating the feed consumption by fish. The fish farmers (33.33%) had complete knowledge regarding the quantity of daily feed ration. About 100% farmers had a high knowledge about the frequency of feeding of the fishes. Least awareness was also found with respect to the knowledge about required protein content of the feed. Interestingly, none of the respondents (100%) checks the manufacturing date of the feed before feeding the fishes in the said district.

The respondents in the district Baramulla had least knowledge about the method for estimating feed consumption by fish (100%) and the required protein content of the feed (100%). However respondents had high Knowledge (76.20%) about the quantity of daily feed ration to be fed and high Knowledge (100%) regarding the frequency of feeding. Interestingly, none of the respondents (100%) checks the manufacturing date of the feed before feeding the fishes in the said district.

4.2.6 Health management

Results in Table 14 and Fig.14. depicts that majority of the respondents in district Bandipora (100%) had no knowledge about monitoring the growth and health of fish within culture. About 33.33% farmers had complete knowledge about the regulations for waste water of the farm.

Findings in below table also indicate that majority of the respondents (33.33%) in district Baramulla had no knowledge about monitoring the growth and health of fish within culture. However a good majority (66.67%) had high knowledge about the regulations for waste water of the farm.

Table 13: Knowledge level of trout feed management in district Bandipora and Baramulla

S.no	Feed management	Bandipora			Baramulla		
		Complete (%)	Partial (%)	No (%)	Complete (%)	Partial (%)	No (%)
1	What should be quantity of daily feed ration?	2 (33.33)	4 (66.67)	0 (0)	16 (76.20)	5 (23.80)	0 (0)
2	What should be the feeding frequency?	6 (100)	0 (0)	0 (0)	21 (100)	0 (0)	0 (0)
3	What should be protein content of feed?	0 (0)	0 (0)	6 (100)	0 (0)	0 (0)	21 (100)
4	Did you see manufacturing date of feed?	0 (0)	0 (0)	6 (100)	0 (0)	0 (0)	21 (100)
	Overall knowledge	33.33%	16.68%	50%	44.05%	5.95%	50%

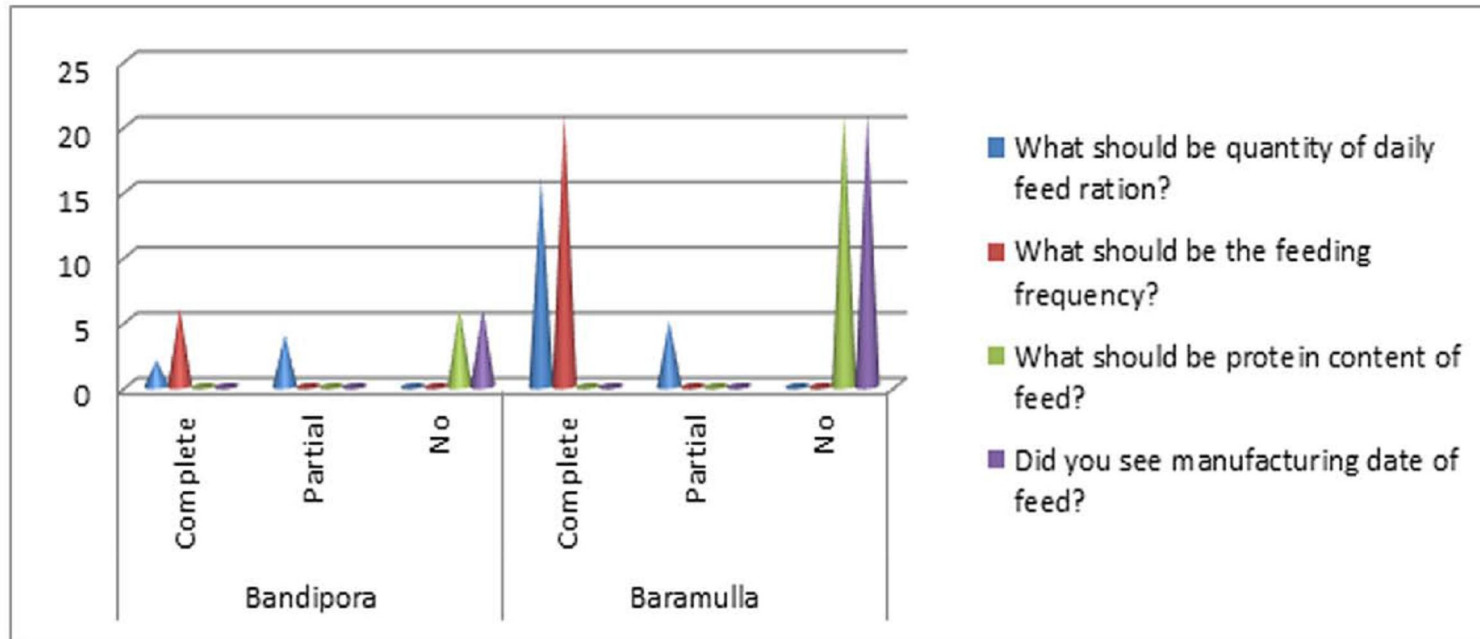


Fig.13: Knowledge level of trout feed management in district Bandipora and Baramulla

Table 14: Knowledge level of trout health management in district Bandipora and Baramulla

S.no	Health management	Bandipora			Baramulla		
		Complete (%)	Partial (%)	No (%)	Complete (%)	Partial (%)	No (%)
1	How can you monitor growth and health of fish within culture?	0 (0)	0 (0)	6 (100)	5 (23.80)	9 (42.86)	7 (33.33)
2	What are the regulations for waste water of farm?	2 (33.33)	4 (66.67)	0 (0)	14 (66.67)	7 (33.33)	0 (0)
	Overall knowledge	16.67%	33.33%	50%	45.23%	38.10%	16.67%

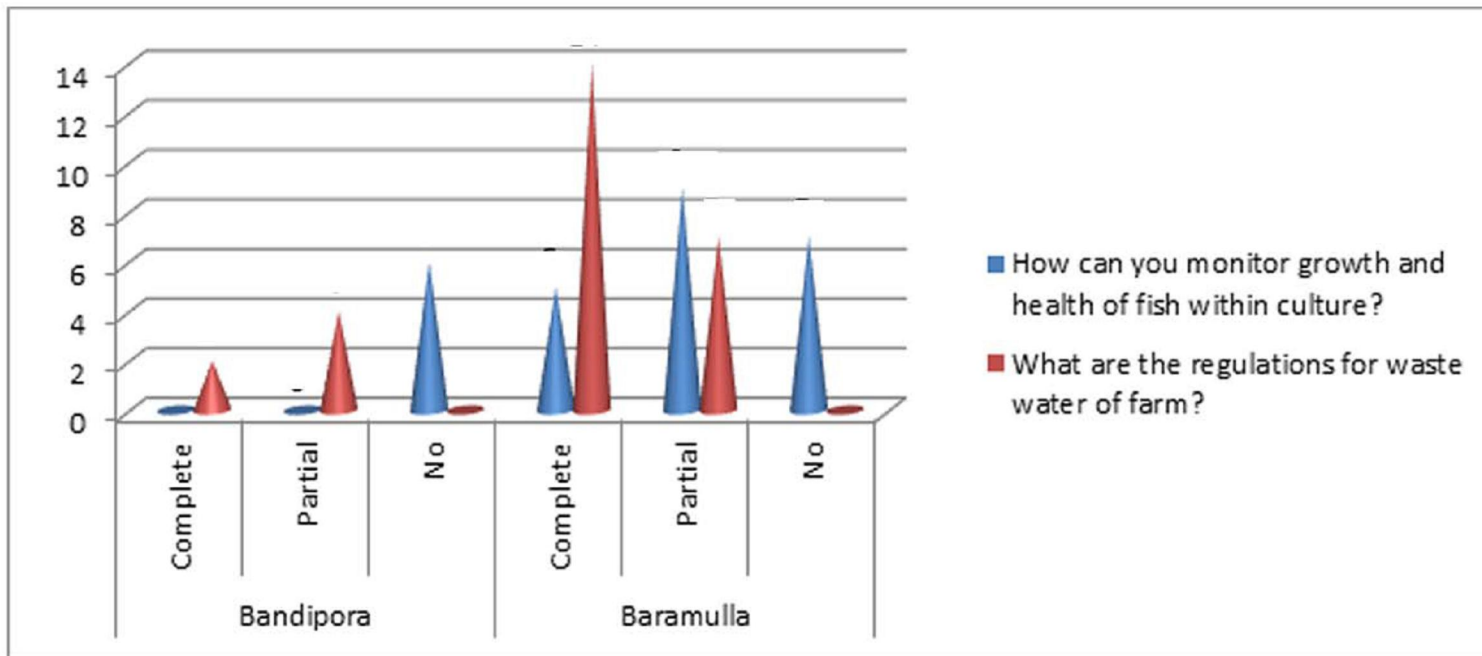


Fig 14: Knowledge level of trout health management in district Bandipora and Baramulla

4.3 Adoption of fish farming practices

4.3.1 Site selection

Adoption level related to site selection is given in Table 15 and Fig.15. The adoption of farmers regarding temperature of water, flow of water and source of water suitable for trout culture was high in District Bandipora. On the other hand, Adoption about flow of water and source of water suitable for trout culture was high in district Baramulla.

4.3.2 Raceway construction

Results in Table 16 and Fig.16 depict that majority of the farmers (100%) in both the districts that is district Bandipora and district Baramulla had completely adopted the farm design and pond construction which included size of raceways, materials of which raceways are made up of, the position about inlet and outlet and the slope of raceways.

4.3.3 Seed management

The results in the below given Table 17 and Fig.17 indicate that majority of the respondents in District Bandipora and District Baramulla had adopted the various measures for managing the seed which included prior stocking of feed, precautionary measures to be taken while transportation and stocking.

4.3.4 Water quality management

Results in Table 18 and Fig.18. indicate that few of the respondents in the district Bandipora and district Baramulla had adopted the measures to maintain the Do level in pond. However least complete adoption was seen in case of the various parameters that need to be checked frequently within the culture.

Table 15: Adoption level of site selection of trout farmers in district Bandipora and Baramulla

S.no	Site selection	Bandipora			Baramulla		
		Complete (%)	Partial (%)	No (%)	Complete (%)	Partial (%)	No (%)
1	Which water source should be suitable for trout culture?	6 (100)	0 (0)	0 (0)	21 (100)	0 (0)	0 (0)
2	Which water characteristics should be checked?	0 (0)	2 (33.33)	4 (66.67)	0 (0)	9 (42.86)	12 (57.14)
3	What should be the temperature of water?	6 (100)	0 (0)	0 (0)	21 (100)	0 (0)	0 (0)
4	What should be flow of water?	6 (100)	0 (0)	0 (0)	21 (100)	0 (0)	0 (0)
5	Which is the ideal site for construction of raceway?	6 (100)	0 (0)	0 (0)	21 (100)	0 (0)	0 (0)
	Overall adoption	80%	6.66%	13.34%	80%	8.57%	11.43%

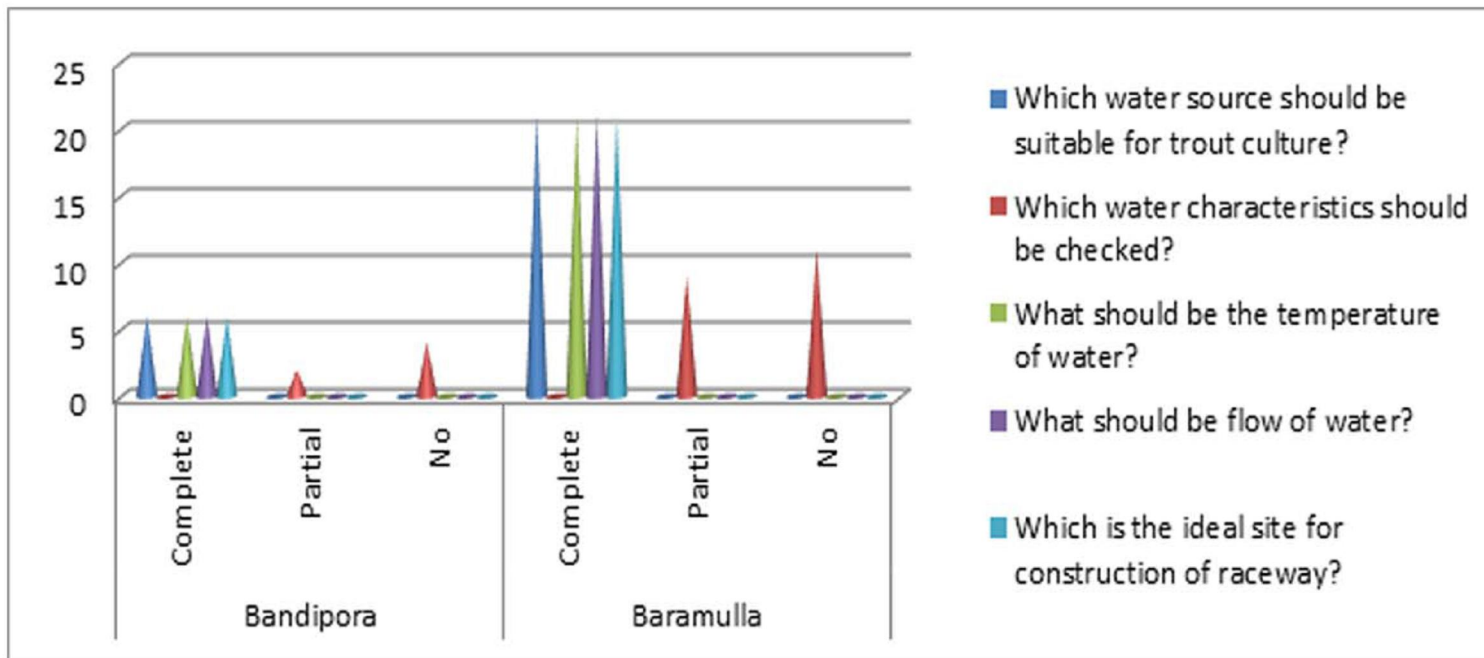


Fig. 15: Adoption level of site selection of trout farmers in district Bandipora and Baramulla

Table 16: Adoption level of raceway construction of trout farmers in district Bandipora and Baramulla

S.no	Raceway Construction	Bandipora			Baramulla		
		Complete (%)	Partial (%)	No (%)	Complete (%)	Partial (%)	No (%)
1	What should be the size of raceways?	6 (100)	0 (0)	0 (0)	21 (100)	0 (0)	0 (0)
2	What are raceways made of?	6 (100)	0 (0)	0 (0)	21 (100)	0 (0)	0 (0)
3	What should be the position of inlet and outlet?	4 (66.67)	2 (33.33)	0 (0)	20 (95.24)	1 (4.76)	0 (0)
4	What should be the slope of raceways?	2 (33.33)	4 (66.67)	0 (0)	21 (100)	0 (0)	0 (0)
5	What should be the shape of raceways?	6 (100)	0 (0)	0 (0)	21 (100)	0 (0)	0 (0)
	Overall adoption	80%	20%	0%	99.04%	0.96%	0%

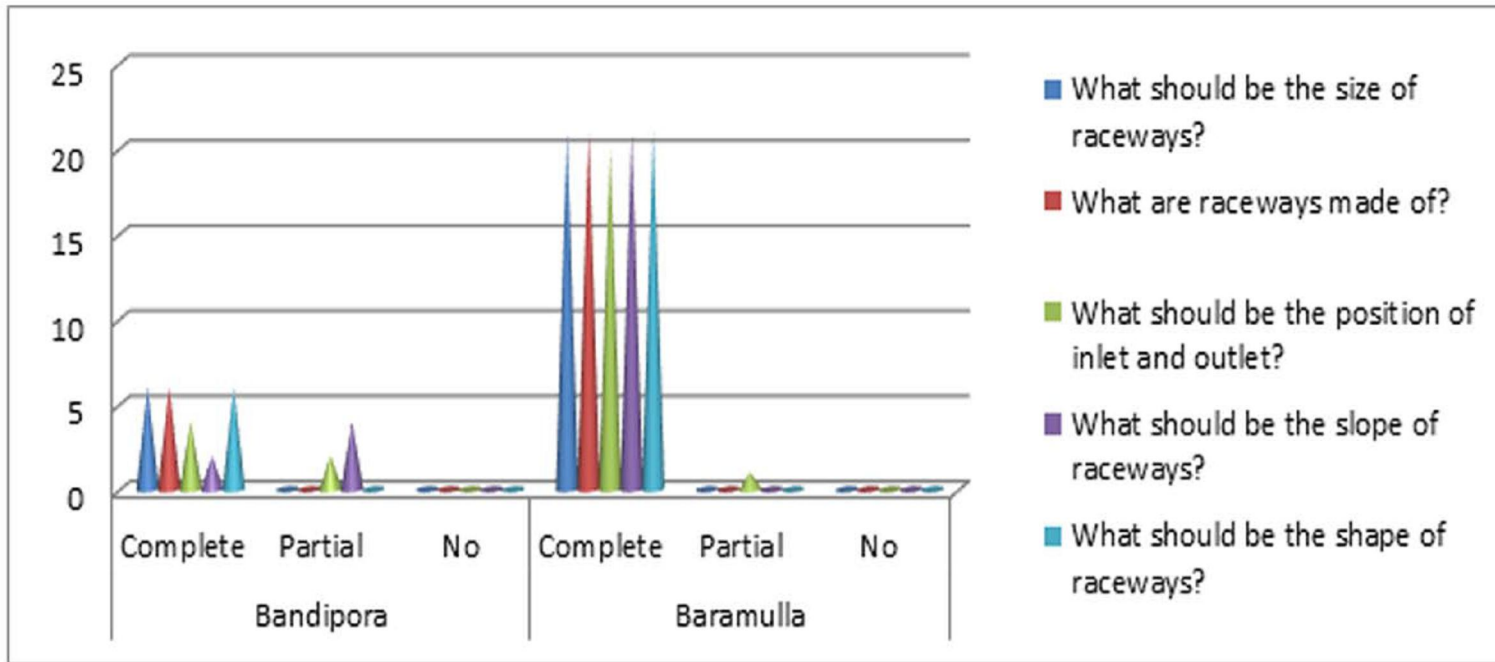


Fig.16: Adoption level of raceway construction of trout farmers in district Bandipora and Baramulla

Table 17: Adoption level of trout seed management in district Bandipora and Baramulla

S.no	Seed Management	Bandipora			Baramulla		
		Complete (%)	Partial (%)	No (%)	Complete (%)	Partial (%)	No (%)
1	Which precautions should be needed within transportation of seed?	4 (66.67)	2 (33.33)	0 (0)	16 (76.19)	5 (23.81)	0 (0)
2	What precautions should be needed prior stocking of seed?	2 (33.33)	4 (66.67)	0 (0)	14 (66.67)	7 (33.33)	0 (0)
3	What should be the stocking rate of seed?	6 (100)	0 (0)	0 (0)	21 (100)	0 (0)	0 (0)
	Overall adoption	66.67%	33.33%	0%	80.96%	19.04%	0%

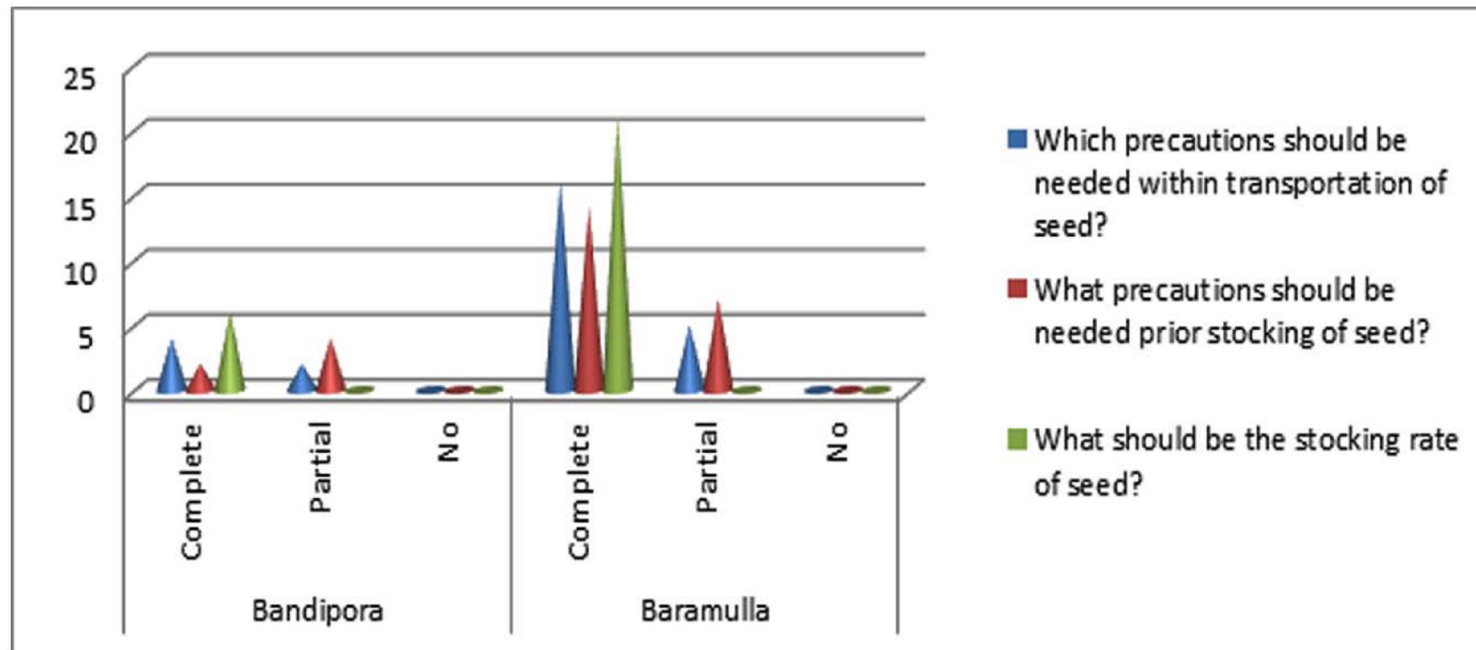


Fig. 17: Adoption level of trout seed management in district Bandipora and Baramulla

Table 18: Adoption level of water quality management for trout farming in district Bandipora and Baramulla

S.no	Water quality Management	Bandipora			Baramulla		
		Complete (%)	Partial (%)	No (%)	Complete (%)	Partial (%)	No (%)
1	What should be done to maintain Do level in pond?	0 (0)	5 (83.33)	1 (16.67)	0 (0)	18 (85.72)	3 (14.28)
2	Which parameters should be checked frequently within the culture?	2 (33.33)	4 (66.67)	0 (0)	6 (28.58)	15 (71.42)	0 (0)
	Overall adoption	16.68%	75%	8.33%	14.29%	78.57%	7.14%

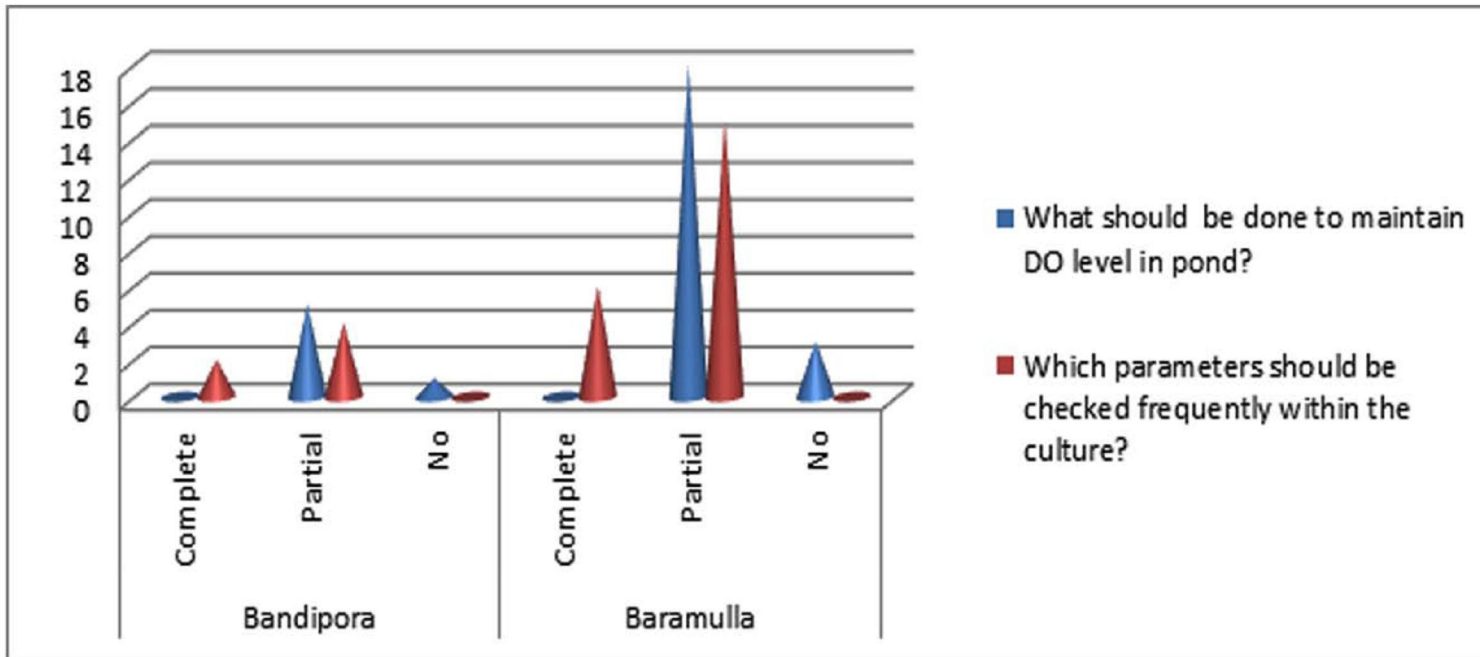


Fig.18: Adoption level of water quality management for trout farming in district Bandipora and Baramulla

4.3.5 Feed management

A perusal of Table 19 and Fig.19 indicates that almost majority of the respondents in district Bandipora and district Baramulla had adopted the feed management which included method for estimating feed consumption by fish, quantity of daily feed ration and feeding frequency. Similarly, cent percent non-adoption was observed with regard to protein content and manufacturing date of feed.

4.3.6 Health management

A perusal of given Table 20 and Fig.20 indicates that majority of the respondents in district Bandipora had not adopted the health management variable that is monitoring the growth and health of fish within the culture. However respondents from district Baramulla (42.86%) had no Knowledge about the same. With respect to the regulations of waste water for farm, a major of respondents (83.33%) had not adopted from Bandipora district and (61.90%) respondents from Baramulla district had not fully adopted the said practice.

Table 19: Adoption level of trout feed management in district Bandipora and Baramulla

S.no	Feed management	Bandipora			Baramulla		
		Complete (%)	Partial (%)	No (%)	Complete (%)	Partial (%)	No (%)
1	What should be quantity of daily feed ration?	0 (0)	4 (66.67)	2 (33.33)	0 (0)	14 (66.67)	7 (33.33)
2	What should be the feeding frequency?	5 (83.33)	1 (16.67)	0 (0)	17 (80.96)	4 (19.04)	0 (0)
3	What should be protein content of feed?	6 (100)	0 (0)	0 (0)	6 (100)	0 (0)	0 (0)
4	Did you see manufacturing date of feed? If yes then within how many days it should be used from manufacturing date?	0 (0)	0 (0)	6 (100)	0 (0)	7 (33.33)	14 (66.67)
	Overall adoption	45.83%	20.84%	33.33%	45.24%	29.77%	24.99%

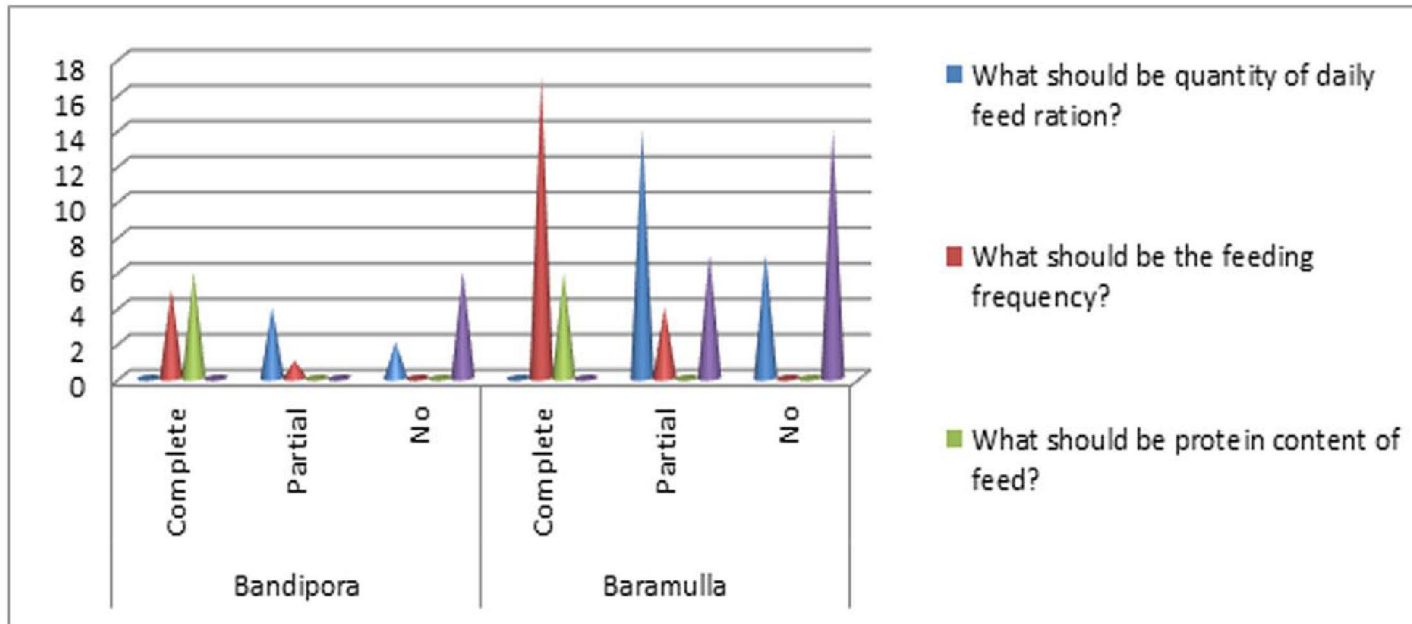


Fig.19: Adoption level of trout feed management in district Bandipora and Baramulla

Table 20: Adoption level of trout health management in district Bandipora and Baramulla

S.no	Health management	Bandipora			Baramulla		
		Complete (%)	Partial (%)	No (%)	Complete (%)	Partial (%)	No (%)
1	How can you monitor growth and health of fish within culture?	0 (0)	2 (33.33)	4 (66.67)	0 (0)	12 (57.14)	9 (42.86)
2	What are the regulations for waste water of farm?	0 (0)	1 (16.67)	5 (83.33)	0 (0)	8 (38.10)	13 (61.90)
	Overall adoption	0%	25%	75%	0%	47.62%	52.38%

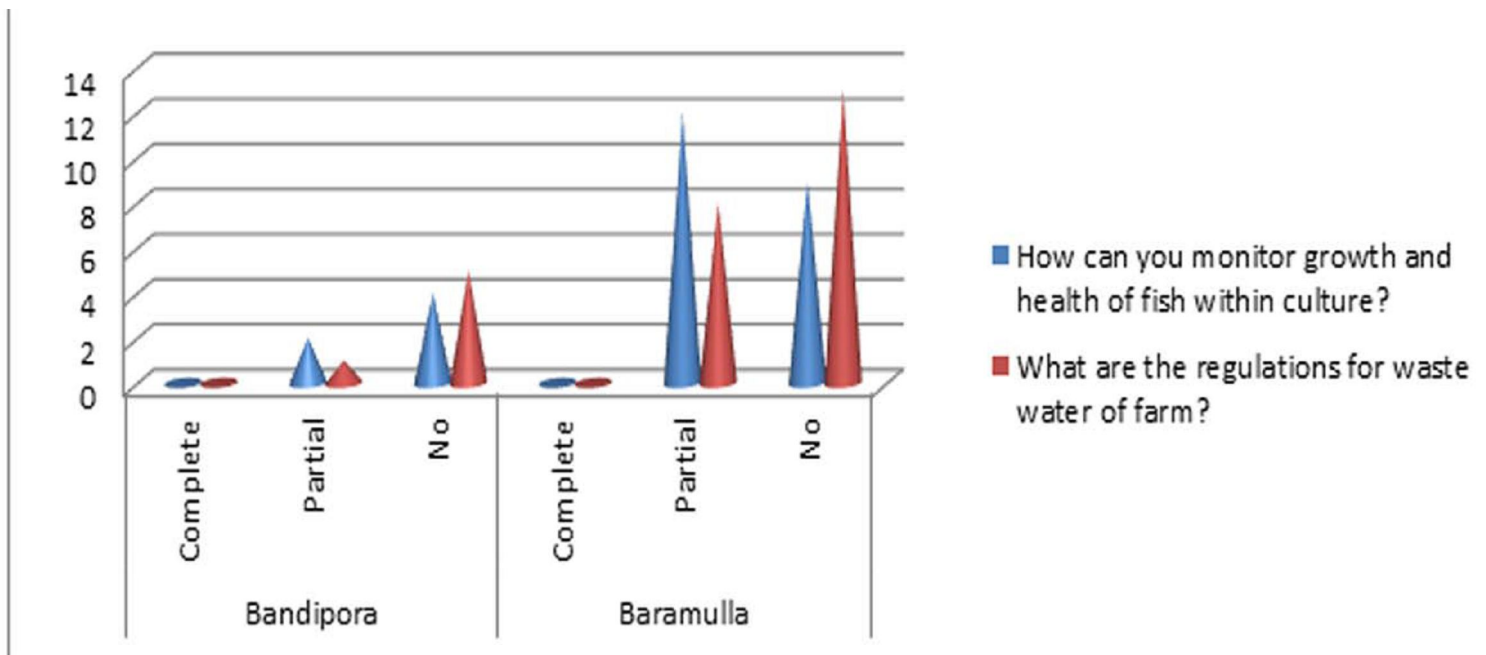


Fig.20: Adoption level of trout health management in district Bandipora and Baramulla

4.4 SOCIO-ECONOMIC PROFILE OF CARP FARMERS

4.4.1 Age of carp farmers

Farmers were classified according to age and their expected number in different age groups were calculated by constructing normal distribution. Number of farmers observed and expected according to age groups is presented in Table 21 and the same is depicted in Figure 21. The results of the table shows that more than half of the respondents (53.84%) from Bandipora district were falling in the age group of 36-50 years. Similarly majority of the respondents (71.05%) from Baramulla district also had an age group of 36-50 years.

Table 21: Age group of carp farmers of district Bandipora and Baramulla

S.No	Age group	Carp fish farmers			
		Bandipora		Baramulla	
		No.	Frequency	No.	Frequency
1	18-35	10	38.47	8	21.06
2	36-50	14	53.84	27	71.05
3	>50	2	7.69	3	7.89
Total		26	100	38	100

4.4.2 Level of education

Education is the process of facilitating learning or acquisition of knowledge, skills, values, beliefs and habits. Table 22 and Fig.22 focuses on the education status of the carp fish farmers in the concerned areas of study. The results of the table depicts that a major good number of farmers (69.23%) and (55.27%) had received education upto primarily level in Bandipora and Baramulla districts respectively.

Table 22: Educational level of carp farmers of district Bandipora and Baramulla

S.No	Education status	Carp fish farmers			
		Bandipora		Baramulla	
		Frequency	%	Frequency	%
1	Primary	18	69.23	21	55.27
2	Secondary	3	11.54	6	15.79
3	Higher secondary	3	11.54	8	21.05
4	Graduation level	2	7.69	3	7.89
Total		26	100	38	100

4.4.3 Family size

A perusal of the Table 23 and Fig.23 depicts that majority (73.08%) of the carp fish farmers in Bandipora district were having a family size of greater than five per household while as more than half of the respondents (55.27%) in Baramulla district had a family size of less than five perhousehold.

Table 23: Family size of carp farmers of district Bandipora and Baramulla

S.No	Size of family	Carp fish farmers			
		Bandipora		Baramulla	
		No.	Frequency	No.	Frequency
1	≤5	7	26.92	21	55.27
2	>5	19	73.08	17	44.73
Total		26	100	38	100

4.4.4: Type of family

Table 24 and Fig.24 shows that majority of the respondents (57.69%) in Bandipora district were residing in joint families as compared to Baramulla district where the major good (68.42%) were living in nuclear Families.

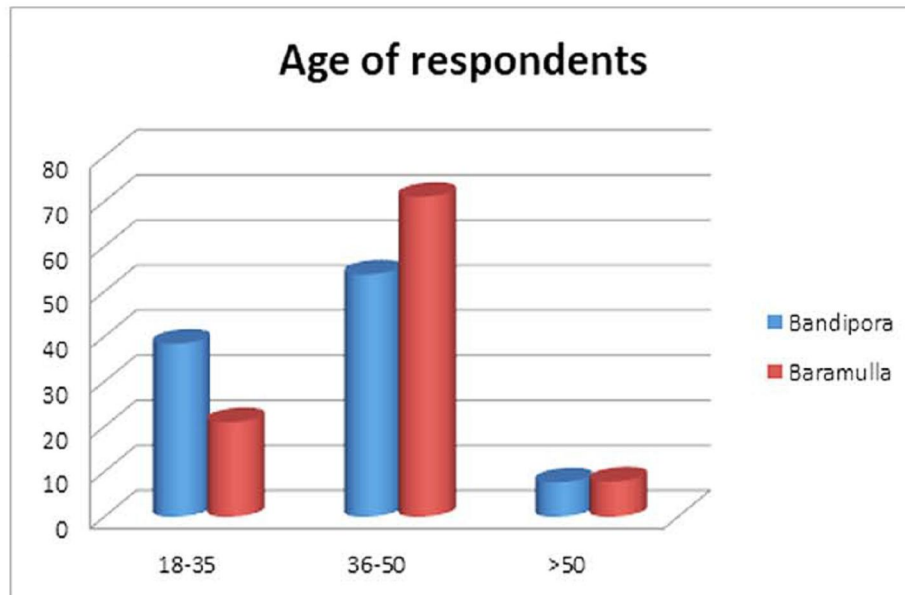


Fig.21: Age group of carp farmers of district Bandipora and Baramulla

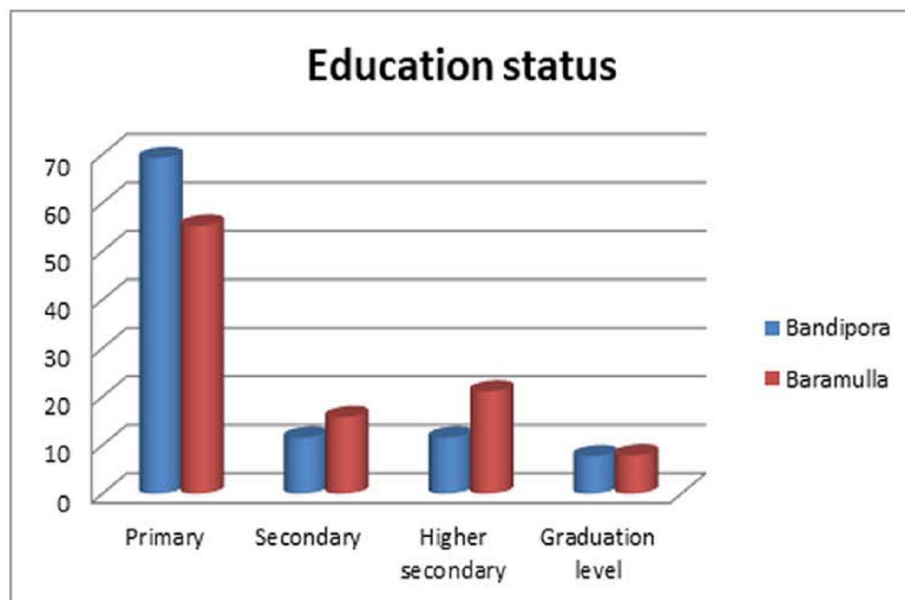


Fig. 22: Educational level of carp farmers of district Bandipora and Baramulla

Table24: Type of family of carp farmers of district Bandipora and Baramulla

S.No	Type of family	Carp fish farmers			
		Bandipora		Baramulla	
		Frequency	%	Frequency	%
1	Nuclear	11	42.31	26	68.42
2	Joint	15	57.69	12	31.58
Total		26	100	38	100

4.4.5 Ownership pattern

Carp fish farmers were classified according to land ownership pattern. A cursory look of the Table 25 and Fig.25 points out to the fact that majority of the respondents (100%) from both the districts that is district Bandipora and district Baramulla were practicing carp fish farming in their own land. Interestingly, none of the carp fish farmers had ownership on partnership and lease basis respectively.

Table 25: Ownership pattern of carp farmers of district Bandipora and Baramulla

S.No	Ownership	Carp Fish farmers			
		Bandipora		Baramulla	
		Frequency	%	Frequency	%
1	Lease	0	0	0	0
2	Partnership	0	0	0	0
3	Own land	26	100	38	100
Total		26	100	38	100

4.4.6 Farming experience

A perusal of the Table 26 and Fig.26 depicts that more than half of the respondents (57.69%) from district Bandipora were having a farming experience of 1-2 years. About 65.78% respondents also had an experience of 2-4 years in fish farming in district Baramulla. Interestingly, none of the respondents from both district was a new entrant in the respective field area.

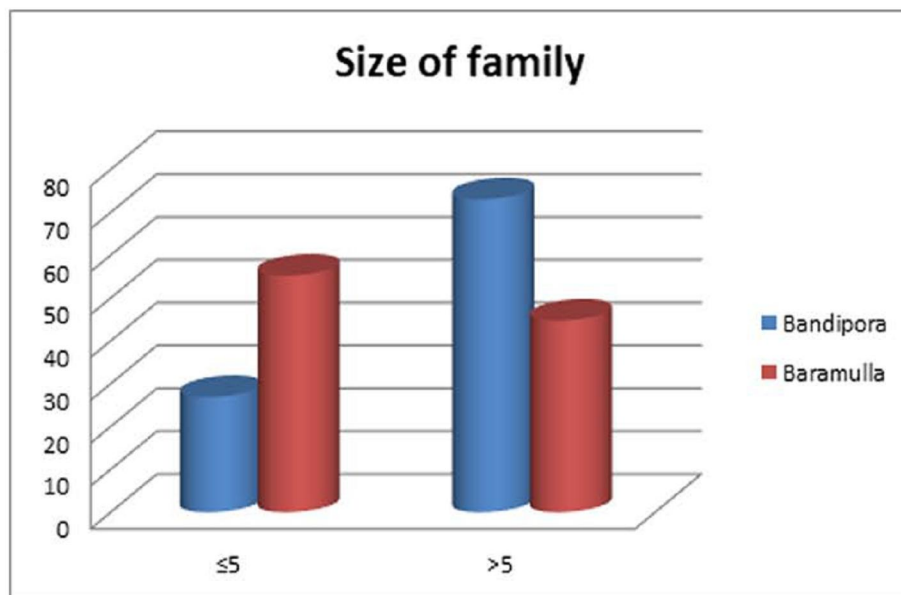


Fig. 23: Family size of carp farmers of district Bandipora and Baramulla

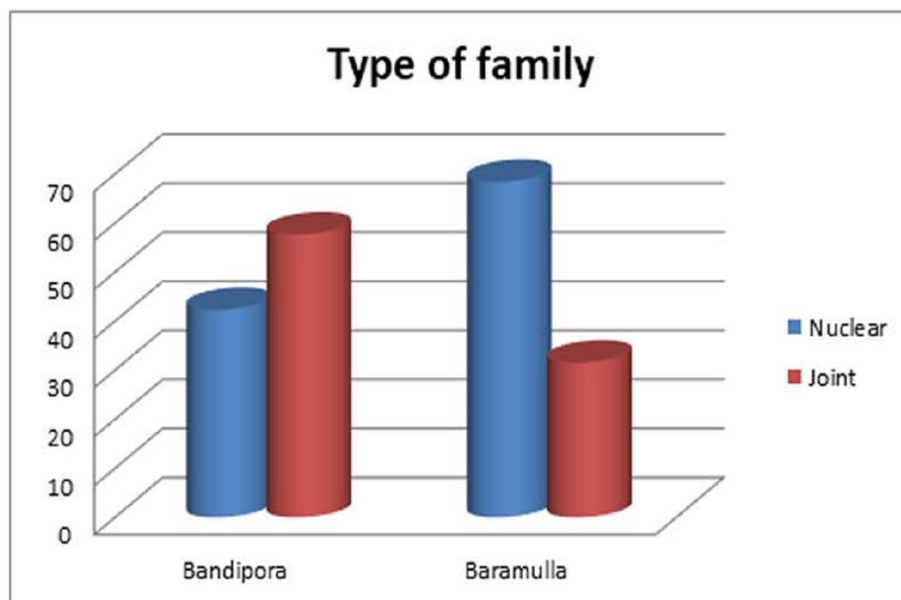


Fig.24: Type of family of carp farmers of district Bandipora and Baramulla

Table 26: Fish farming experience before starting farm of carp farmers in district Bandipora and Baramulla

S.No	Experience	Carp fish farmers			
		Bandipora		Baramulla	
		No.	Frequency	No.	Frequency
1	0-1 years	11	42.31	13	34.22
2	2 years	15	57.69	25	65.78
3	>2 years	0	0	0	0
Total		26	100	38	100

4.4.7 Occupation

The findings in the Table 27 and Fig.27 indicate that the main occupation of more than half of the respondents (53.85%) in district Bandipora was business (small scale) followed by doing agricultural farming (30.78%) and fish farming (11.53%). Similarly the respondents from Baramulla district (47.37%) were engaged in doing small scale business followed by agricultural farming (31.58%) and fish farming (15.79%) respectively.

Table 27: Occupation of carp farmers in district Bandipora and Baramulla

S.No	Occupation	Carp fish farmers			
		Bandipora		Baramulla	
		No.	Frequency	No.	Frequency
1	Fish farming	3	11.53	6	15.79
2	Agriculture farming	8	30.78	12	31.58
3	Business	14	53.85	18	47.37
4	Others	1	3.84	2	5.26
Total		26	100	38	100

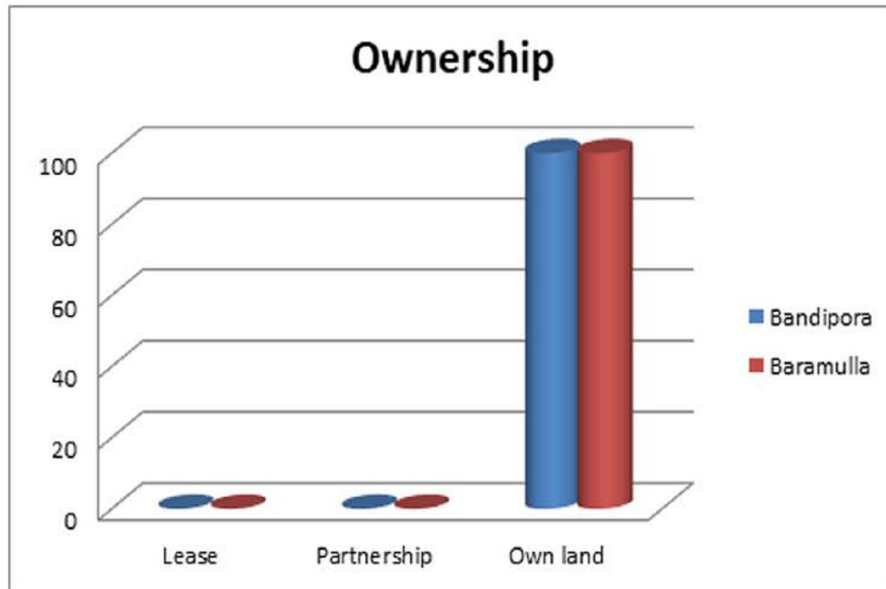


Fig 25: Ownership pattern of carp farmers in district Bandipora and Baramulla

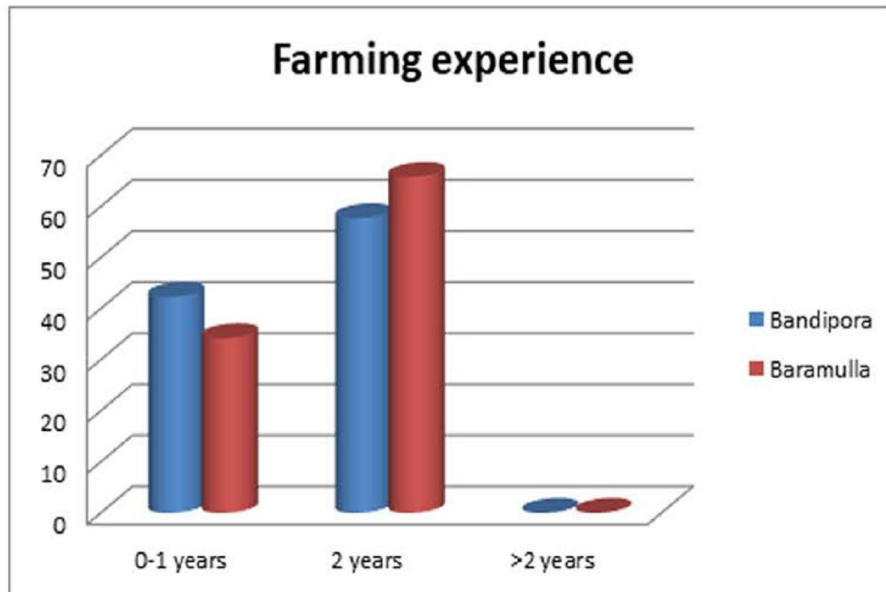


Fig.26: Fish farming experience before starting carp farm of district Bandipora and Baramulla

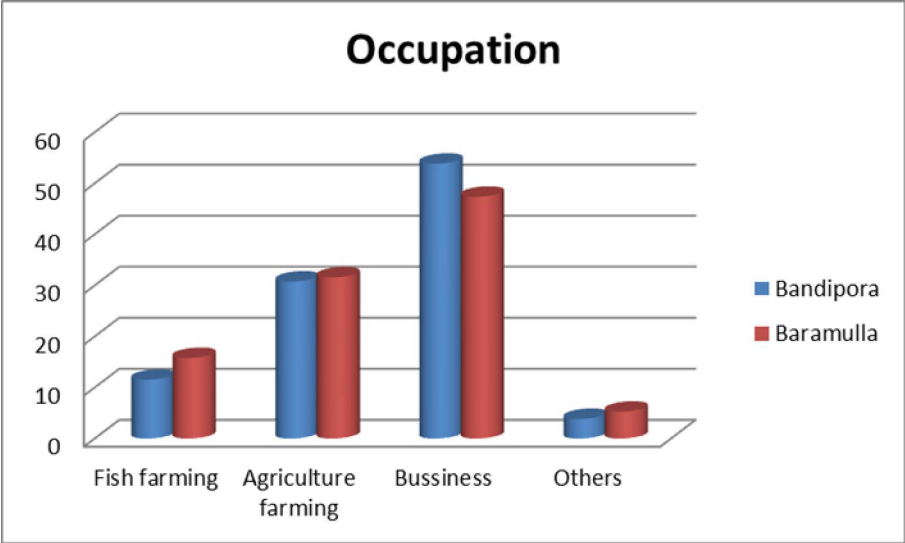


Fig. 27: Occupation of carp farmers of district Bandipora and Baramulla

4.5 Knowledge of Carp Fish Farming Practices

4.5.1 Site selection

Knowledge level related to site selection is given in Table 28 and Fig.28. Practices such as soil type, checking of soil (chemical) and water characteristics and topography were included in site selection category of practices. With respect to the characteristics of the soil that should be checked, the knowledge level of majority (38.47%) of the fish farmers in Bandipora district was found no knowledge partial in comparison to the farmers of Baramulla district where the majority (73.69%) being unaware about the same. The major findings in the below given table indicate that majority (65.39%) of the fish farmers in Bandipora district were not aware about the various characteristics of water that need to be checked. On the other hand, about 21.06% respondents in district Baramulla were having no Knowledge about the same.

Table 28: Knowledge level of site selection of carp farmers in district Bandipora and Baramulla

s.no	Site selection	Knowledge					
		Bandipora			Baramulla		
		Complete (%)	Partial (%)	No (%)	Complete (%)	Partial (%)	No (%)
1	Which soil (chemical) Characteristics should be checked	0 (0)	16 (61.53)	10 (38.47)	0 (0)	10 (26.31)	28 (73.69)
2	Which water characteristics should be checked?	0 (0)	9 (34.61)	17 (65.39)	0 (0)	30 (78.94)	8 (21.06)
3	Which type of soil is necessary for farm?	0 (0)	0 (0)	0 (100)	0 (0)	0 (0)	0 (100)
	Overall knowledge	0%	32.04%	67.96%	0%	35.09%	64.91%

4.5.2 Farm design and pond construction

The results in the below given Table 29 and Fig.29 indicate that majority of the fish farmers in both Districts viz., District Bandipora and district Baramulla had no Knowledge about the level of freeboard (100) and no knowledge about how should the farm be constructed for taking natural benefit of wind direction (100%).

The results in the below given table also indicate that less than half of the fish farmers (46.15%) in district Bandipora were completely aware about the average height of the dike required in the concerned study areas. The fish farmers from Baramulla District were also completely aware (76.31%) about the height of the dike required for construction of a pond .

A cursory look in the below given table also indicate that about 61.53% fish farmers of Bandipora District and 63.16% fish farmers of Baramulla district were having complete knowledge about the slope of the dike be like in the respective study areas.

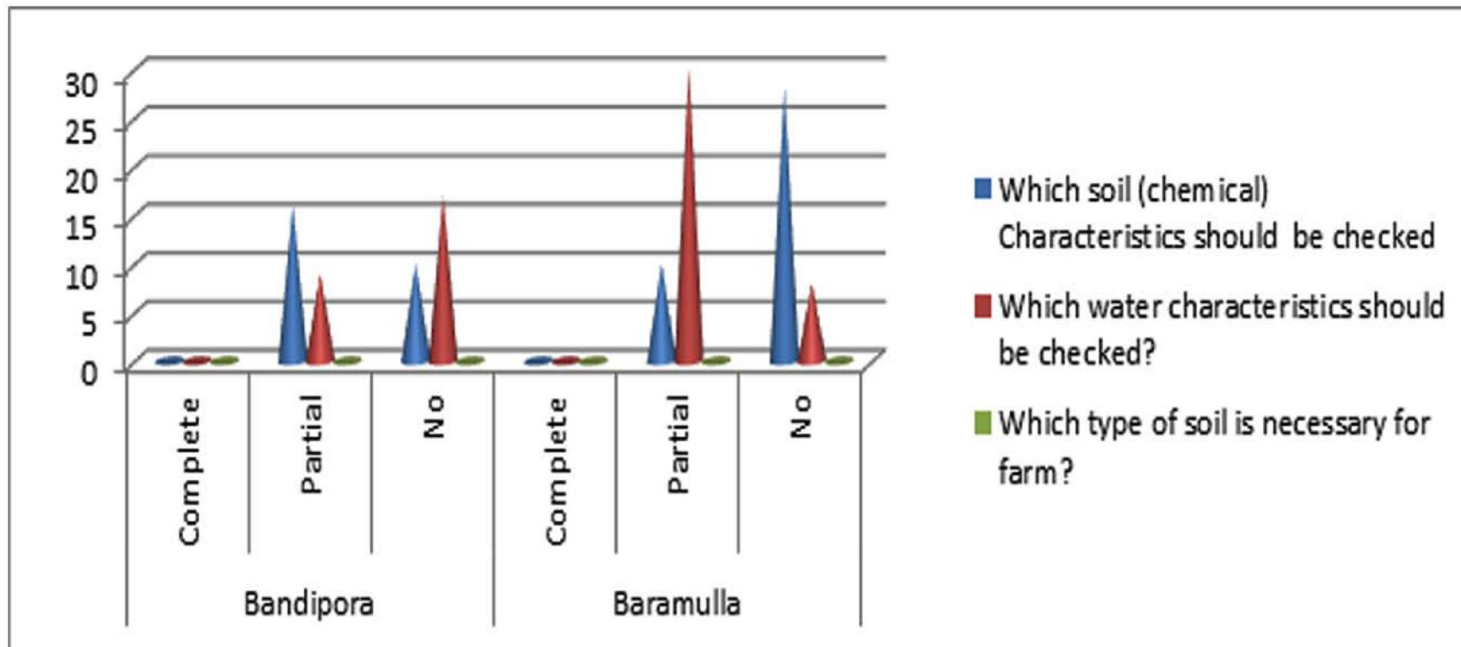


Fig.28: Knowledge level of site selection of carp farmers in district Bandipora and Baramulla

Majority of the fish farmers (100%) in both of the districts *viz.*, district Bandipora and district Baramulla were unaware about the position of inlet and outlet in their respective fish farms.

With respect to the pond shape the major good farmers (100%) from district Bandipora were fully aware about the same. However majority (100%) of fish farmers also had a full knowledge about the shape of the pond to be like in their respective areas.

Table 29: Knowledge level of pond construction of carp farmers in district Bandipora and Baramulla

S.No	Farm design and pond construction	Knowledge					
		Bandipora			Baramulla		
		Complete (%)	Partial (%)	No (%)	Complete (%)	Partial (%)	No (%)
1	What should be used as core of bund?	14 (53.84)	12 (46.16)	0 (0)	9 (23.69)	29 (76.31)	0 (0)
2	What should be the height of dike?	12 (46.16)	14 (53.84)	0 (0)	29 (76.31)	9 (23.69)	0 (0)
3	What should be the slope of dike?	16 (61.53)	6 (23.08)	4 (15.39)	24 (63.16)	10 (26.31)	4 (10.53)
4	What should be the freeboard level?	0 (0)	0 (0)	26 (100)	0 (0)	0 (0)	38 (100)
5	What should be the position of inlet and outlet?	0 (0)	26 (100)	0 (0)	0 (0)	38 (100)	0 (0)
6	What should be the pond bottom slope?	0 (0)	20 (76.92)	6 (23.08)	0 (0)	28 (73.69)	10 (26.31)
7	How should be farm construct for taking natural benefit of wind direction?	0 (0)	0 (0)	26 (100)	0 (0)	0 (0)	38 (100)
8	What should be the pond shape?	26 (100)	0 (0)	0 (0)	38 (100)	0 (0)	0 (0)
	Overall knowledge	32.69%	37.50%	29.81%	32.87%	37.53%	29.60%

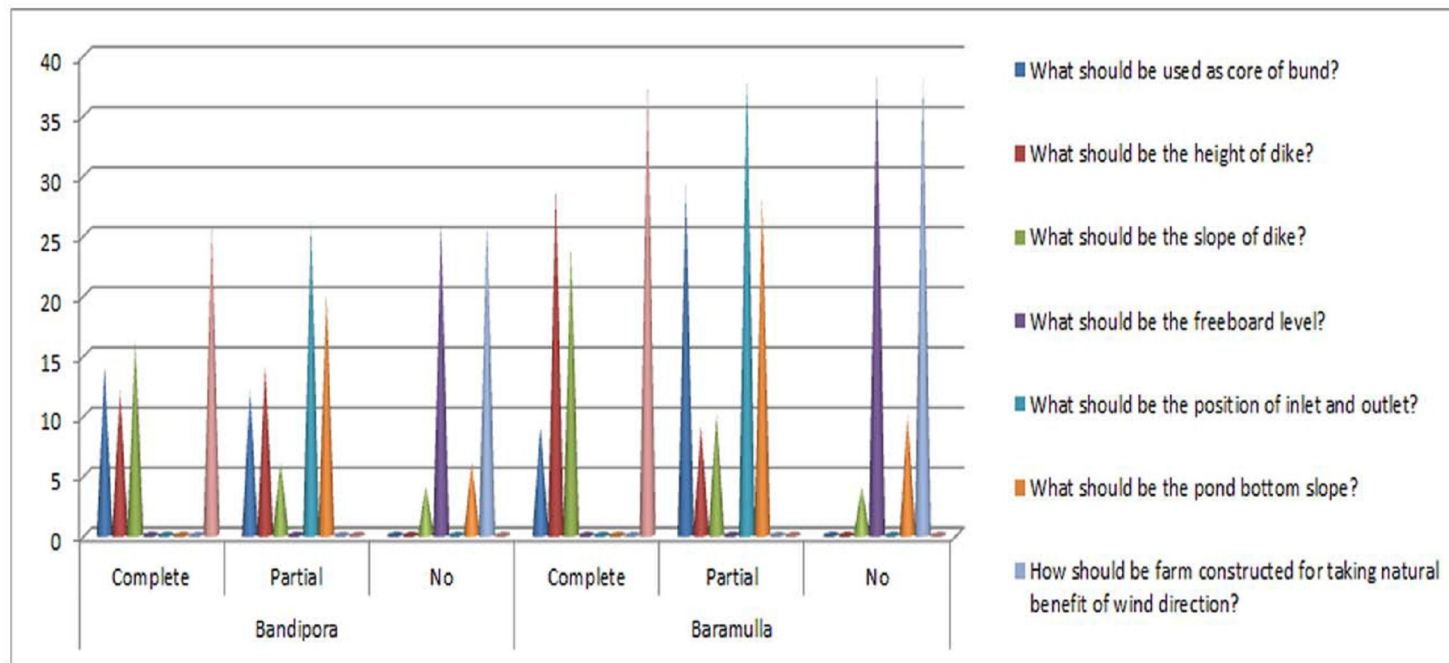


Fig.29: Knowledge level pond construction of carp farmers in district Bandipora and Baramulla

4.5.3 Pond preparation and pre-stocking management

The results in the Table 30 and Fig.30 clearly indicates that majority of the fish farmers in district Bandipora (69.23%) and district Baramulla (78.94%) had complete knowledge about the total number of days the pond should be crack dried. With respect to the dose of bleaching the major being the ones who were completely unaware (100%) about the same in both of the districts respectively. About 65.38% of the fish farmers in district Bandipora were fully aware about the quantity of lime to be used in the pond. However the major good numbers (23.68%) in district Baramulla were the ones who had complete Knowledge about the quantity of lime to be used in the pond.

The findings in the below table indicate that more than half of the respondents from district Bandipora (42.30%) and district Baramulla (47.36%) had complete knowledge about the quantity of organic manure to be used in fish pond.

Results in the below given table depict that maximum fish farmers in district Bandipora and district Baramulla were completely aware about the colour of pond water before stocking.

Findings in the below given table depicts that majority of the fish farmers (100%) in district Bandipora and district Baramulla were unaware about the reading of the secchi disk and the things that should be done in case of low or high secchi disk reading.

Table 30: Knowledge level of pond preparation of carp farmers in district Bandipora and Baramulla

S.no	Pond preparation and pre stocking management	Knowledge					
		Bandipora			Baramulla		
		Complete (%)	Partial (%)	No (%)	Complete (%)	Partial (%)	No (%)
1	How many days pond should be crack dried?	18 (69.23)	6 (23.08)	2 (7.69)	30 (78.94)	5 (13.15)	3 (7.89)
2	What should be dose of bleaching?	0 (0)	0 (0)	26 (100)	0 (0)	0 (0)	38 (100)
3	What should be quantity of lime?	17 (65.38)	5 (19.24)	4 (15.38)	9 (23.68)	25 (65.78)	4 (10.52)
4	What should be quantity of organic manure? (raw cow dung and raw chicken manure)	11 (42.30)	15 (57.70)	0 (0)	18 (47.36)	20 (52.63)	0 (0)
5	What should be colour of pond water before stocking?	20 (76.92)	6 (23.08)	0 (0)	38 (100)	0 (0)	0 (0)
6	What should be Secchi disk reading?	0 (0)	0 (0)	26 (100)	0 (0)	0 (0)	38 (100)
7	What should be done in case of low or high Secchi disk reading?	0 (0)	0 (0)	26 (100)	0 (0)	0 (0)	38 (100)
	Overall knowledge	36.27%	17.61%	46.12%	35.71%	18.81%	45.48%

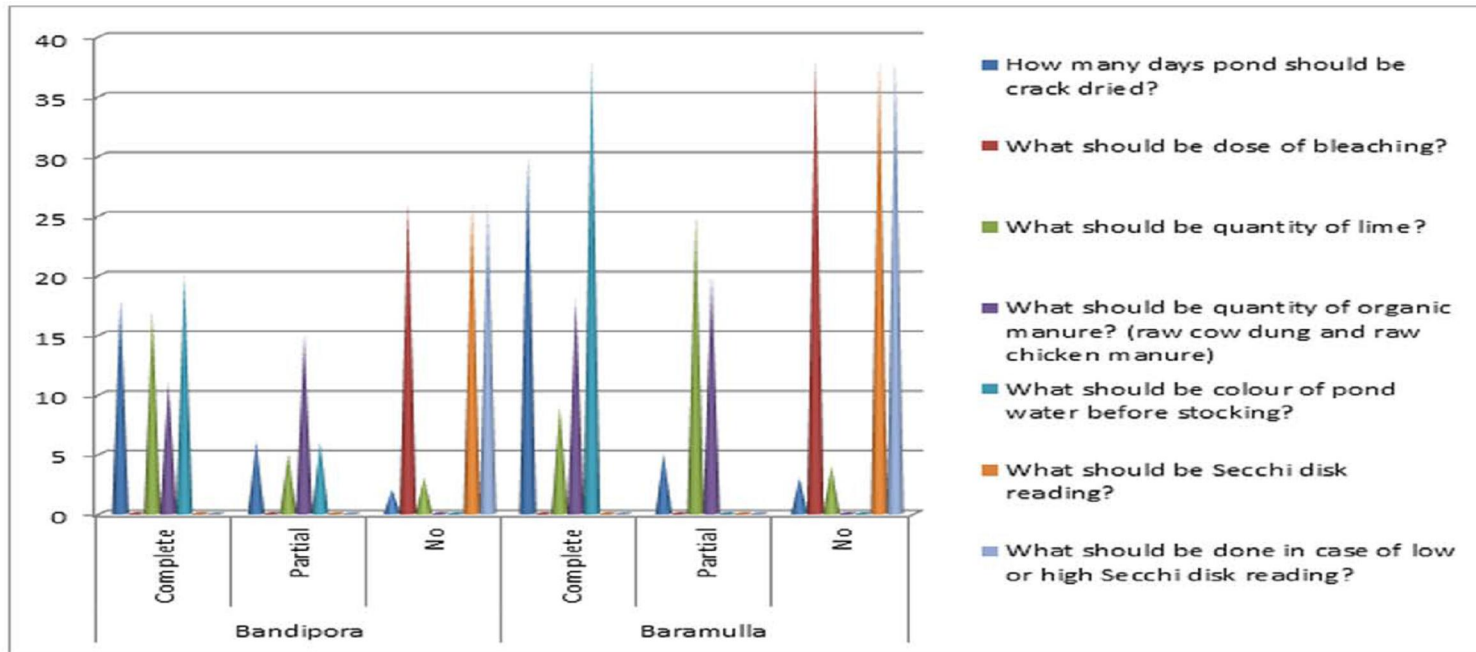


Fig.30: Knowledge level of pond preparation of carp farmers in district Bandipora and Baramulla

4.5.4 Seed management

The results in the Table 31 and Fig.31 depicts that majority (100%) of fish farmers in district Bandipora and Baramulla were having no knowledge about various precautions that are required prior stocking of seed. The fish Farmers in both the districts had complete knowledge about the stocking density of fingerling, the percentage being (38.46%) and (26.31%) in district Bandipora and district Baramulla respectively.

Table 31: Knowledge level of carp seed management in district Bandipora and Baramulla

s.no	Seed management	Knowledge					
		Bandipora			Baramulla		
		Complete (%)	Partial (%)	N0 (%)	Complete (%)	Partial (%)	N0 (%)
1	Prior stocking of seed, what should be done for testing quality of seed?	0 (0)	0 (0)	26 (100)	0 (0)	0 (0)	38 (100)
2	Which precautions should be needed within transportation of seed?	0 (0)	26 (100)	0 (0)	0 (0)	10 (26.31)	28 (73.69)
3	What precautions should be needed prior stocking of seed?	0 (0)	0 (0)	26 (100)	0 (0)	0 (0)	38 (100)
4	What should be stocking density of fry/fingerling?	10 (38.46)	13 (50)	3 (11.54)	10 (26.31)	18 (47.35)	10 (26.34)
	Overall knowledge	9.61%	37.5%	52.89%	6.58%	18.41%	75.01%

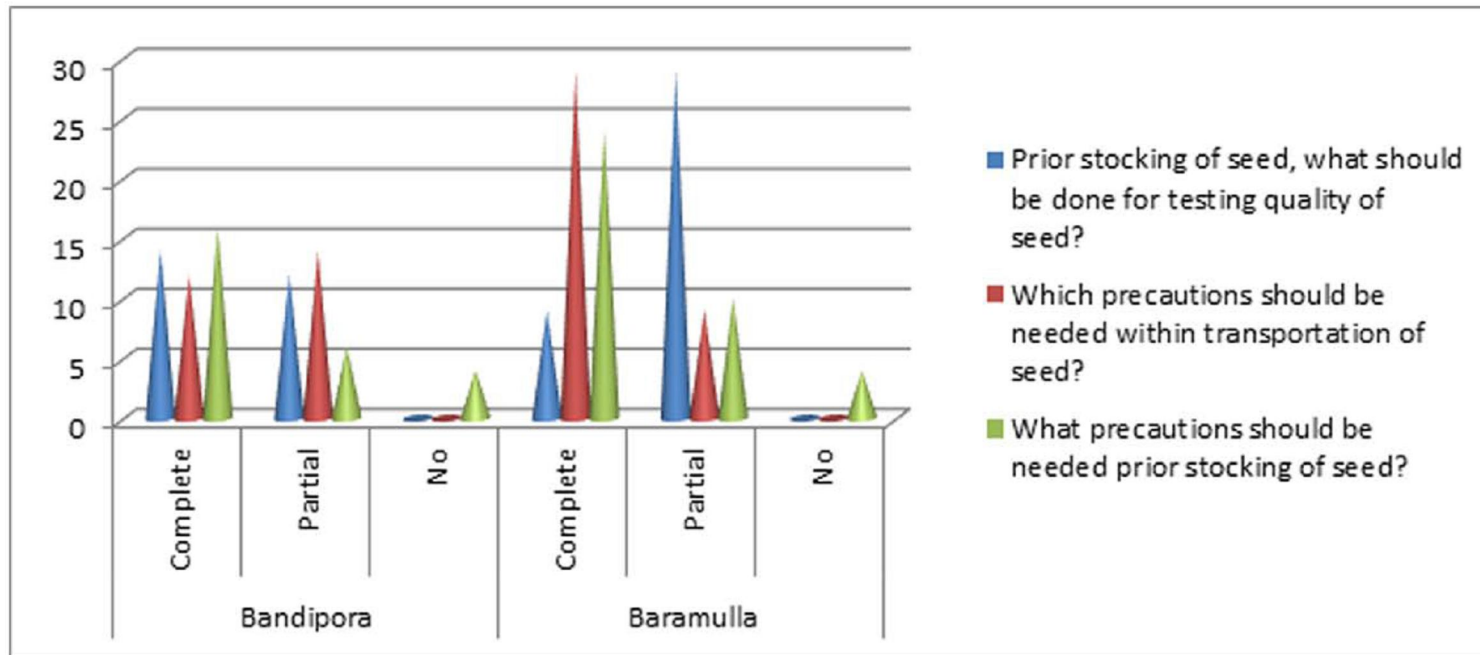


Fig.31: Knowledge level of carp seed management in district Bandipora and Baramulla

4.5.5 Water quality management

Knowledge of farmers about water quality management category of practices is presented in Table 32 and Fig.32. The result indicates that fish farmers in both of the districts *viz.*, district Bandipora and district Baramulla had no knowledge about the things to be done for water quality management in their respective fish farms (100%).

Table 32: Knowledge level of water quality management for carp farming in district Bandipora and Baramulla

	Water quality management	Knowledge					
		Bandipora			Baramulla		
		Complete (%)	Partial (%)	N0 (%)	Complete (%)	Partial (%)	N0 (%)
1	What should be applied in pond for maintaining water quality of pond?	0 (0)	0 (0)	26 (100)	0 (0)	0 (0)	38 (100)
2	What should be done to maintain Do level in pond?	0 (0)	0 (0)	26 (0)	0 (0)	0 (0)	38 (100)
3	Which parameters should be checked frequently within the culture?	0 (0)	0 (0)	26 (100)	0 (0)	0 (0)	38 (100)
	Overall knowledge	0	0	100%	0	0	100%

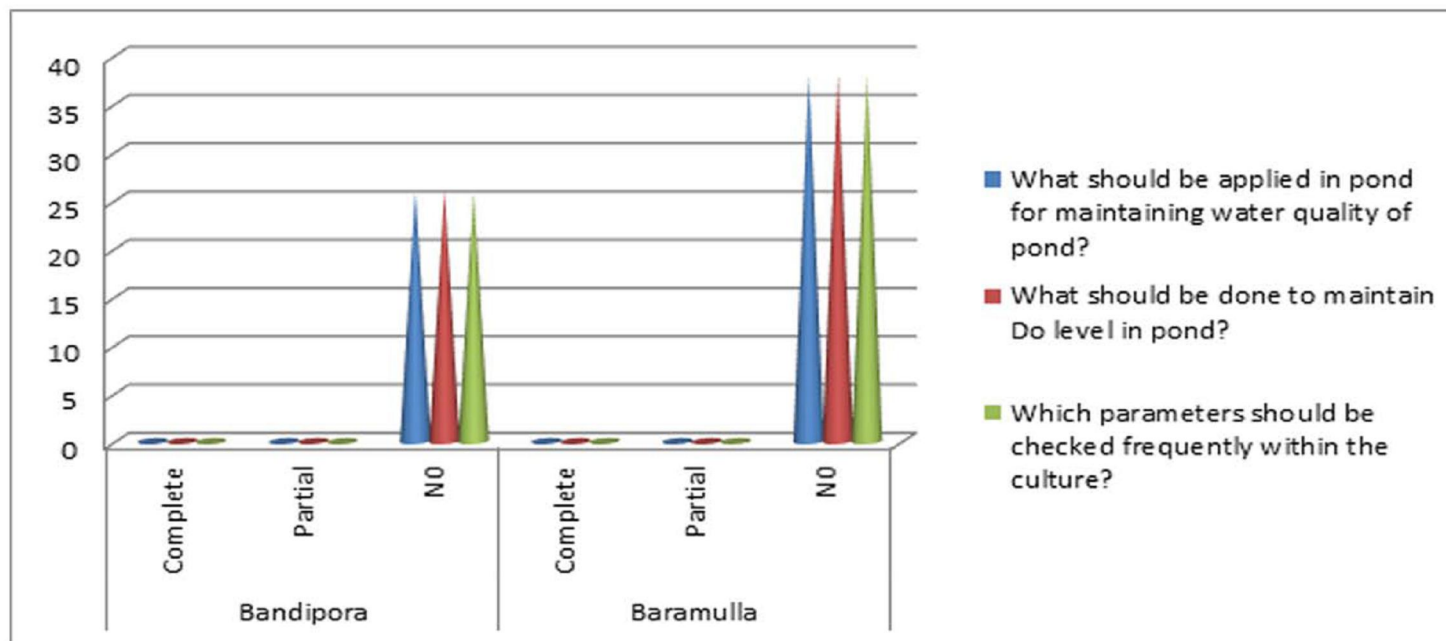


Fig.32: Knowledge level of water quality management for carp farming in district Bandipora and Baramulla

4.5.6 Feed management

The results in Table 33 and Fig.33 indicate that majority of the carp farmers were having less knowledge about the feed management techniques like method of estimating feed consumption by fish, ideal protein content of feed (100%) and taking into notice the manufacturing date of feed to be given to the fish (100%) in both of the districts. However, Fish farmers in Bandipora district and Baramulla district were completely aware about the quantity of daily feed ration (76.92% and 26.31) to be given to each carp and had also unaware about the frequency of feeding of the fish in their concerned fish farms.

Table 33: Knowledge level of carp feed management in district Bandipora and Baramulla

s.no	Feed management	Knowledge					
		Bandipora			Baramulla		
		Complete (%)	Partial (%)	No (%)	Complete (%)	Partial (%)	No (%)
1	Which is the method for estimating feed consumption by fish?	0 (0)	0 (0)	26 (100)	0 (0)	0 (0)	38 (100)
2	What should be quantity of daily feed ration?	20 (76.92)	0 (0)	6 (23.07)	10 (26.31)	28 (73.68)	0 (0)
3	What should be the feeding frequency?	0 (0)	26 (100)	0 (0)	0 (0)	38 (100)	0 (0)
4	What should be protein content of feed?	0 (0)	0 (0)	26 (100)	0 (0)	0 (0)	38 (100)
5	Did you see manufacturing date of feed? If yes then within how many days it should be used from manufacturing date?	0 (0)	0 (0)	26 (100)	0 (0)	0 (0)	38 (100)
	Overall knowledge	15.39%	20%	64.61%	5.26%	34.74%	60%

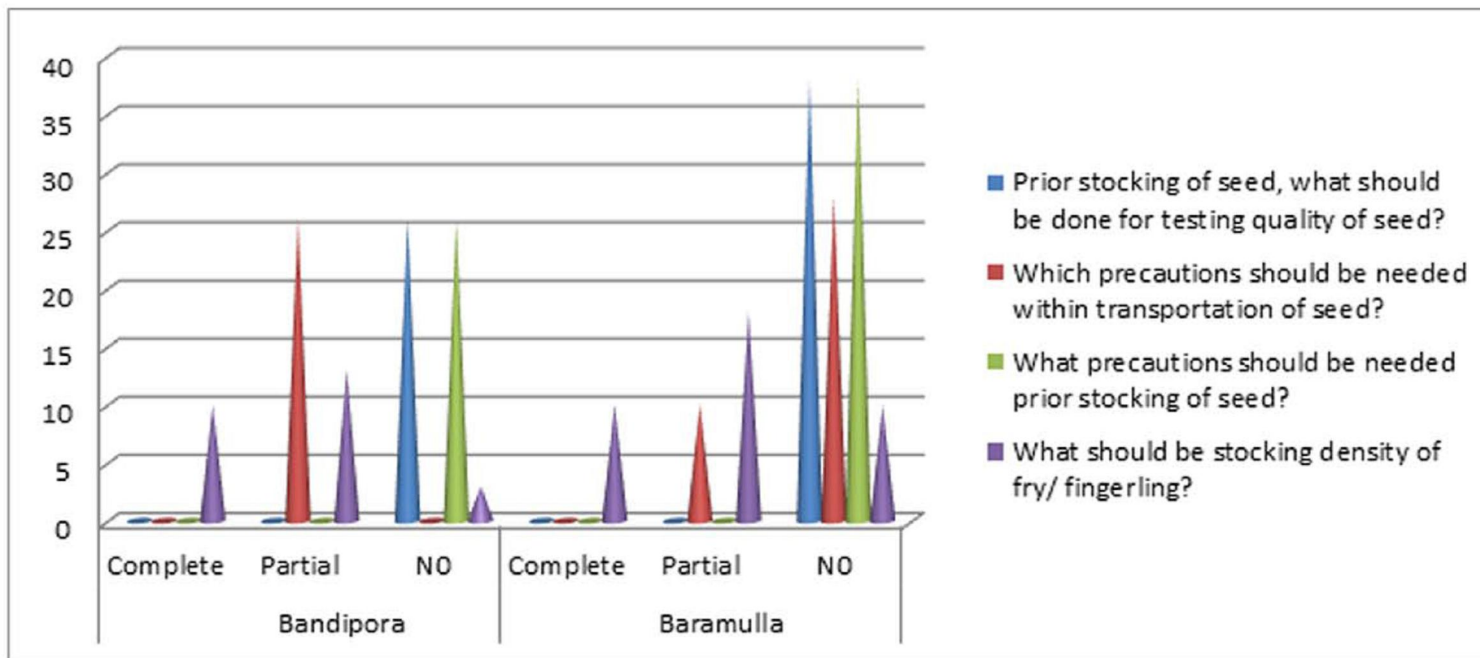


Fig.33: Knowledge level of carp seed management in district Bandipora and Baramulla

4.5.7 Health management

Knowledge level of fish farmers regarding this category of practices is given in Table 34 and Fig.34. Interestingly, the results depict that none of the fish farmers in district Bandipora and in district Baramulla had any knowledge about the health care management of the fishes present in their respective fish farm.

Table 34: Knowledge level of carp health management in district Bandipora and Baramulla

s.no	Health management	Knowledge					
		Bandipora			Baramulla		
		Complete (%)	Partial (%)	N0 (%)	Complete (%)	Partial (%)	N0 (%)
1	How can you monitor growth and health of fish within culture?	0 (0)	0 (0)	26 (100)	0 (0)	0 (0)	38 (100)
2	What are the regulations for waste water of farm?	0 (0)	0 (0)	26 (100)	0 (0)	0 (0)	38 (100)
	Overall knowledge	0%	0%	100%	0%	0%	100%

4.6 Adoption of Carp Fish Farming Practices

4.6.1 Site selection

The adoption level of farmers for practices related to site selection is given in Table 35 and Fig.35. Results showed that, overall adoption level was complete with 47.43% in district Bandipora and 45.61% in district Baramulla.

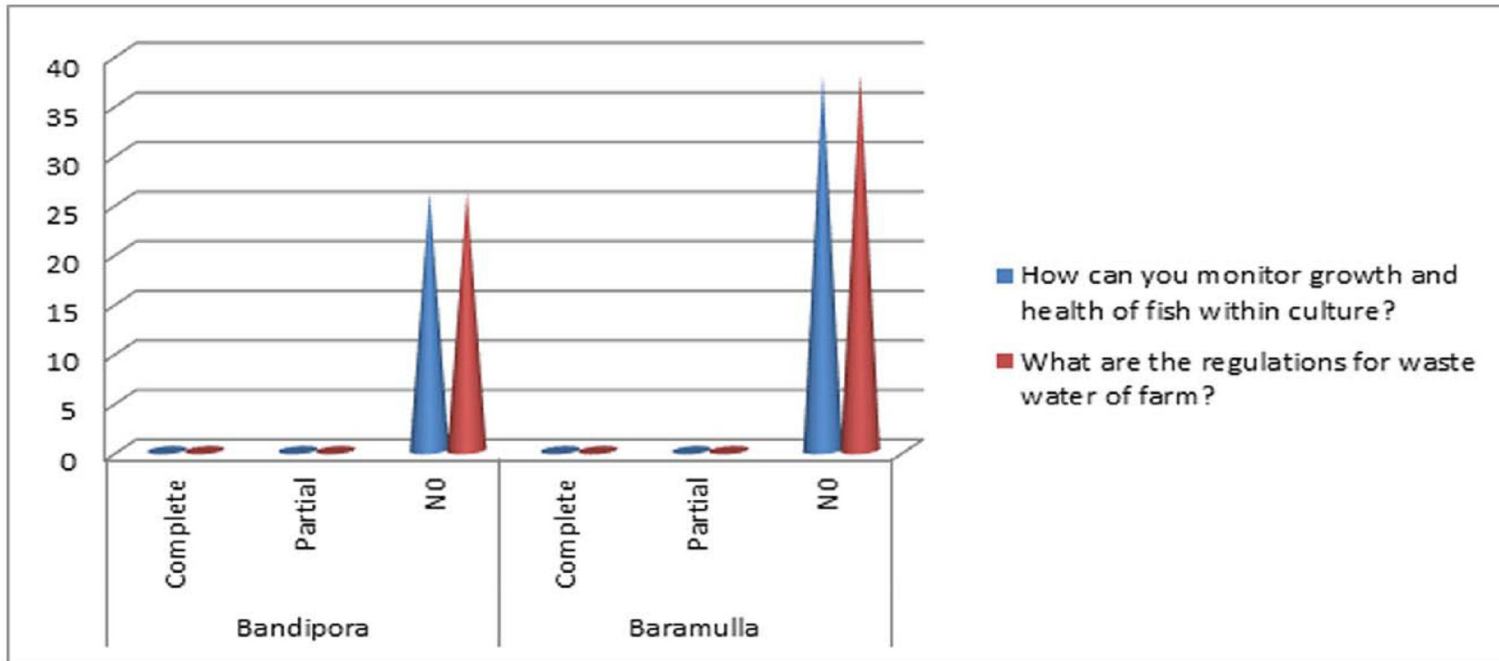


Fig.34: Knowledge level of carp health management in district Bandipora and Baramulla

Table 35:Adoption level of site selection of carp farmers in district Bandipora and Baramulla

s.no	Site selection	Adoption					
		Bandipora			Baramulla		
		Complete (%)	Partial (%)	No (%)	Complete (%)	Partial (%)	No (%)
1	Which soil (chemical) Characteristics should be checked	11 (42.31)	26 (57.69)	0 (0)	14 (36.84)	24 (63.16)	0 (0)
2	Which water parameters should be checked?	0 (0)	0 (0)	26 (100)	0 (0)	9 (23.69)	29 (76.31)
3	Which type of soil is necessary for farm?	26 (100)	0 (0)	0 (0)	38 (100)	0 (0)	0 (0)
	Overall adoption	47.43%	19.24%	33.33%	45.61%	28.95%	25.44%

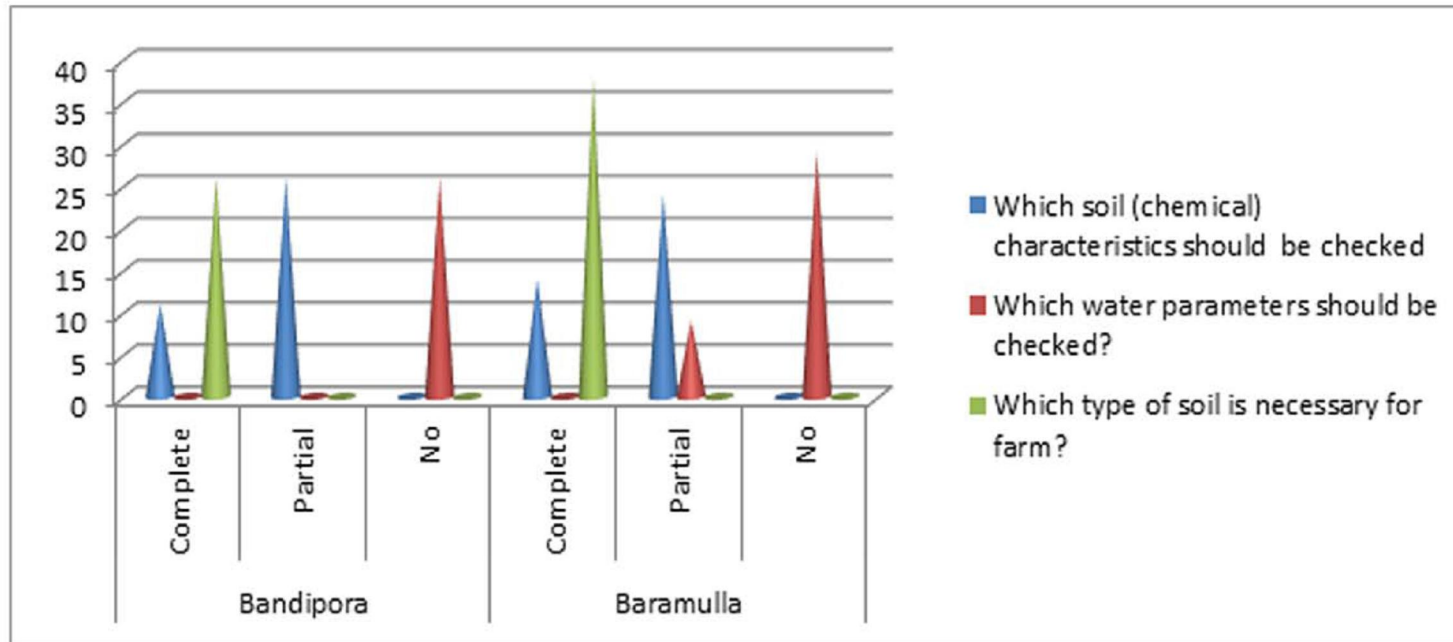


Fig.35:Adoption level of site selection of carp farmers in district Bandipora and Baramulla

4.6.2 Farm design and pond construction

Adoption level of farmers regarding farm design and pond construction category of practices is given in Table 36 and Fig.36. The results indicate that majority of the respondents had adopted the farm design and pond construction parameters like height of the dike (57.69%) in district Bandipora, (52.63%) in district Baramulla, the position of inlet and outlet and the pond shape (100%) in both of the districts. However the parameters like slope of dike, slope of pond bottom and type of farm construct were not completely adopted by majority of the respondents in both of the districts viz Bandipora and Baramulla districts respectively.

Table 36: Adoption level of pond construction in district Bandipora and Baramulla

S.No	Farm design and pond construction	Adoption					
		Bandipora			Baramulla		
		Complete (%)	Partial (%)	No (%)	Complete (%)	Partial (%)	N0 (%)
1	What should be used as core of bund?	26 (100)	0 (0)	0 (0)	38 (100)	0 (0)	0 (0)
2	What should be the height of dike?	15 (57.69)	6 (23.07)	5 (19.23)	20 (52.63)	8 (21.05)	10 (26.31)
3	What should be the slope of dike?	0 (0)	26 (100)	0 (0)	18 (47.36)	20 (52.63)	0 (0)
4	What should be the freeboard level?	0 (0)	0 (0)	26 (100)	0 (0)	0 (0)	38 (100)
5	What should be the position of inlet and outlet?	26 (100)	0 (0)	0 (0)	38 (100)	0 (0)	0 (0)
6	What should be the pond bottom slope?	0 (0)	26 (100)	0 (0)	0 (0)	38 (100)	0 (0)
7	How should be farm construct for taking natural benefit of wind direction?	0 (0)	26 (100)	0 (0)	38 (100)	0 (0)	0 (0)
8	What should be the pond shape?	26 (100)	0 (0)	0 (0)	38 (100)	0 (0)	0 (0)
	Overall adoption	44.71%	40.39%	14.90%	62.49%	21.71%	15.78%

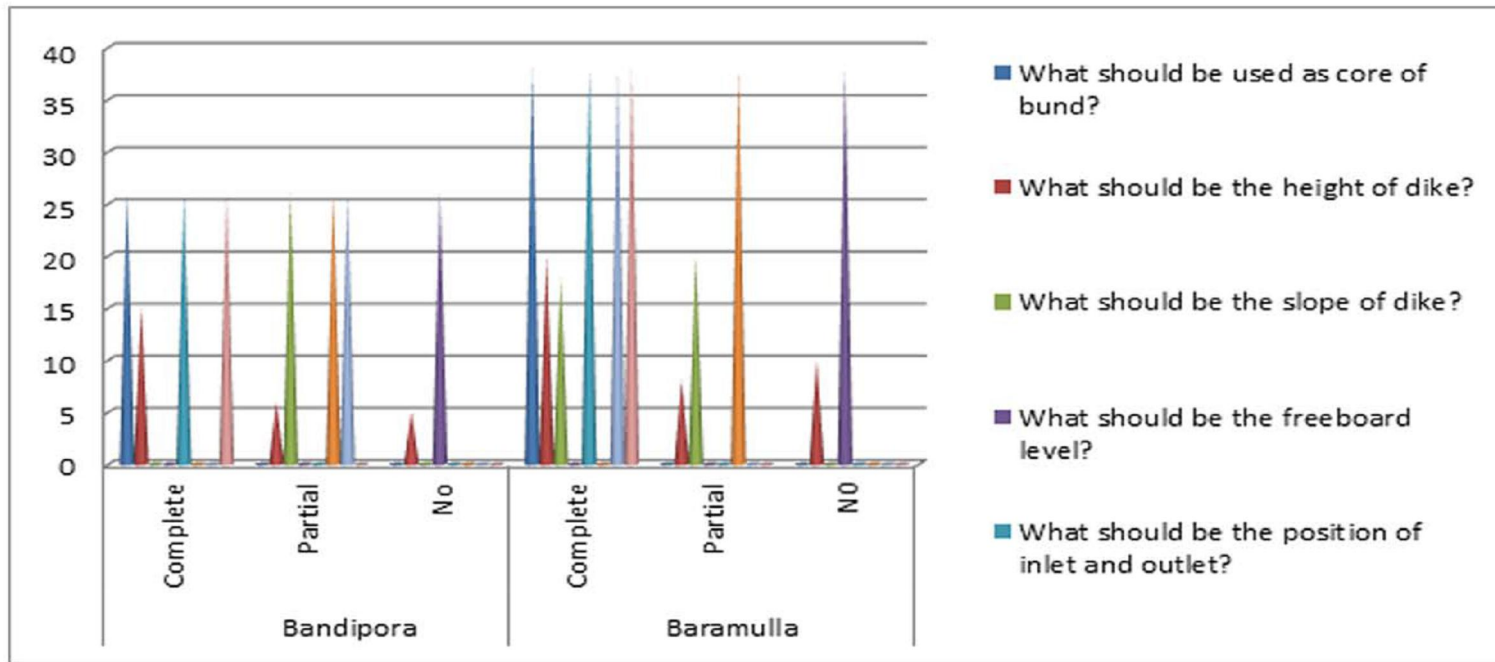


Fig.36: Adoption level of pond construction in district Bandipora and Baramulla

4.6.3 Pond preparation and pre-stocking management

Adoption of practices in the category of pond preparation and pre-stocking management is presented in Table 37 and Fig.37. The results depict that, the respondents in district Bandipora and district Baramulla had completely adopted the practices like number of days ponds should be crack dried, the percentage being 11.53% and 39.47% in district Bandipora and district Baramulla, had not adopted the type of colour of the water in fish pond in both of the districts and had completely adopted the Knowledge of average quantity of lime in the fish pond, 76.92% in District Bandipora and 47.36% in District Baramulla. The quantity of organic water to be used is also completely adopted by majority fish farmers in both of the districts as depicted from the findings in the given mentioned table.

Table 37: Adoption level of pond preparation and pre stocking management of carp farmers in district Bandipora and Baramulla

S.no	Pond preparation and pre stocking management	Adoption					
		Bandipora			Baramulla		
		Complete (%)	Partial (%)	N0 (%)	Complete (%)	Partial (%)	N0 (%)
1	How many days pond should be crack dried?	3 (11.53)	17 (65.38)	6 (23.07)	15 (39.47)	20 (52.63)	3 (7.89)
2	What should be dose of bleaching?	0 (0)	0 (0)	26 (100)	0 (0)	0 (0)	38 (100)
3	What should be quantity of lime?	20 (76.92)	0 (0)	6 (23.07)	18 (47.36)	15 (39.47)	5 (13.15)
4	What should be quantity of organic manure? (raw cow dung and raw chicken manure)	13 (50)	9 (34.61)	4 (15.38)	18 (47.36)	11 (28.94)	9 (23.68)
5	What should be color of pond water before stocking?	0 (0)	26 (100)	0 (0)	0 (0)	38 (100)	0 (0)
6	What should be Secchi disk reading?	0 (0)	0 (0)	26 (100)	0 (0)	0 (0)	38 (100)
7	What should be done in case of low or high Secchi disk reading?	0 (0)	0 (0)	26 (100)	0 (0)	0 (0)	38 (100)
	Overall adoption	19.79%	28.57%	51.64%	19.17%	31.59%	49.24%

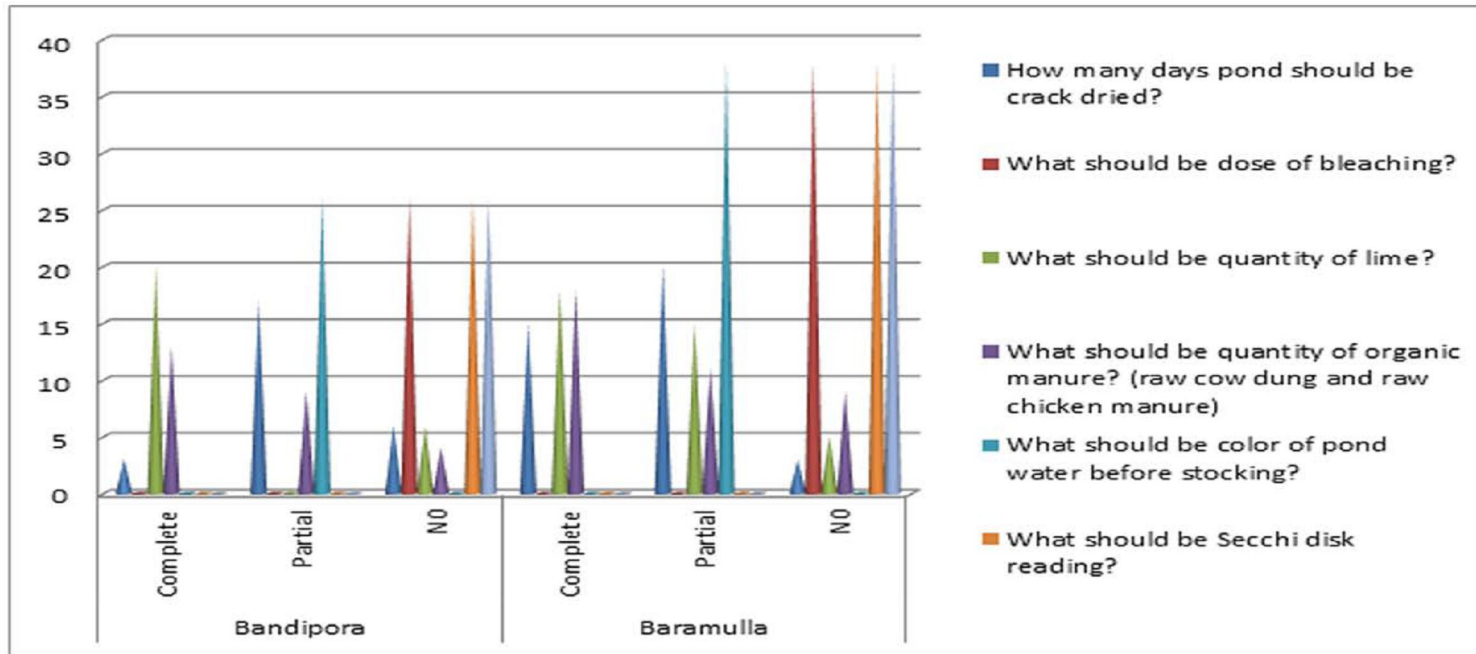


Fig.37: Adoption level of pond preparation and pre stocking management of carp farmers in district Bandipora and Baramulla

4.6.4 Seed management

The adoption level for seed management category of practices is tabulated in table 38 and 38. It is interesting to note that majority of the fish farmers in both of the districts had no knowledge about the management of the seed as indicated by their major good percentage in the no knowledge category.

Table 38: Adoption level of carp seed management in district Bandipora and Baramulla

s.no	Seed management	Adoption					
		Bandipora			Baramulla		
		Complete (%)	Partial (%)	N0 (%)	Complete (%)	Partial (%)	N0 (%)
1	Prior stocking of seed, what should be done for testing quality of seed?	0 (0)	0 (0)	26 (100)	0 (0)	0 (0)	38 (100)
2	Which precautions should be needed within transportation of seed?	16 (61.53)	10 (38.46)	0 (0)	9 (23.68)	29 (76.31)	0 (0)
3	What precautions should be needed prior stocking of seed?	0 (0)	0 (0)	26 (100)	0 (0)	0 (0)	38 (100)
4	What should be stocking density of fry/fingerling?	16 (61.53)	10 (38.46)	0 (0)	29 (76.31)	9 (23.68)	0 (0)
	Overall adoption	30.76%	19.24%	50%	25%	25%	50%

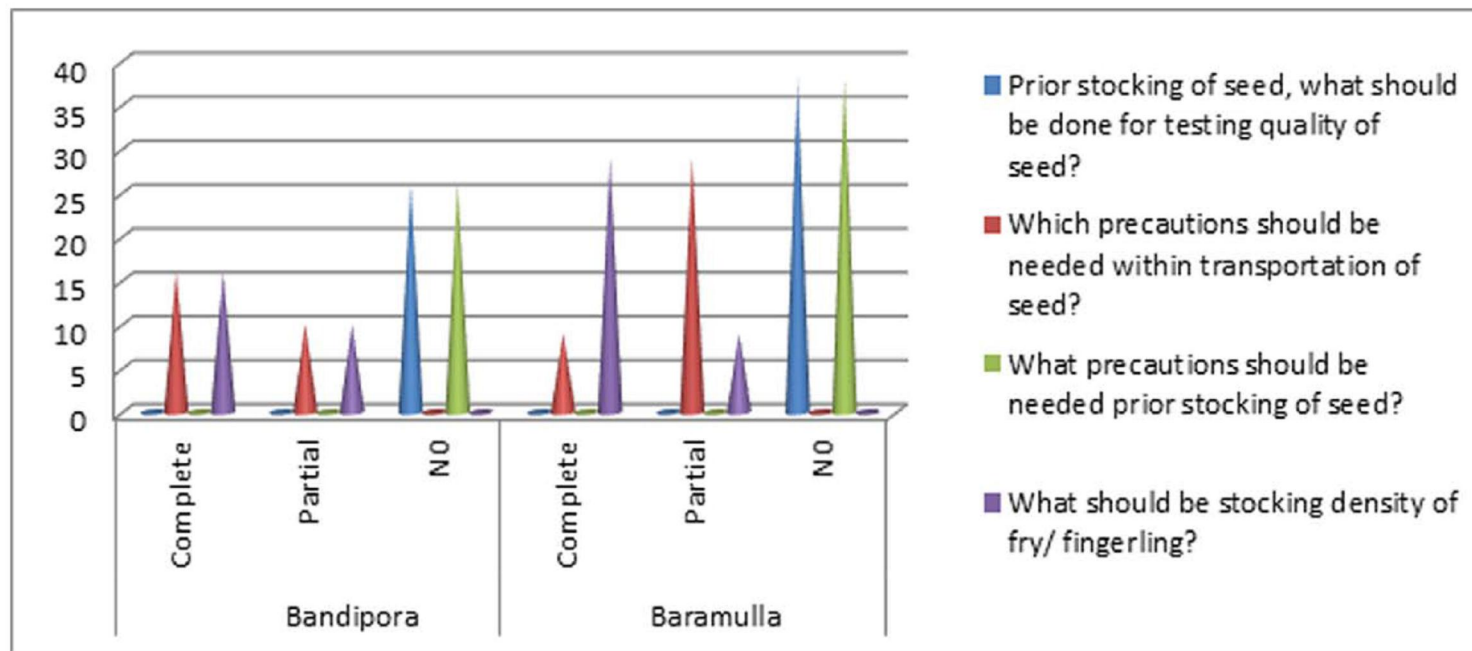


Fig.38: Adoption level of carp seed management in district Bandipora and Baramulla

4.6.5 Water quality management

Adoption for water quality management category of practices was presented in Table 39 Fig.39. None of the farmer was in higher adopter group. The farmers in medium adoption level were (73.07%) in district Bandipora and 100% in district Baramulla.

Table 39: Adoption level of water quality management for carp farming in district Bandipora and Baramulla

s.no	Water quality management	Adoption					
		Bandipora			Baramulla		
		Complete (%)	Partial (%)	N0 (%)	Complete (%)	Partial (%)	N0 (%)
1	What should be applied in pond for maintaining water quality of pond?	0 (0)	20 (76.92)	6 (23.07)	0 (0)	13 (34.21)	25 (65.79)
2	What should be done to maintain Do level in pond?	0 (0)	19 (73.07)	7 (26.92)	0 (0)	38 (100)	0 (0)
3	Which parameters should be checked frequently within the culture?	0 (0)	14 (53.84)	12 (46.15)	0 (0)	0 (0)	38 (100)
	Overall adoption	0%	67.96%	32.04%	0%	44.74%	55.26%

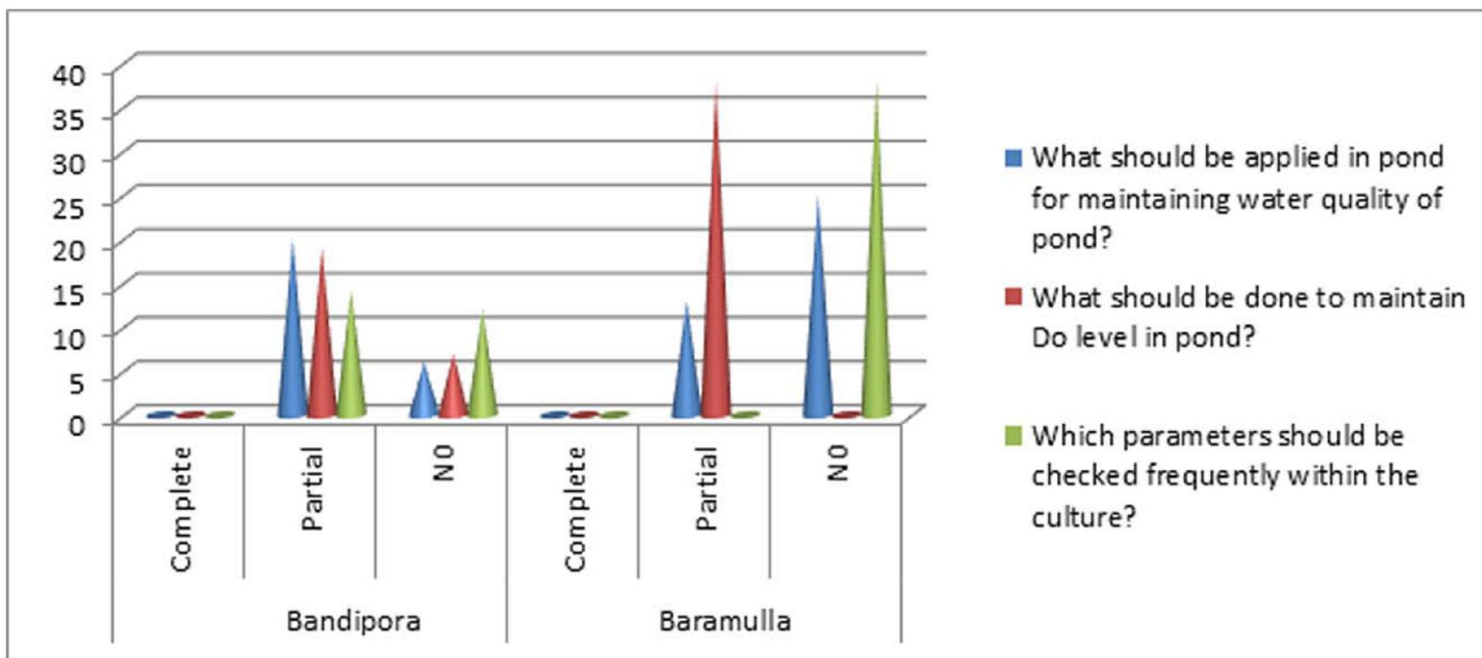


Fig.39: Adoption level of water quality management for carp farming in district Bandipora and Baramulla

4.6.6 Feed management

Adoption pattern of farmers related to feed management practices is given in below Table 40 and Fig.40. The results indicate that majority of the respondents had not adopted the feed management which include estimating feed consumption by fish, quantity of daily feed ration, feeding frequency etc in both of the concerned survey districts viz., district Bandipora and district Baramulla.

Table 40: Adoption level of carp feed management in district Bandipora and Baramulla

s.no	Feed management	Adoption					
		Bandipora			Baramulla		
		Complete (%)	Partial (%)	No (%)	Complete (%)	Partial (%)	No (%)
1	Which is the method for estimating feed consumption by fish?	0 (0)	0 (0)	26 (100)	0 (0)	0 (0)	38 (100)
2	What should be quantity of daily feed ration?	5 (19.23)	3 (11.53)	18 (69.23)	0 (0)	8 (21.05)	30 (78.95)
3	What should be the feeding frequency?	0 (0)	20 (76.92)	6 (23.07)	0 (0)	0 (0)	38 (100)
4	What should be protein content of feed?	0 (0)	0 (0)	26 (100)	0 (0)	0 (0)	38 (100)
5	Did you see manufacturing date of feed? If yes then within how many days it should be used from manufacturing date?	0 (0)	0 (0)	26 (100)	0 (0)	0 (0)	38 (100)
	Overall adoption	3.84%	17.70%	78.46%	0%	4.21%	95.79%

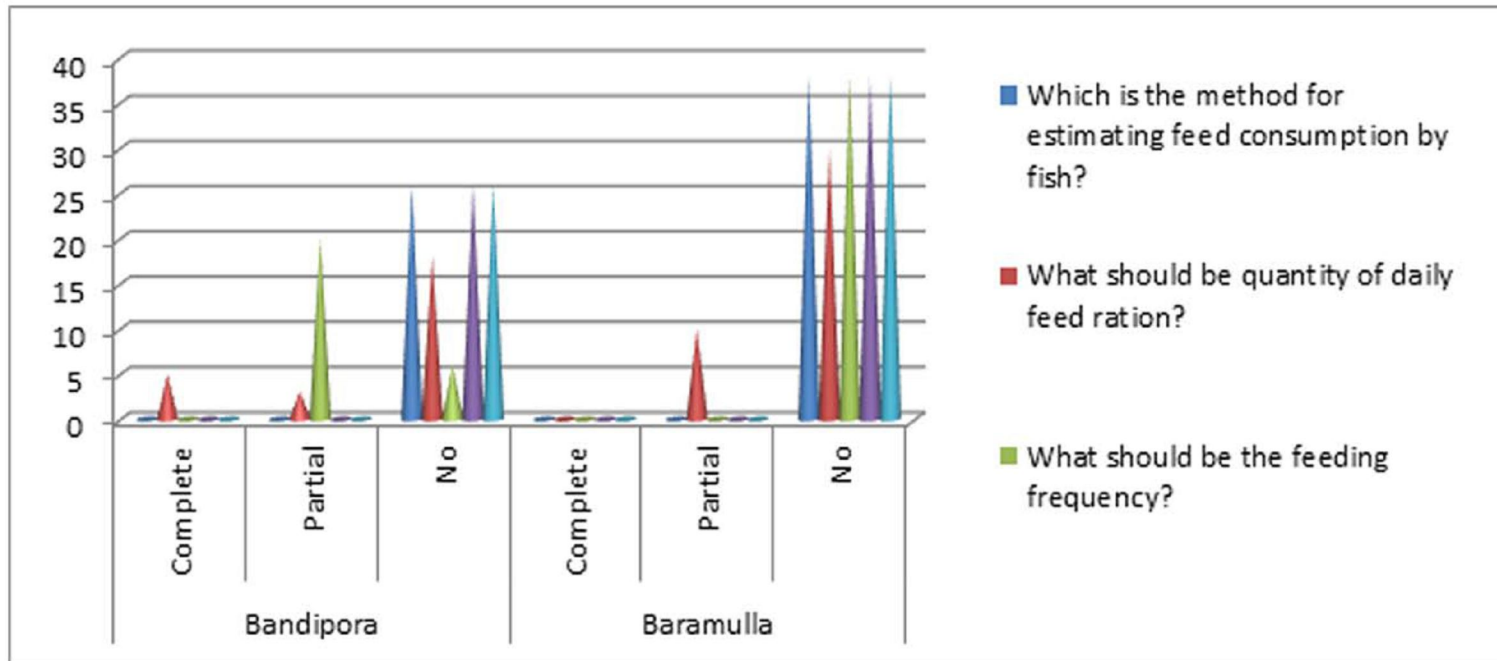


Fig.40: Adoption level of carp feed management in district Bandipora and Baramulla

4.6.7 Health management

The adoption pattern for health management recommendation is given in Table 41 and Fig.41. All farmers had not adopted the recommendations with regard to health management in both of the districts *viz.*, district Bandipora and district Baramulla.

Table 41: Adoption level of carp health management in district Bandipora and Baramulla

S.no	Health management	Adoption					
		Bandipora			Baramulla		
		Complete (%)	Partial (%)	N0 (%)	Complete (%)	Partial (%)	N0 (%)
1	How can you monitor growth and health of fish within culture?	0 (0)	0 (0)	26 (100)	0 (0)	0 (0)	38 (100)
2	What are the regulations for waste water of farm?	0 (0)	0 (0)	26 (100)	0 (0)	0 (0)	38 (100)
	Overall adoption	0%	0%	100%	0%	0%	100%

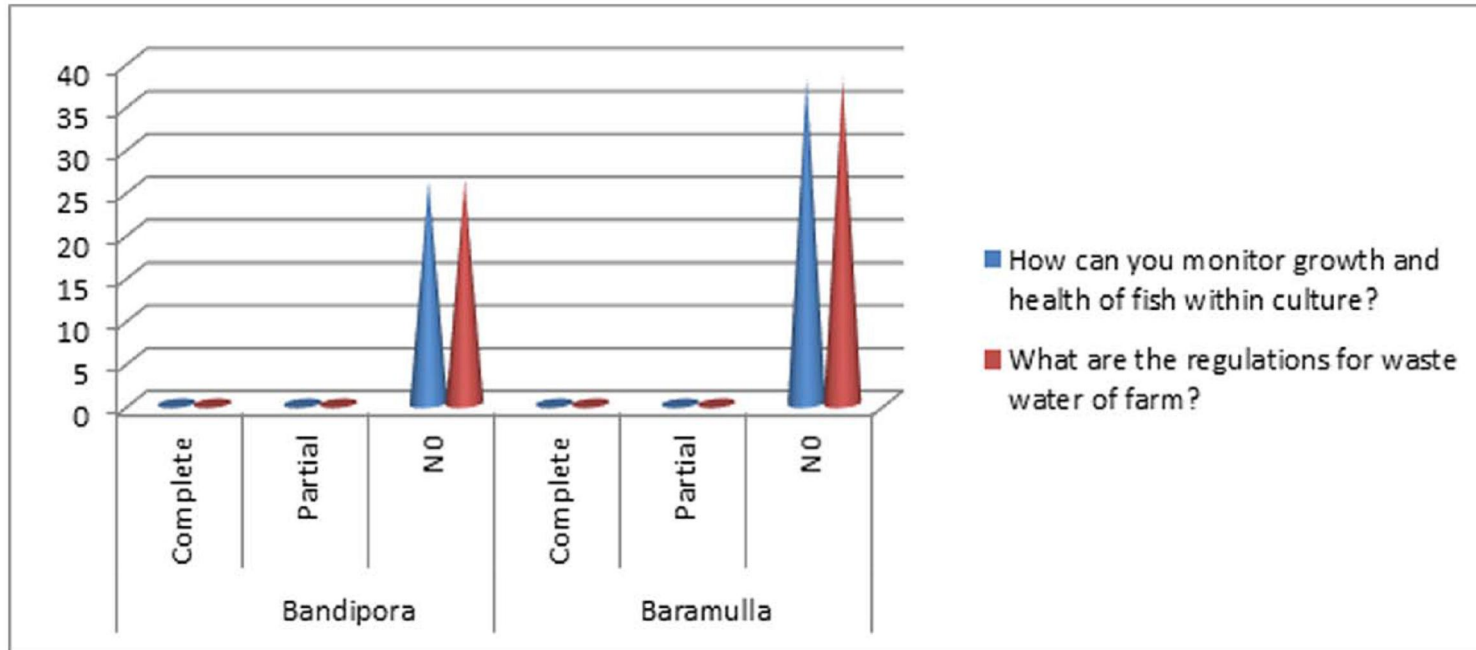


Fig.41: Adoption level of carp health management in district Bandipora and Baramulla

Chapter - 5

DISCUSSION

In this chapter, the results obtained are discussed in the view of objectives of study, literature and findings obtained after analyzing data from farmers. The aim of present study was to evaluate the knowledge of fish farmers, practices and to judge the extent of adoptions by fish farmers of district Bandipora and Baramulla. The data collection were done from trout and carp farmers of Bandipora and Baramulla.

5.1 SOCIO-PERSONAL PROFILE OF FISH FARMERS

5.5.1 Age and level of education

Altogether more than 50 % of the trout and carp farmers of study area belonged to 36-50 age group, similar results were observed by Khatun *et al.* (2013), Ike and Roseline (2010), Alam *et al.* (2017). In district Baramulla 71.05 % of the fish farmers belonged to 36-50 age group. Rahman *et al.* (2016) and Muddasir *et al.* (2017) also found 71.45% of farmers in similar age group in their respective studies. Sen & Roy (2015) observed that 52.3% belonged to less than 50 years which supports our study as in district Bandipora 53.84% of fish farmers belongs to less than 50 years.

A good number of carp farmers (69.23%) and (55.27%) had received education upto primary level in Bandipora and Baramulla district respectively. Taking into account secondary level education in Baramulla were observed to the no. of carp farmers (21.05%). In district Bandipora the highest numbers of trout farmers (66.67%) were observed to have secondary education level followed by higher primary level (16.66%). In the present study more than 50% trout and carp farmers in district Bandipora and Baramulla were educated. A cent percent education level of farmers were observed by Gawade (2004) and Kumaran *et al.* (2003). Sanclay

and Bose (2017) revealed that only 70% of fish farmers were literate. The level of education in a region is basically attributed to the facilities available to establish a strong education system.

5.1.2 Type and size of family

The findings of the study revealed that in district Bandipora carp farmers with more than five members in their family were 73.08% and in district Baramulla majority (55.27%) carp farmers were with five or less than five members in their family, where as majority (66.67%) trout farmers in district Bandipora had more than five members in their family and in district Baramulla 57.14% trout farmers had five or less than five members in their family. Similarly, Sancley and Bose (2017) found that 35.84% were having 1 to 5 members in their family. Also Lekshmi *et al.* (2005) found 57.50% farmers had less than five members in their family while Ponnusamy *et al.* (2004) found the percentage to be significantly higher, i.e. 74%. Rahman *et al.* (2016) found that 62.5% fish farmers contained 0-7 family members, 32.5% farmers contained 8-12 family members and 5% farmers were above 12.

During the study in district Bandipora majority (57.69%) carp farmers had joint families. While as in both the district majority trout farmers had nuclear families. Similarly Sancley and Bose (2017) found that 79.24% of the fish farmers were having nuclear families while, Sen and Roy (2015) found that majority (66.4%) of fish farmers belong to medium family (4-6 members).

5.1.3 Ownership pattern

The findings of the study revealed that in district Bandipora and Baramulla, 100% of trout and carp farmers had their own land. Similarly Lekshmi *et al.* (2005) found 90.83% farmers within same category, where as Gawade (2004) and Ponnusamy *et al.* (2004) documented 65% and 66% of farmers as sole proprietors respectively.

5.1.4 Occupation

In districts Bandipora and Baramulla only (11.53% & 15.79%) of fish farmers had fish farming as primary business. Similar observations were recorded by Khatun *et al.* (2013) and Alam *et al.* (2017). Although in both the districts for trout farmers, trout farming was their main occupation recording percentage of (83.33% & 66.66%). Similarly, Sarker (2004) found 52% farmers had fish farming as primary business.

5.2 KNOWLEDGE OF FISH FARMING PRACTICES

In the present study the knowledge of farmers was also analyzed as per categories of practices. In district Bandipora overall complete knowledge level for site selection of trout was 33.33% and carp farmers had low knowledge 67.96%, where as in district Baramulla was low knowledge 64.91% for carp farmers and 33.33% had complete knowledge for trout farmers. Similarly, Wani *et al.* (2016) found that overall knowledge level of fish farmers for site selection was 15.38%.

During the present study in case of raceways construction overall complete knowledge level in both the districts was about 70%, where as in case of pond construction overall complete knowledge level in district Bandipora and Baramullawas 32.69% and 32.89% respectively. Wani *et al.* (2016) found that overall knowledge level of fish farmers for farm design and construction was 76.92%.

During the present study overall knowledge level of pond preparation and pre-stocking management in district Bandipora and Baramullawas 36.27% and 35.71% respectively. Similarly, Biswarup Saha (2011) revealed that knowledge level of fish farms about pond preparation was 31.58%. Wani *et al.* (2016) found that overall knowledge level of fish farmers for pond preparation and pre-stocking management was 36.26%. Olaoye *et al.* (2016) stated that all fish farmers were

aware of the use of lime as a neutralizer and also revealed that almost all fish farmers were aware that cow dung could be used as fertilizer on their fish farms

The current study revealed that overall complete knowledge level of trout seed management in district Bandipora and Baramulla was 33.33% and Biswarup Saha (2011) revealed almost similar results about this practice.

During the study overall complete knowledge level of carp farmers for water quality management practices in both the district was zero percent. Trout farmers overall complete knowledge level in district Baramulla was 4.76%. Wani *et al.* (2016) found that overall knowledge level of fish farmers for water quality management was 32.05%. The current study revealed that overall complete knowledge level of trout and carp farmers for health management in both the districts was zero percent. Wani *et al.* (2016) found that overall knowledge level of fish farmers for health management was 22.12%. Biswarup Saha (2011) revealed that fish farmers knowledge about health management was 26.80%.

In the present study, overall complete knowledge level of trout feed management in district Bandipora and Baramulla was (33.33% & 44.05)% health management was zero. Wani *et al.* (2016) were also found similar results. Biswarup Saha (2011) revealed that 39.35% of fish farmers had knowledge of feed management and 26.80% of fish farmers had knowledge about health management.

5.3 ADOPTION OF FISH FARMING PRACTICES

In the present study the adoption of farmers was also analyzed as per categories of practices. In districts Bandipora and Baramulla overall complete adoption level for site selection of trout and carp farmers was 80% and 40% respectively. Similarly, Ike and Roseline (2010) reported that 27% of fish farmers had adopted the proper site selection. Wani *et al.* (2016) found that overall adoption level of fish farmers for site selection was 91.03%. Regarding soil (chemical) and water characteristics, farmers' adoption was very low. This could be due to unavailability of sophisticated soil and water checking laboratory in the

nearby areas of district Bandipora and Baramulla. Same observation was mentioned by the Kumaran *et al.* (2003) and Gawade *et al.* (2004) in their study area also.

During the present study in case of raceways construction overall complete adoption level in district Bandipora and Baramulla was 80% and 99.04, where as in case of carp pond construction overall complete adoption level in district Bandipora and Baramulla was 44.71% and 62.49% respectively. Similarly, Ike and Roseline (2010) reported that 54% fish farmers had adopted pond construction. Ajieh and Chuks (2010) revealed that 94.4% fish farmers had moderately adopted pond construction. Wani *et al.* (2016) found that overall adoption level of fish farmers for farm design and construction was 79.33%. None of the farmer constructed bund using concrete puddle core. It could be due to unawareness of the practice. Instead of using puddle core, majority of farmers went for digging pond and using the same pond soil to construct bund. Also none of the farmer used the Secchi disk to check the turbidity of the culture ponds.

During the present study overall adoption level of pond preparation and pre-stocking management in district Bandipora and Baramulla was 50% and 47.36% respectively. Similarly, Ike and Roseline (2010) reported that 44% fish farmers had adopted pond preparation. Also, Wani *et al.* (2016) found that overall adoption level of fish farmers for pond preparation and pre-stocking management was 45.60%. Ajiehand Chuks (2010) revealed that fish farmers had moderately adopted pond management technologies Olaoye *et al.* (2016) revealed that the majority (86 and 77) of the 90 fish farmers tried and adopted the use of lime, respectively, with only about 7 fish farmers discontinuing the use of lime after previous adoption and about 84 and 82 out of the 90 fish farmers tried and adopted its use, respectively. However, about 20 of those that adopted the use of cow dung as pond fertilizer discontinued its usage after some time of adoption. This may be due to the fact that cow dungs harbour lots of pathogens and diseases

that could be dangerous to the health of fishes. Same result was observed by Gawade (2004) while studying in the south Konkan.

Maintaining colour of pond water is the most important aspect of farming as this forms the major food of fish in their earlier stages. So, majority of farmers maintain colour of pond water by employing traditional methods. Prior to stocking of seed, acclimatization is done by most of the farmers. Same result was observed by Shrinath *et al.* (1996), Kumaran *et al.* (2003) and Gawade *et al.* (2004). They observed that all the farmers in their study area acclimatize the seed prior to stocking. Lekshmi *et al.* (2005) found 92% farmers acclimatize seed prior to stocking.

The farmers adopted cent percent technique of biomass sampling in the study areas. This finding is similar to that observed by Kumaran *et al.* (2003) and Gawade (2004) in their area of study. This technique of pond biomass sampling help in identifying the survival rate and also monitoring of feed and fish health.

The current study revealed that overall complete adoption level of trout seed management in district Bandipora and Baramulla was 66.67% and 80.96% respectively, where as overall complete adoption level of carp seed management in district Bandipora was 30.76% and district Baramulla was 25%. Similarly, Ike and Roseline (2010) reported that 28% fish farmers had adopted stocking practice. Also, Wani *et al.* (2016) found that overall adoption level of fish farmers for seed management was 23.08%.

During the study overall complete adoption level of trout farmers for water quality management practices in district Bandipora and Baramulla was 16.68% and 14.29% respectively. Carp farmers overall complete adoption level in district Bandipora and Baramulla was 0%. Wani *et al.* (2016) found that overall adoption level of fish farmers for water quality management was 32.05%.

In the present study overall complete adoption level of trout feed management in district Bandipora and Baramulla was more than 40%, where none of the carp farmer from both districts Bandipora and Baramulla had adopted. Ike

and Roseline (2010) reported that 41% fish farmers had adopted feeding practices. Wani *et al.* (2016) found that overall adoption level of fish farmers for feed management was 3.08%. Lekshmi *et al.* (2005) found that about majority of farmers adopt the practices. The current study revealed that overall complete adoption level of trout farmers for health management in district Bandipora was 0%. Wani *et al.* (2016) found that overall adoption level of fish farmers for health management was 44.71%. Ike and Roseline (2010) reported that 44% fish farmers had adopted maintenance of pond.

It is curious to note in the present study that cent percent non-adoption was observed in practices such as puddle core, Secchi disk and effluent treatment plant. Also, significantly lower adoption was found in position of inlet and outlet, liming, organic manure, water exchange timing, aeration, etc. In addition practices such as soil (chemical) and water characteristics were not adopted by more number of farmers. None of the farmers were interested in having effluent treatment plant on their farm. Lekshmi *et al.* (2005) also noticed same type of intension in the farmers of Tamil Nadu and Andhra Pradesh. Effluent treatment plant (ETP) recommended for bigger farms. Majority of farms in the present area of study were small in size so ETP is not a mandatory for them. For an effective water exchange, pond inlet and outlet should be opposite to each other. Majority of the farmers in both the districts were found to have adopted this technology. Maximum number of farmers did not follow recommendations regarding the organic manuring and liming of pond. Farmers usually used traditional low-cost manures instead of lime and organic manures to lower the cost. Shrinath (1996) found similar results in case of organic manure.

Chapter-6

SUMMARY AND CONCLUSION

Fish farming is the principal form of aquaculture. It is the fastest growing area of animal food production. Today, about half the fish consumed globally are raised in these artificial environments. Present research expertise covers the knowledge and adoption level of farmers with regards to aquaculture practice and one aspect of the present study also covered the socio-economic status of fish farmers of Bandipora and Baramulla districts.

Distinguished findings are summarized below:

1. Total 91 fish farmers were selected for data collection in district Bandipora and Baramulla.
2. In district Bandipora fifty percent of the trout farmers (50.00%) belonged to 36-50 age groups and majority of the carp farmers (53.84%) belonged to 18-35 age group while in Baramulla district majority of farmers (71.05%) had an age group of 36-50 years and highest percentage of trout farmers (61.91%) belonged to 36-50 age group.
3. In the present study all farmers in Bandipora and Baramulla districts were educated. A good number of carp farmers (69.23%) and (55.27%) had received education upto primary level in Bandipora and Baramulla districts respectively.
4. Majority (73.08%) of the carp fish farmers in Bandipora district were having a family size of >5 per household and majority (57.69%) were residing in joint families while as more than fifty percent of the respondents (55.27%) in Baramulla district had a family size of <5 per household where the major good (68.42%) were living in nuclear Families.
5. The present study revealed that all fish farmers practiced fish farming on their own land in both districts
6. Study regarding trout fish farming revealed that a higher percentage of farmers (83.33%) in district Bandipora showed maximum occupation of fish

farming while as in district Baramulla maximum (66.67%) occupation of a farmer was fish farming. The study unveiled 11.53% respondents in district Bandipora were doing carp fish farming. Similarly, from Baramulla district about 15.79% of respondents were engaged in carp fish farming.

7. The present study unveiled the knowledge regarding various site selection among carp farmers were low in district Bandipora (67.96%) and Baramulla district (64.91%).
8. Majority of the carp fish farmers (100%) in both districts *viz.*, district Bandipora and district Baramulla had no knowledge about the farm designing and construction. Present study revealed that fish farmers (46.16%) in district Bandipora were aware about the average height of the dike. Contrary to that the carp fish farmers from Baramulla district were completely aware (76.31%) about the height of the dike required for construction of a pond.
9. Present study revealed percentage of carp fish farmers from both districts were seen aware about positioning of inlet and outlet of water sources in respective fish farmers.
10. Carp farmers from both districts were seen fully aware (100%) about the pond shape. However, in district Bandipora 65.38% farmers were fully aware about the knowledge level of the lime application to ponds and 23.68% in district Baramulla had complete knowledge about the same.
11. Respondents from district Bandipora (42.30%) and district Baramulla (62.69%) were seen having complete knowledge about the quantity of organic manure to be used in carp pond.
12. Unveiled by study adoption of practices were seen complete regarding pond preparation and pre stocking management with percentage being 11.53% and 39.47% in district Bandipora and Baramulla. Complete adoption were seen

for the quantity of lime used in districts Bandipora (76.92%) and Baramulla (47.36%).

13. Carp farmers in both the districts had no knowledge regarding the seed management and so the adoption level was not found interestingly among farmers of both districts as revealed by a major percent of respondents.
14. The knowledge and adoption level regarding quality of water and management among farmers were seen low level in Bandipora district and cent percent in Baramulla. During survey study revealed that adoption and knowledge regarding feed management with feed consumption by fish, quantity of daily feed ration, feeding frequency etc. were seen not adopted by majority of respondents in both regions. All farmers from both regions had not adopted recommendations with regard to health management.
15. During survey study revealed that scientific adoption and knowledge regarding feed management were seen fully adopted by majority of respondents in both regions. All farmers from both regions had not adopted recommendations with regard to health management.

The study examined the knowledge and adoption level of trout and carp farming practices among fish farmers in district Bandipora and Baramulla. Results from this study showed that the overall knowledge regarding improved aquaculture practices was low. Very limited number of farmers were having knowledge about soil type, topography, dyke height, position of inlet and outlet, crack drying, colour of the pond before stocking, frequent testing of water parameters and feeding frequency. All the farmers were completely aware regarding the pond shape and acclimatization of seed. Farmers were observed to have lowest knowledge regarding pond construction, pond preparation and pre-stocking management.

Category-wise farmers adoption was more in seed management followed by feed management category, whereas in pre-stocking management, water quality and health management category farmers adopted practices at low.

LITERATURE CITED

- Adesoji, S. A. and Kerere, F. O. 2013. Assessment of the knowledge level of fisher and fish farmers in Lagos State, Nigeria. *International Journal of Knowledge, Innovation and Entrepreneurship* **1**(1-2): 41-56.
- Ajeh and Chuks, P., 2010. Adoption of Fishery Technologies by Fish Farmers in Akoko- edo Local Government Area, Edo State, Nigeria. *Research Journal of Fisheries and Hydrobiology*. **5**(2): 137-143
- Alam, M., Paul, S. K. and Marma, K. 2017. Study on existing technology and knowledge on aquaculture by fish farmers in Gomastapur Upazila of Chapai Nawabgonj district, Bangladesh. *Fish Aqua. J.* **8**:3.
- Anonymous. 2011. <http://bandipora.nic.in>
- Anonymous. 2011. <http://baramulla.nic.in>
- Apata, O. M. 2012. Awareness and adoption of fish production technologies in South-Western, Nigeria. *Journal of Emerging Trends in Engineering and Applied Sciences* **3**(5): 819-822.
- Ayyappan. S.2008. Handbook BOOK OF of Fisheries and Aquaculture
- Balasubramaniam, S. and Perumal, G. 1990. Adoption behaviour and impact of technology transfer among fish farmers. *Fishery Technology***27**: 75-78.
- Barman, B.K., Little, D.C. & Edwards, P. 2007. Small-scale fish culture in northwest Bangladesh - a participatory appraisal focussing on the role of tilapias. pp 227–244. In P. Edwards, D.C. Little & H. Demaine, (eds.) Rural Aquaculture. *Bangkok, AIT and Wallingford, England, CABI Publishing*.
- Bhaumik, U., Pandit, P.K. and Karmakar, H.C. 1992. Adoption behaviour of fish farmers towards composite fish culture. *Journal of Inland Fisheries Society India* **24**(1): 50-55.

- Biswaruo Saha. 2011. Knowledge Level of the Fish Farmers in Tripura Regarding Scientific Fish Production Practices. *Journal of Community Mobilization and Sustainable Development*. **6**(1).
- Das, P., Bhaumik, U., Pandit, P. K., Roy, B., Banerjee, B. K. and Mondal, S. K. 1988. Some variables contributing to the adoption of composite fish culture innovations. **In**: M. Mohan Joseph (Ed.). *The first Indian Fisheries Forum, Proceedings. Asian Fisheries Society, Indian Branch, Mangalore*, pp. 467-470.
- Fisheries Department J&K. 2015.
- Fisheries Department J&K. 2018
- Food and Agriculture Organisation. 2011.
- Food and Agriculture Organisation. 2018.
- Gawade, M. M. 2004. Efficacy and constraints in adoption of improved aquaculture Techniques by shrimp farmers in South Konkan region. M.F.Sc. Thesis, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli.
- Goswami. B., Ziauddin, G. and Datta, S.N. 2010. Adoption behaviour of fish farmers in relation to scientific fish culture practices in West Bengal. *Indian Res. J. Ext. Edu.* **10** (1).
- Gupta. T. and Dey. M. 2015. Socio economic and cultural profile of fish farmers: A study in and around the lunding town, Nagaon district of Assam. *Indian Journal of Environmental Sciences* **19**(1-2).
- Haque, M. A. 1981. Adoption of recommended species of fish in composite fish culture. **In** : *Studies in Agricultural Extension and management* (Ed. G. L. Ray): 99-130.

- Ike, N. and Roseline, O. 2010. Adoption of Aquaculture Technology by Fish Farmers in Imo State of Nigeria. *The Journal of Technology Studies* pp.57-63.
- Kalavathi, S., Sandhya, M. and Shenoy. 1997. The relative cost-effectiveness and constraints in adoption of rice-fish farming systems in Kerala- an analysis. *Indian Journal of Extension Education* **33**: 146-149.
- Khanna. S.S. 2006. A text Fish Biology and Fisheries
- Khatun, S., Adhikary, R. K., Rahman, M., Sikder M. N. A. and Hossain, M. B. 2013. Socioeconomic status of pond fish farmers of Charbata, Noakhali, Bangladesh. *Int. J. Life Sc. Bt & Pharm. Res.*
- Kumar, M., Ojha, S. N., Sharma, A. and Kumar, R. 2014. Constraints faced by fish farmers in adoption of scientific aquaculture practices in East Champaran and West Champaran districts of Bihar. *Conference: 10th Indian Fisheries and Aquaculture Forum (10ifaf), At Lucknow* **25**
- Kumaran, M., Ponnusamy, K. and Kalaimani, N. 2003. Diffusion and adoption of shrimp farming technologies. *Aquaculture Asia* **8(2)**: 20-23.
- Lekshmi, P. S. S., Chandrakandan, K., Kumaran, M. and Balasubramani, N. 2005. Socio economic profile of shrimp farmers and its influence on the extent of adoption of shrimp culture technologies. *Fishery Technology* **42(2)**: 225-230.
- Meeran, N. M. 2000. Influence of socio-personal, socio-economic and socio-psychological characteristics on the adoption behaviour of shrimp farmer in Tamil Nadu. *Journal of Extension Education* **11(2)**: 2742-2746.
- Misra, S. 1996. Transfer of technology on pisciculture and enquiry into socio-economic constraints. *Journal of Inland Fisheries Society India* **28(1)**: 33-36.

- Muddassir, M., Noor, M. A., Ahmed, A., Aldosari, F., Waqas, M. A., Zia, M. A., Mubushar M., Zuhaibe, A. H and Jalip, M.W. 2017. Awareness and adoption level of fish farmers regarding recommended fish farming practices in Hafizabad, Pakistan. *Journal of the Saudi Society of Agricultural Sciences*.
- Nayak, A. K., Behara, B. K., Misra, C. K., Mukhi, S. K. and Kohli, M. P. S. 2001. Constraints in the adoption of shrimp farming in Orissa. *Applied Fisheries and Aquaculture* **1**(1): 111-112.
- NFDB 2018. National Fisheries Development Board, Govt. of India [Web log post], <http://nfdb.gov.in/about-indian-fisheries.htm> (Accessed 15 March 2018)
- Ofuoku, U. A., Olele, F. N. and Emah, N. G. 2008. Determinants of Adoption of Improved Fish Production Technologies among Fish Farmers in Delta State, Nigeria. *The Journal of Agricultural Education and Extension* **14**(4).
- Olaoye, O. J. and Oloruntoba, A. 2010. Determinant of aquaculture technologies adoption among fish-farmers in obafemi – owode local government area of Ogun state, Nigeria. *Journal of Humanities, Social Sciences and Creative Arts*.
- Olaoye, O. J., Ezeri, G. N. O., Samsons, Y. A., Awotunde, I. M. and Ojebiyi. W. G. 2016. Dynamics of the adoption of improved aquaculture technologies among fish farmers in Lagos State, Nigeria. *Croatian Journal of Fisheries*, **74**, 56-70.
- Olatunji. S. O. and Ogunremi. J. B. 2016. Assessment of Awareness and Adoption of Fish Farming Technologies in Obio-Akpor Local Government Area of Rivers State, Nigeria. *The Journal of Agricultural Sciences* **11**(3):147-154.
- Pandey, D. K. and Upadhayay, A. 2012. Socio-Economic Profile of Fish Farmers of an Adopted Model Aquaculture Village: Kulubari, West Tripura. *Indian*

- Ponnusamy, K., Gopinathan, K., Kumaran, M. and Krishnam, M. 2004. Constraints in the adoption of shrimp farming in Tamil Nadu. *Applied Fisheries and Aquaculture* **1**(1): 103-105.
- Rahman, M. M., Chowdhury, P., and Islam, M. S. 2016. Socio-Economic status of fish farmers in Dhumki Upazila under Patuakhali District, Bangladesh. *International Journal of Fisheries and Aquatic Studies* **4**(3): 288-292.
- Razvi, M. 2006. Lahore –absolutely fishy: Nutritional value. *The Review, Dawn*, 12-13 pp.
- Saengnong, A. and Lebel, L. 2003. Experience, knowledge, and the technology choices of shrimp farmers in Thailand and Vietnam. [http://www.sustainable.org.nz/conference2003/papers/poster % 20 papers /amnuay.pdf](http://www.sustainable.org.nz/conference2003/papers/poster%20papers/amnuay.pdf).
- Sakib, M. H. and Afrad, M. S. I. 2014. Adoption of Modern Aquaculture Technologies by the Fish Farmers in Bogra District of Bangladesh. *International Journal of Agriculture Innovations and Research* **3**(2): 2319-1473.
- Sancley, D. and Bose, D. K. 2017. Adoption of improved fish farming practices in Ri-bhoi district of Meghalaya. *Journal of Pharmacognosy and Phytochemistry* **6**(5): 94-96.
- Sarkar, B.C., Pandey S, Kumbhar, B.K., Agrawal Y.C., *Journal of Food Science and Technology –Mysore* **41**(6),604-608,2004
- Sen, A and Roy, M. 2015. Socio-economic status of fish farmers in Tripura, India. *International Journal of Current Research* **7** (6):17090-17096.
- Sevelleja, R. C. 2000. Adoption and economics of Tilapia farming technology in the Philippines.

- Shrinath, K. 1996. Adoption of shrimp culture practices by farmers. *Seafood Export Journal* **10**: 9-12.
- Snedecor, G. W. and Cochran, W. G. 1967. Statistical methods, Sixth Edition, Oxford and IBH publishing Co., New Delhi pp. 593.
- Sultan, S. 2012. A text book of Trout in India.
- Sundaraswamy, B. 1987. A study on need achievement and job performance of Assistant Agricultural Officers in Karnataka state. Tamil Nadu Agricultural University, Coimbatore, India.
- Sundaraswamy, B. 1987. A study on need achievement and job performance of Assistant Agricultural Officers in Karnataka state. Tamil Nadu Agricultural University, Coimbatore, India.
- Wani, G. B., Balkhi, M. H., Darve, S. I., Bhat, T. H. and Hussain, N. 2016. Knowledge and Adoption of Fish Farming Practices by Fish Farmers of Indian Himalayas: District Ganderbal (Kashmir). *Annals of Biology* **32** (2): 238-241.



Sher-e-Kashmir
University of Agricultural Sciences & Technology of Kashmir
Faculty of Fisheries, Rangil, Ganderbal

CERTIFICATE

Certified that all the corrections/amendments as suggested by External Examiner **Dr. Imtiaz Ahmed Khan Senior Assistant Professor, Department of Zoology, University of Kashmir, Hazratbal Srinagar** during viva voce examination held on **22-03-2019** have been incorporated in the manuscript entitled “**Knowledge and adoption level of fish farming practices of district Baramulla and Bandipora**” submitted by **Mr. Umar Farooq Ahmed Khan (Reg. No. 2016-F-51-M)**.

(Dr. Gohar Bilal Wani)
Chairman
Advisory Committee