Economic prospects of pisciculture in Assam- a case study on Nalbari District using Computer Vision

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Introduction:

Agriculture and allied activities are the backbone of rural economy in India and is considered crucial for rural development. It plays a significant role in economic development of a country, which contributes to poverty alleviation, infrastructure development and creation of job opportunities for rural youth. Due to its enormous importance, during first Five Year Plan (1951-1956) this sector recognized as the important allied sector in the state. It is the key sectors of economy as well as main pillars of human civilization. Agriculture and allied activities are the major source of livelihood for significant portion of global population, especially in developing countries where large number of workforce engaged in various activities like farming, animal husbandry, fisheries, forestry and processing of agricultural products.Among the allied sector of agriculture pisciculture or fish farming is very well known farming, which is the process of breeding, raising and transportation of fishes for domestic and commercial purpose.

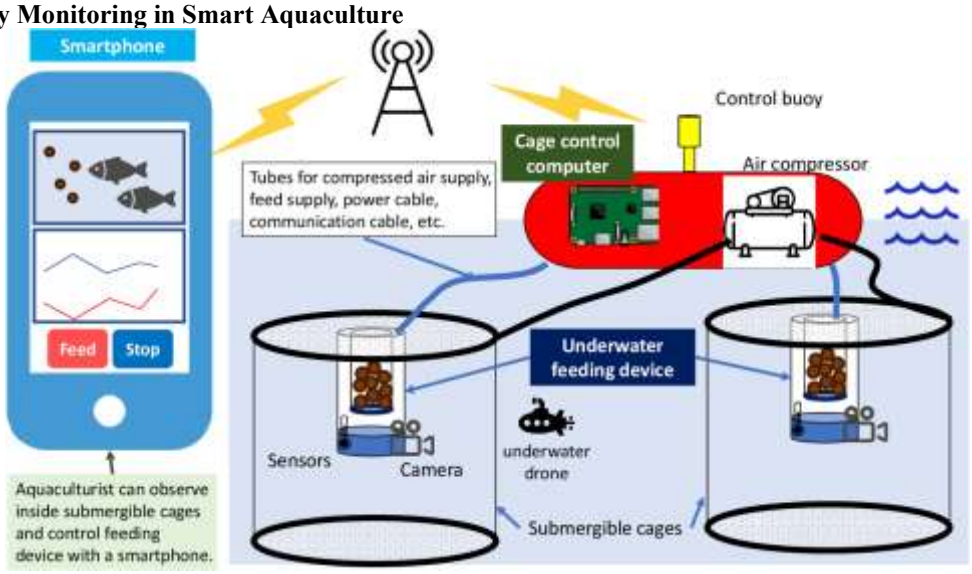
The fishery is broadly divided into two categories that are capture fishery and culture fishery. Capture fishery involves harvesting wild fish from natural habitants (Marine and other fresh water like rivers, lake and estuaries) and culture fisheries also known as aquaculture refers to the farming and cultivation of fish (NFDB- National Fisheries Development Board 2018)**.**Food and Agriculture Organization of United Nations 2020 (FAO) indicates that the fisheries and aquaculture sector provide job opportunities about 59.5 million people globally where 39 million people engaged in primary production (fishing and aquaculture) and 20.5 million of people are engaged in secondary production and support services like processing ,marketing and trade etc. (FAO 2020)**.**Fish farming or pisciculture is an old age occupation of the country and Since the days of hunting, catching fish for food has been important source of life. Further with growing population and growing demand for nutrition, it has become a significant part of food behavior of human being (NBDB- National Fisheries Development Board 2015, 2018. Present times with the development of high technology a lot of young farmers and entrepreneurs have been choosing farming as their occupation among which pisciculture is a popular sector. Thus, after agricultural activities fishery play a very significant role in the generation of income and self employment opportunities especially in the rural areas of a state. This sector has tremendous potential for self employment and has been recognized as a powerful income and self employment generator. The multiple benefits of fishery is that it provides job opportunities for youth, empowerment of women, promoting tourism and contributing foreign exchange earnings and economic growth.(NFDB- National Fisheries Development Board 2018).

A. Literature Review:

Some relevant literatures regarding the fishery sector of Assam is tried to Contextualize in this study. SK Das (2003-04) have said that the aquaculture not only plays an important role in nutrition but also in the rural economy of the State. A pilot project conducted with a group of resource poor tribal farmers revealed that a production of about 1 800 kg/ha/yr could be achieved from small seasonal homestead ponds through integrated use of locally available biological resources. This implies an excellent opportunity for improving the rural economy through the development of small-scale fish culture enterprises. In this project, a greater emphasis was placed on improving the knowledge and skills of the farmers and their farming practices so that in the future they would be in a position to expand their activities with financial assistance made available locally.

Bora V. and Sharma (2000) have submitted that the wetland resources of north east India have great potential to be utilize for aquaculture some minor groups of fishes which have tremendous economic importance are listed. Some suggestion for fishery development in the region for both major crops and commercially important potential aquarium are provided in the articles. Assam is one of the richest state in the country with surface water resources where beelfisheries and pond & tank fisheries alone occupies about 1.40 lakh hectares area. Some Literature Surveys are-

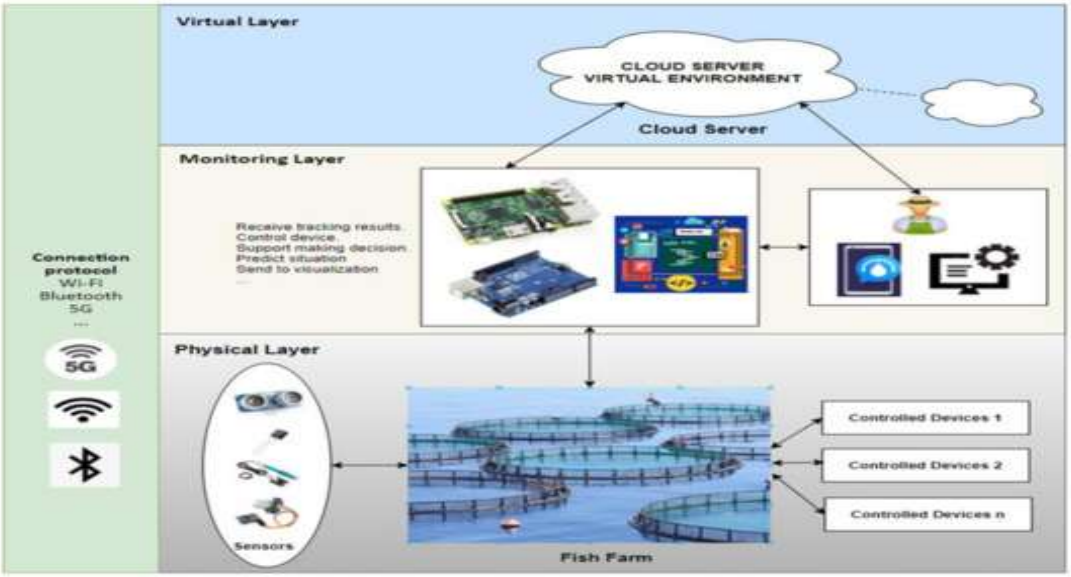
Water Quality Monitoring in Smart Aquaculture



Water quality is the main factor which contributes to success and efficient management in aquaculture. There are several water quality parameters which play a vital role in direct or indirect on the survival and growth of cultured species that have been considered such as temperature, turbidity, carbon dioxide, pH, alkalinity, ammonia, nitrite, and nitrate, etc. Among them, temperature, dissolved oxygen and pH are most robust .During the last few years, IoT has had various applications in different fields including aquaculture. Using IoT in aquaculture has opened a new trend to develop this field in a sustainable way with intelligent devices in real time using connected water monitoring capabilities that help to improve aquaculture famer's working conditions.

There are 4 main layers of an IoT Aquaculture System: Physical Layer, Monitoring Layer, Virtual Layer, and Connection protocol.The smart farm industry/intelligent aquaculture has become the inevitable trend in order to decrease labor costs, to increase operational efficiency, and to lead to higher productivity. The future IoT-based systems could also aim to detect fish diseases and prevent production loss. It is worth noting that although there are several achievements in the application of artificial intelligent devices for aquaculture to build up intelligent, and high-precision fish farming is progressing quickly, there are still many challenges to operate fully automated systems. Because aquaculture activities and its products are different from others, labor management is high in risk, as there is still a need for a certain amount of observation, information analyzation, and decision making during the fish farming process. However, a lot of intelligent equipment, such as the technologies mentioned above, are responsible for monitoring fish farming environments: robotic devices for production; data and information sorting; and energy-saving processing equipment will continue to greatly automate different stages of fish farming operations [64]. These can be implemented in aquaculture for fish identification, mass estimation, and behavior management. In addition, it is necessary to create new sensors which integrate several functions in a sensor/multifunctional sensor with high reliability, have the wide range applications, and long-life cycle .Figure shows an IoT aquaculture system.

Smart Aquaculture

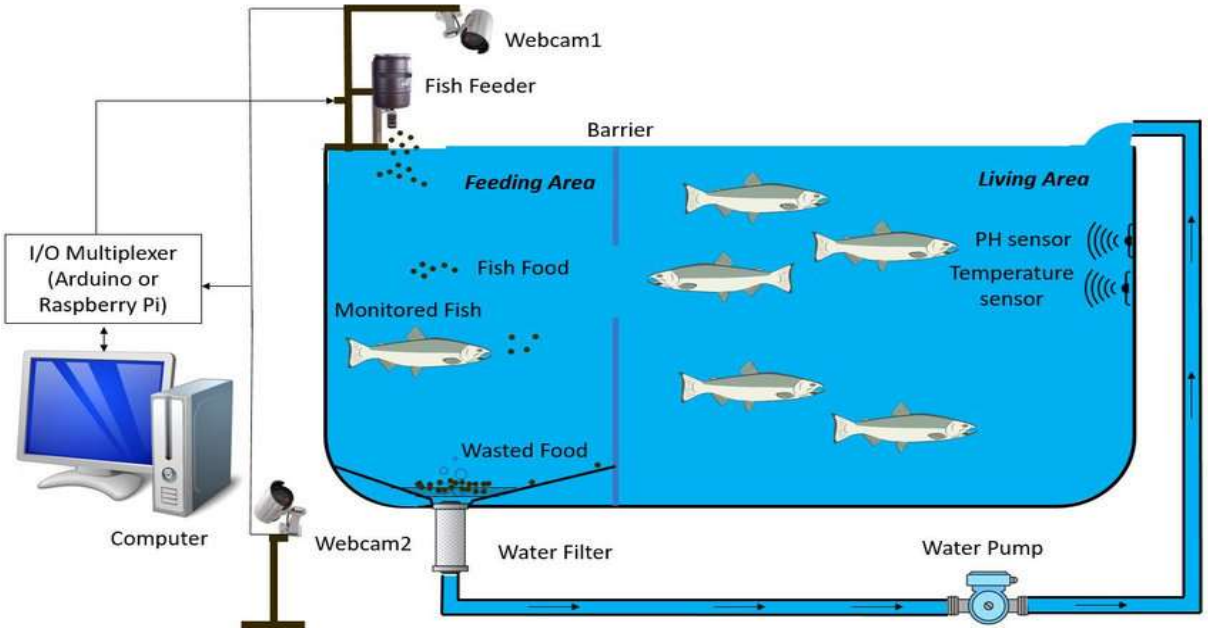


Based on the advanced of artificial intelligent, smart aquaculture can perfect all stages from breeding, nursery to grow out stages of cultured species, as well as other processing like preparation of cultured water resource, manage the water quality, feed preparation, feeding, classification, grading, counting and washing the cultured systems. The final goal for developing the smart aquaculture is to obtain high aquaculture production to match world demand as well as protect environment.

Feeding Controlling

One of the main problems in aquaculture is feeding. According to the traditional method, farmers will spread food all over the pond, or at a certain location in the pond, depending on the eating characteristics of cultured species. Therefore, it is necessary to apply IoT in the feeding system to control the feeding amount as well as feed automatically which brings many benefits such as saving manpower and controlling the amount of leftovers, reducing water quality pollution in aquaculture. There are some studies which have been conducted.

For instance, Malathi et al. provides an efficient semi-automatic system that facilitates the healthy growth of aquatic organisms in aquaculture. This study is conducted not only for a feeding system but also for water quality parameters in a cultured system through sensors such as a pH sensor and temperature sensor. The GSM module is used to alert the cultivator whenever the quality parameters violate the normal range. The feeding system automatically feeds the fish based upon its requirements. The system mainly consists of an Arduino Uno, a DS18B20 Temperature Sensor, a pH sensor, and a SIM900A-GSM module. Daud et al. proposed water quality system based on IoT devices in a smart aquarium. The goal of this study is to maintain the freshwater in aquarium tank at a suitable level for fish habitats and feeding condition. This system is designed with MEGA and NodeMCU controllers and is controlled by a smartphone in its operation. Arduino are used in the designed system. Wi-Fi communication on the Node MCU is connected between the smartphone and the controller to control the operation.



B. Statement of the problem

Fish farming or pisciculture is an old age occupation of the country. Among the allied sector agriculture pisciculture is considered as an important economic in the state of Assam. It has progressed from stocking and harvesting of single species to composite sector. Action in the state tense to increase over the period but the state has still used domestic market potential to meet the demand of consumer for fish besides fish production is affected by various factors such as ecological biological social and economical etc.

Moreover the economy of Assam is suffering from the severe problem of unemployment from several years which acts as a major hindrance in the socio economic development of the state. The widespread problem of unemployment is one of the major root causes of youth unrest and ongoing insurgency problem of the state. Issue of unemployment among the educated youth is even more dangerous as it leads to waste of human resources.

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The study helps to understand the social economic condition of fish farmers. Such study will be useful for necessary steps for improvement of fish production and also the productivity of fish farming. The primary goal of the study is to analyze the various challenges faced by the farmers in the study area and exploring the immense potential of Pisciculture.

C. Fisheries Resources in Assam

Fishery is a significant economic activity in Assam providing livelihood to a large number of people particularly in rural areas. Fish consumption has deep cultural roots in Northeast India especially in Assam (Bhuyan et al.,2017). Fishing in Indigenous communities is not just a source of food but a vital tradition that strengthens cultural identity and enriches social and festive life.

The fisheries sector plays a crutial role in Assam economy contributing significantly to the state GDP, employment and food security. Fisheries provides employment opportunities to millions of people globally especially in developing countries. According to food and acqua culture organisation (FAO) over 59.6 million people were engaged in fisheries in aquaculture production in 2020 (source FAO- fisheries and aquaculture department)

- In Assam, there are 71843.50 numbers of registered beel fisheries covering an area 71843.50 hectares.
- There are 547237 ponds and tanks spanning across 92386.22 hectares.
- Reverse fisheries covering an area of 11060.60 hectares.
- Forest fisheries covering an area of 6990.90 hectares.
- Derelict water bodies/swamps encompass 83555.26 hectares.
- Reservoir fisheries extend across 564 hectares.
- The production of fish seed in government as well as private sector is 18218.70 million

Source: Statistical Handbook, Department of Economics and Statistics, Government of Assam.

Fish seed and fish production during last five years
Table: 1.1

Year	Fish seed (million nos.)	Fish (lakh MT)
2018-19	9893	3.31
2019-2020	9519	3.73
2020-2021	9886	3.93
2021-2022	18219	4.17

Source: Directorate of Fishery, Government of Assam

To increase quality fish production by applying some innovative technique fishery department conducted some research based studies so that benefit can be disseminated to the grassroots level users and promote entrepreneurship. As a result fish production gradually increased year by year in last five year as mentioned in Table:1.1 .

Present Fishery resources/ Infrastructure in Nalbari the District:
Table:1.2

Resources	Numbers	Water area(in hectare)
Ponds and tanks	27115	3457
Beel fisheries	25	792
Swamps/ low lying areas	-	3645
Paddy field/canals	-	5040
River fisheries	7	263.23 Km
Eco-hatchery	15	-
Fish feed mill	1	-
Wholesale fish market	8	-

Source: DFD Office, Nalbari

Annual fish production, requirement and Surplus in Nalbari District during last two years:
Table 1.3

Year	Production of fish(in MT)	Requirements of fish(in MT)	Surplus of Fish (in MT)

2020-21	12605.36	10483	2122.26
2021-22	29716.43	26516	2306.43

Source: DFD Office, Nalbari

Annual fish seed Fingerlings production, requirement and Surplus in Nalbari District a during last two years:

Table 1.4

Year	Production of fish seed fingerlings (in lakh)	Requirements of fishs s eed fingerlings(in lakh)	Surplus of Fish seed fingerlings(in lakh)
2020-21	387.67	386.55	1.16
2021-22	432.80	431.36	1.44

Source: DFD Office, Nalbari

Resource wise fish production in pub Nalbari block in the ye

Table 1.5

Private individual ponds			Private community tanks			Govt. Ponds/tanks/farms		
Total existing water area and nos.		Total fish productio n (in kg)	Total existing water area and Nos.		Total fish productio n (in kg)	Total existing water area and nos.		Total fish productio n (in kg)
Water area(in Ha.)	Nos.		Water area(in Ha.)	Nos.		Water area (in Ha.)	Nos.	
615.00	4968	215250	17.40	67	3900	3.00	6	0

Source: DFD Office, Nalbari

D. Schemes Taken by the Government of Assam for the Development of Pisciculture:

1**. Pradhan Mantri Matsya Sampada Yojana (PMMSY**):

PMMSY , launched in the year 2020, is a flagship scheme by the government of India to drive sustainable development of fisheries sector in the Country.By supporting modern acqualture practices and infrastructure development the programme aims to make India a leader in fish production and processing. This scheme develops a plan vision to improve India's fishing industry in a way that it is socially inclusive, economically viable and ecologically sound.

Progress Report of PMMSY Scheme:

Pradhan Mantri matsya sampada Yojana (PMMSY) progress report in Nalbari District 2020-21 and 2021-22

Table 1.6

year	2020-21		2021-22	
Activities/components	No of beneficiary	Progress (in%)	No of beneficiary	Progress(in%)
Integrated fish farming	21	100	16	50
Livelihood support to fishers	1250	100	600	98
New pond construction-NEH	24	100	16	40
Construction of rearing pond	21	100	33	40
Inputs for fish farming	24	100	16	70
Fingerings stocking in wetland	3	100	2	30

Source: DFD office,Nalbari

The main objectives of the scheme are enhancing fish and fish products exports through expansion, intensification, diversification and productive utilization of land and water. As per the progress report received DFD office lesser number of beneficiaries benefited by the scheme in 2021-22 as compared to 2020-21.

Rashtriya Krishi Vikash Yojana (RKVY-RAFTAAR)

Table 1.7

1	2020-21	Air Breathing fish culture in existing tank	2 Ha	18 nos	100%

2	2021-22	Development of waterlogged area to fish pond	2 Ha (2 nos)	2 nos	100%

Source: DFD office,Nalbari.

Rural Infrastructure Development Fund (RIDF-XXVI), 2021-22:

Department of Fisheries, Assam has been implementing different fishery related infrastructure development programmes under NABARD's Rural Infrastructure Development Fund (RIDF), contributing towards agricultural growth, rural connectivity and other social sector development. Under this programme beel fisheries development and up-gradation of Departmental Fish Farm has been initiated along with construction of marketing infrastructure and fish landing centers. Under RIDF- XXIII the Department has been implementing "Ghare Ghare Pukhuri Ghare Ghare Maach" under which more than 1300 Ha individual ponds and about 500 Ha village community tanks under process of excavation covering more than 9500 beneficiaries.

Rural infrastructure development scheme

Table 1.8

SL. no	Name of scheme	No of beneficiary	Physical achievement
1	Refrigerated Fish transport vehicle (four wheelers)	4 nos	100%
2	Three wheelers vehicle with ice box	12 nos	Yet to distribute
3	Establishment of fish feed plants (small size 100-500 kg per day)	2 nos	70%
4	Establishment of fish feed plant medium size 200 kg per hour	1 no	Yet to construct

Source: DFD office,Nalbari.

Most of the people engaged in the fishery sector, either in the culture or in the capture fisheries are not very sound economically. Moreover due to lack of awareness, knowledge and skill on scientific fish culture practices and management, fish production in the state is comparatively low in relation to its potential. Department of fisheries can play important role in bridging these gaps and contribute for technical backstopping. Due to constant effort of the state as well as central government and growing interest of the farming community during the last few years, fishery sector in the state has reached to a significant position in the state economy. The department has adopted development planning for the fisheries sector as per the United Nations sustainable development goals (SDG) self sufficiency followed by surplus production export.

Economic Contribution of Piciculture:

Fishery is a significant economic activity in Assam providing livelihood to a large number of people particularly in rural areas. Fish consumption has deep cultural roots in Northeast India especially in Assam (Bhuyan et al.,2017). Indigenous communities continue the age old practice of fishing which not only fulfills dietary needs but also contributes to social customs and festivities (Dubey and Gogoi,2021)

The fisheries sector plays a crutial role in Assam economy contributing significantly to the state GDP, employment and food security. Fisheries provides employment opportunities to millions of people globally especially in developing countries. According to food and acqua culture organization (FAO) over 59.6 million people were engaged in fisherries in aquaculture production in 2020 .(Fisheries and Aquaculture Department -2020).Government funding for fisheries in India has seen a significant rise in recent years. While the Blue Revolution initiative experienced reduced budgetary allocations, the introduction of the Pradhan Mantri Matsya Sampada Yojana (PMMSY) in 2020 marked a turning point. This central government program serves as an umbrella scheme to support the Blue Revolution's goals. Fishery is a significant economic activity in Assam providing livelihood to a large number of people particularly in rural areas. Fish consumption has deep cultural roots in Northeast India especially in Assam (Bhuyan et al.,2017). Indigenous communities uphold fishing not merely as a livelihood, but as a cherished heritage that enriches their cuisine, customs and celebration in north east India specially Assam.

The fisheries sector plays a crutial role in Assam economy contributing significantly to the state GDP, employment and food security. Fisheries provides employment opportunities to millions of people globally especially in developing countries. According to food and acqua culture organisation (FAO) over 59.6 million people were engaged in fisherries in aquaculture production in 2020 source fao fisheries and aquaculture department.

Primary analysis of Data

In order to fulfill the objectives of the research study a set of questionnaire was prepared as a source for collecting information relating to the Economic Prospects of Pisciculture in Nalbari District of Assam. A total number of 50 respondents have been taken by randomly from different villages for the study and collect their opinion on five points

likert scale technique. Sample studies of villages under Pub Nalbari Development Block were Dalua, Paikarkuchi, Barajol,Charia, Khat Katra, Nankar Bhaira, and Sandha.

Presentation analysis and interpretation of data

Table 1.9

Categoy	Description	gender		Total respondent	percentage
		male	female		
age	Less than 30 30-40 40-50 Above 50	7 18 12 6	- 5 2 -	7 23 14 6	14 46 28 12
total		43	07	50	100
gender	Male	43	-	43	86
	Female	-	7	7	14
total		43	7	50	100
Educational qualification	Non graduate postgraduate, professsional graduate	24 6 13	4 - 3	28 6 16	56 12 22
total		43	7	50	100

Source- Primary Data

From the table 1.11 it reveals that maximum non graduate male fish farmer under the age group of 30 to 40 are engaged in fish farming. Due to unemployment problem and professional interest a least number of respondents engaged in fish farming.

Involvement in allied activities other than Pisciculture

Table 1.10

SL no	Activities	No of respondents
1	Agri based fish farming	10
2	Live stock fish farming	25
3	Both agri based and live stock fish farming	15
	Total	50

Source: Field survey

Interpretation The study reveals that all the respondents are having integrated fish farming of which majority are having live-stock fish farming like Pig cum fish farming, poultry cum fish farming, duck cum fish farming, goat cum fish farming etc and minority are having agri-based fish farming like paddy cum fish farming etc.

Statistical summary of various opinion collected from fish farmers under Likert scale technique

Table 1.11.

statement	Strongly disagree	disagree	Undecided agree		Strongly agree
Training programme conducted for fish farmers are sufficient	22(44)	15(30)	5(10)	6(12)	2(4)
Presently I am adopted traditional practices for fish farming	3(6)	10(20)	2(4)	15(30)	20(40)
I am interested in adopting new aquaculture technique for my farm	----------	3(6)	------	25(50)	22(44)
The use of modern aquaculture technique has improved my fish production effectively	------	1(2)	2(4)	23(46)	25(50)
The government support policies for fish farming development is sufficent	21(42)	18(36)	4(8)	7(14)	----------
Access to credit facilities is essential for growth of my fish farm	2(4)	2(4)	4(8)	20(40)	22(44)
Access to quality fish seed is a major obstacles for my fish farm	20(40)	22(44)	2(4)	3(6)	1(2)
Fish farming plays prominent role in boosting local economey	------	3(6)	2(4)	15(30)	30(60)

Fish farming as a carrier option solved unemplynet problem in rural areas	1(2)	3(6)	1(2)	17(34)	28(56)
There is the potentiality of fish farming business in the future	2(4)	5(10)	2(4)	21(42)	20(40)
Fish farming is a sustainable and environment friendly practice	1(2)	2(4)	------	27(54)	23(56)

Source- Field survey

E. Results and discussion

- **The majority of the Pisciculturists, i.e 44% are not very rich; they need financial assistance to run their business smoothly, but the government has failed to provide all kinds of necessary support or assistance to all needy Pisciculturists at the desired level. This is hampering the growth of the fishery in the district.**
- **A maximum of 40% respondent of respondents in the study area are involved in traditional fish farming, which reflects a lack of knowledge of scientific fish farming. From the above table, it shows that they are interested in adopting modern aquacultre techniques, but due to a lack of training, they are not able to fulfil their desire.**
- **For the overall growth of the sector, the department functions with the slogan of " grow more fish" and the following mandates: To increase fish and quality fish seed production in the state with optimum utilisation of resources.**
- **Implementation of the related scheme of the government of Assam and the government of India.**
- **To identify and promote research and studies on fisheries and fishery related areas so that benefits can be disseminated to the grassroots level users.**
- **To collect, compile, analyse and make available adequate/ relevant statistical and other information for proper planning to promote fish farming and related industries**
- **To prepare/support the preparation/of project reports and proposals related to fisheries and fishery-related industries**
- **To provide extension services to fish farmers/fishermen and fishery entrepreneurs.**
- **Shortage of quality fish seeds in the district is affecting the probability of high production from the fishery sector.**
- **The state has adopted a variety of schemes for the expansion of the fish culture area. But despite several schemes adopted by the state, the overall production of fish is quite low because most of the schemes are only for SC or ST in particular.**
- **It is found that farmers are facing the problem of insufficient training for the culture of fish and fish seed production, for which the mortality rate of fingerlings is high.**
- **It is exposed that the majority of the farmers are engaged in fish farming due to the swelling problem of unemployment.**
- **The study reveals that the problem of flood adversely affects the fisheries in the study area as well as in the State.**
- **It is found that during the study period, a few Pisciculturists, along with the Fishery Department of the Government of Assam, processed the project for Fish pickle, Dry Fish, low-cost breeding fish Seed Hatchery, and Polyculture of Prawn with Carps.**
- **During the study, it was found that a few of the farmers are starting to produce Ornamental Fish, which is the most profitable business nowadays.**
- **It is found in the study that only 2 or 3 pisciculturists produce fish seed in large amounts and supply not only in the District but also in other States after getting well trained in different cities outside of Assam.**

Therefore, there is enormous need to assess that the schemes should be acquirable by all the farmers instead of SC or ST. Government should urgently look over the devastating problem of flood which adversely affects the fisheries in large quantity.

It has been found that there is insufficiency for fish seed in the study area. Therefore, there is prominent requirement for production of more fish seed which can only be possible if farmers are provided well training programs for production of fish seeds.

During the survey it is noticed that only a few farmers are producing ornamental fish although District Fishery Development Office take some initiatives for production of ornamental fish which is insufficient in the study area.

Though the majority of the farmers are engaged in fish farming due the swelling problem of unemployment, yet maximum of them are not so profitable because of proper training and financial assistance are not available as per requirement in the study area.

It can be seen that a few farmers are producing ornamental fish and it is a trend now-a-days for decorating purpose, which is also most profitable business. During the survey it is noticed that although District Fishery Development Office takes some initiatives for well production of ornamental fish but it is insufficient in the study area.

State government should develop electrification facilities to boost the fish production in the state. Proper initiatives for the development of this sector will not only boost fish production but also decrease the unemployment problem by allocating adequate financial assistance to the Pisciculturist in the study area.

Most of the people engaged in the fishery sector,either in the culture or in the capture fisheries are not very sound economically. Moreover due to lack of awareness, knowledge and skill on scientific fish culture practices and management, fish production in the state is comparatively low in relation to its potential. Department of fisheries can play important role in bridging these gaps and contribute for technical backstopping. Due to constant effort of the state as well as central government and growing interest of the farming community during the last few years, fishery sector in the state has reached to a significant position in the state economy. Recently fish farming has been taken by many rural youth and entrepreneurs as a commercial activity.

For overall growth of the sector the department functions with the slogan of " grow more fish" and the following mandates:

- To increase fish and quality fish seed production in the state with optimum utilizatioon of resources.
- Implementation of fishery related scheme of the government of assam and government of india.
- To identify and promote research and studies on fisheries and fishery related areas so that benefit can be disseminated to the grass root level users.
- To collect compile analyze and make available adequate/ relevant statistical and other information for proper planning to promote fish farming and related industries
- To prepare/support in preparation/vet project reports and proposals related to fisheries and fishery related industries
- To provide extension services to fish farmers/fisherman and fishery entrepreneurs.

The department has adopted development planning for the fisheries sector as per the United Nations sustainable development goals (SDG) self sufficiency followed by surplus production export.Assam, located in northeastern India boasts a rich diversity of fish resources due to its abundant water bodies like river lakes and ponds . Fishery is a significant economic activity in Assam providing livelihood to a large number of people particularly in rural areas. Fish consumption has deep cultural roots in Northeast India especially in Assam (Bhuyan et al.,2017). Indigenous communities continue the age old practice of fishing which not only fulfills dietary needs but also contributes to social customs and festivities. The fisheries sector plays a crucial role in Assam economy contributing significantly to the state GDP, employment and food security. Fisheries provides employment opportunities to millions of people globally especially in developing countries. As per the report of food and acqua culture organisation (FAO) over 59.6 million people were engaged in fisherries in aquaculture production in 2020.

F. Conclusion:

In Assam, fishery activities have always remained a major source of livelihood for the people of the state, generating a considerable amount of income and employment opportunities. The demand for fish has been continuously increasing in recent years. Due to the deficiency in production, the prices of fish have recorded a rapid increase. Considering the vast open water resources in the state, the growth and trend of fish production leave much to be desired. There are substantial opportunities to increase fish production through more productive use of aquatic resources. Assam has huge potential for fisheries development. If proper steps are taken by the government, then it will be able to achieve development in the fishery sectors within a short period.

Fish play a crucial role in food security and nutrition. The growing population necessitates a transformation of India's agri-food system to ensure sustainable food security, improved nutrition, and affordable healthy diets, all while protecting livelihoods and natural resources.

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