**Promotion of fish production and doubling farmer's income among Scheduled Caste fish farmers in Assam, India**


## Abstract

Aquaculture plays an important role in supporting livelihoods worldwide and also forms an important source of diet for over one billion people. The inland fisheries are of particular importance to the rural poor accounting for about fifteen per cent of total global employment. Besides employment, it caters to the nutritional need of the rural poor. Being an agrarian economy, fish farming is one of the important livelihood activities in Assam.Though"Kaibartta" is the main fishing community in Assam the professionhas been taken over by the immigrant Muslim people in various districts of the state. Nevertheless, Scheduled Caste people living in rural areas have their own ponds at the back of their houses and they culture fish for domestic consumption. It is observed that rural farmerslack exposure to scientific fish farming and this may be considered one of the obstacles to low production and productivity. Thus, looking into the huge potentiality of the sector and its associated problems, a small intervention in the form of capacity building of the fish farmers' belonging to the Scheduled Caste and distribution of various fishery inputs was undertaken. Twenty percent of three villages belonging to Schedule Caste in the Nagaon district were selected randomly for the interventions to be administered. The paper analyses the process of implementation along with the outcomeof the project on the sample households. The result shows that the intervention has augmented the knowledge base and skill of the SC farmers and thereby enhanceshousehold income and nutritional security in a sustainable manner.



Keywords: Fish production, Floodplain wetland, Kaibartta, Livelihood security, SC population.


## Introduction:

Agriculture is the most important occupation of the rural population. Among various farm activities fishery is considered to be a sector catering to employment needs besides producing nutritious food for the undernourished population (Nandeesha, 1992). Fishery plays an important role in supporting the livelihoods to about 15 per cent of the total global employment (FAO, 2000)and also forms an important source of diet for over one billion people. It is recognised as a powerful income source and employment generator as it stimulates the growth of a number of subsidiary industries and is a source of cheap and nutritious food besides being a foreign exchange earner(Sarma*et al.*, 2022).The inland fisheries are of particular importance to the rural poor accounting for about 15 per cent of total global employment (FAO, 2000).

India has extensive floodplain wetlands, defined as low-lying areas bordering large rivers, which are seasonally inundated by spillover from the main river channels. India is the second largest fish-producing country in the world and accounts for 66.3 per cent of global production(MoEA-GoI, 2019).Fish production in India has reached an all-time high of 14.16 million metric tons during 2019-20 (ES, 2020-21). The fishery sector contributes 1.24 GVA

and 7.28 per cent to the agricultural GVA (ES, 2020-21). The livelihood opportunities provided by this sector have been instrumental in sustaining the incomes of over 28 million people in India, which was 12 million in 2008-09 (Manasi *et al.* 2009), especially the marginalised and vulnerable communities and have promoted meaningful socio-economic development (ES, 2020-21).

Assam, the heart of North-East India, is located between $21.57^0$ N – 29.30° N latitude and $89.46^0$ E – 97.30° E longitude with an area of 78,438 sq. Km. Assam is the second largest state of the North Eastern Region which has been blessed with vast and varied aquatic resources in the form of riverine, floodplain wetlands, low lying paddy field which supports a sizable variety of freshwater fishes(Gogoi *et al*, 2015). Out of the total geographical area of Assam, 10.5% area is occupied by surface water bodies, of which 6503 sq km is held by all the river systems including the mighty Brahmaputra and 1748 sq. km by natural wetlands including seasonal and permanent waterlogged, marshy areas and both natural and man-made reservoirs, ponds and tanks of size more than 2.5 ha (ASTEC, 2007).

The economy of Assam is predominantly an agrarian one with more than 86% of the population living in rural areas(Census, 2011). Besides agriculture, fish farming is one of the main occupations of the people of Assam. The fishery sector occupies a very important place in the socio-economic development of Assam. It has been recognised as a powerful sector both for income and employment generation. The Fishery sector contributes more than 2 % of the State'sGDP and plays an important role in providing livelihood to a significant proportion of the population in the state(Deka, 2021). The contribution of the fishery sector to the State Domestic Product (at constant 2011- 12 prices) was Rs. 4414.30 lakhs (with a growth rate of 6.86 per cent) as per provisional estimates in 2013-14 which increased to 4721.19 lakhs (with a growth rate of 4.68 per cent as per quick estimates 2015-16 (ESA, 2016-17).

Fish forms an integral part of the cuisine and culture of the people of Assam(Baruah, 2015; Gogoi *et al.*, 2015; Gupta & Mithra, 2015).It is an important part of the daily meal. Fish is highly preferred and largely consumed in the state. Fisheries sector development is also very important for the state's economic development, as a livelihood issue, for the provision of the required nutrition, employment and income to its people and is traditionally interwoven in their everyday life.Over the last two decades, the fisheries sector has been able to achieve remarkable growth. It has also been taken up as a commercial activity and has ushered in a silent revolution of progress and prosperity throughout the length and breadth of the state. The fishery resources of Assam in percentage are represented in Figure 1. The trend of fish production in Assam and Nagaon district is given in Figure 2. Figure 3 symbolizes the quantity of fish imported for the state of Assam and particularly for Nagaon district (SHA, 2019).

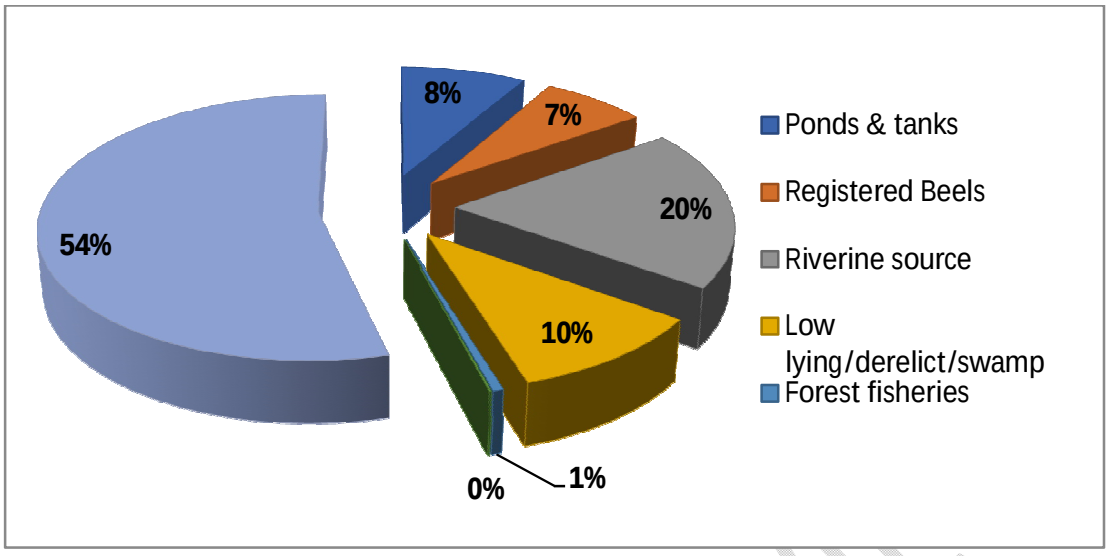
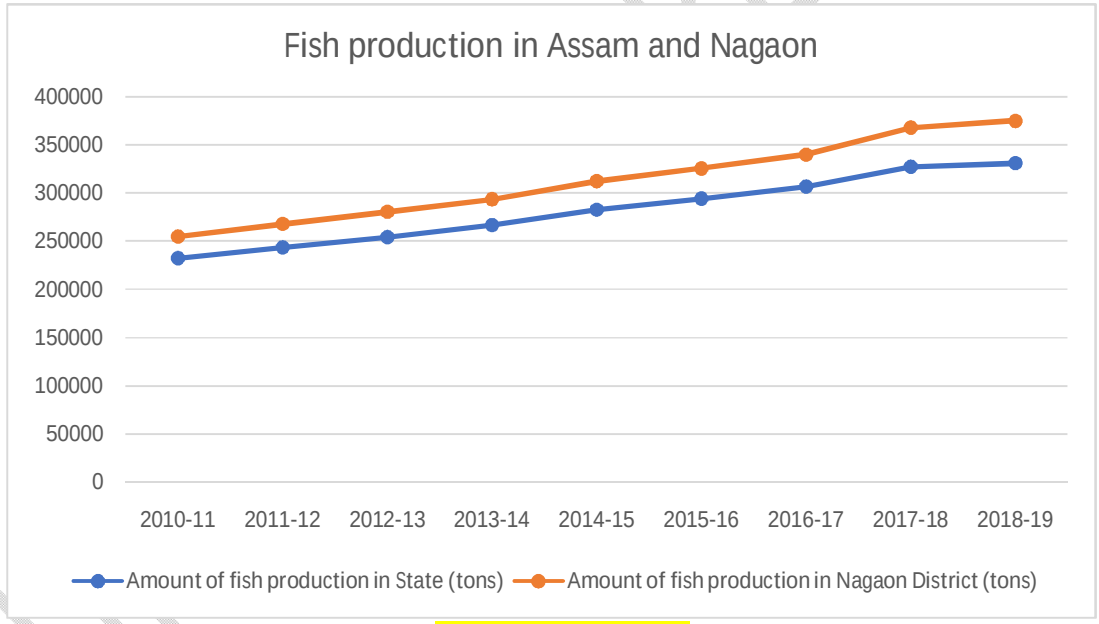



Fig.1 Fishery resources of Assam, India




(Source: SHA, 2019)

Fig.2 Trend of fish production in Assam and Nagaon

(Source: SHA, 2019)

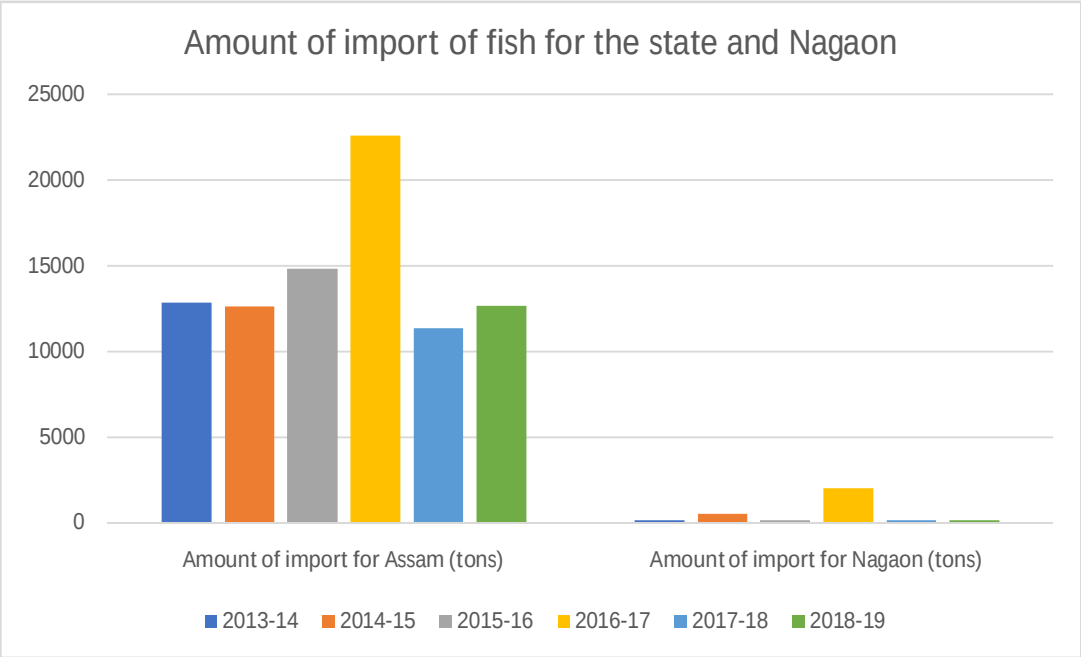



Fig.3 Import of fish for Nagaon and Assam, India

Source: SHA, 2019

Contextual to this, it is an utmost necessity to increase the production of fish by utilizing the rich water resources and available production systems of the state.To satisfy the domestic demand, non-conventional aquaculture techniques have to be adopted and proper utilization and management of available resources have to be ensured (Gogoi *et al*., 2015). There is an excellent scope to produce more fish through adequate control of beels (Baruah *et al*., 2000). The productivity from beels can be enhanced through culture-based capture fisheries with community participation.

It is worth mentioning that Schedule Caste people, primarily the "Kaibartta" areone of the main fishermen communities in the state comprising 31.8 per cent of the total Scheduled Caste population (Census of India, 2001). Most of the Kaibartta people are now engaged in different livelihood activities,primarily cultivation and fishing have been taken over mostly by the immigrant Muslim people in the state(Sarma, 2005).The Schedule Caste people living in rural areas culture fish for domestic consumption. However, it is worth noting that in most of the cases these poor people don't have any exposure to scientific fish farming practices resulting in very low production and productivity.

It is in this context, a scientific study was conducted on the selected SC fish farmersin three villages of the Nagaon district of Assamto identify the constraints of the existingbackyardfish farming system and to provide suggestive measures for uplifting the livelihood and socio-economic status through the dissemination of critical technical inputs, awareness, training and skill development.

**Materials and Methods**

**Profile of the study area**

The studied villages, i.e., Sukotipota, Lomati, and Rangalumukh are located between latitude $26^0$219' N to $26^0$229' N and longitude $92^0$675' E to $92^0$686' E.The three villages selected for the study is old settlements. Around 70-80 years back people from surrounding areas migrated to settle in these villages. There are both push and pull factors responsible for such local migration. The push factors are those that compel a person to leave that place and go to some other place. On the other hand, the pull factors are those which attract the migrants to an area(Kainth, 2009). The push factor are those life situations in one's present homeland that generate dissatisfaction, such as poverty, unemployment, rapid population growth, low social status, etc. In contrast, the pull that makes migration appealing are well-being, job opportunities, education, etc. (Zanabazar*et al*., 2021). In the case of the present study, the push factors are found to be thelack of land in the place of origin as a result of the increased size of the family and fragmentation of the joint family while the pull factor is the fertile land of the present location. There are 207 households (HHs) in all the three villages studied according to the 2011 census. The total population is 959 out of which 475 are female which shows a female-male ratio of as high as 981. The literacy rate is estimated to be 77 percent. The people living in these villages depend primarily on agriculture for their livelihood. Winter and Bao paddy, mustard, sugarcane,and various seasonal vegetables are grown on a large scale for their livelihood. The study was carried outduring 2020-22.

**Primary data**

Secondary data was not sufficient related to the study; therefore, emphasis was given to collecting the primary data for a proper analysis of the situation. A Rapid Rural Appraisal (RRA) was administered to select the villages and understand the field condition. The primary data has been collected by the authors by adopting other Participatory Rural Appraisal (PRA) methods. PRA is a way of enabling local people to analyse their living conditions, to share the outcomes and to plan their activities (Sontakki*et al*., 2019). The PRA tools administered for the present study are such as observation, questionnaire and Focus Group Discussion. A semi-structured questionnaire was designed and administered to elicit the required data and information regarding the socio-economics of the villages. A flow chart was prepared to represent the detailed methodology undertaken for the study (Fig.4).

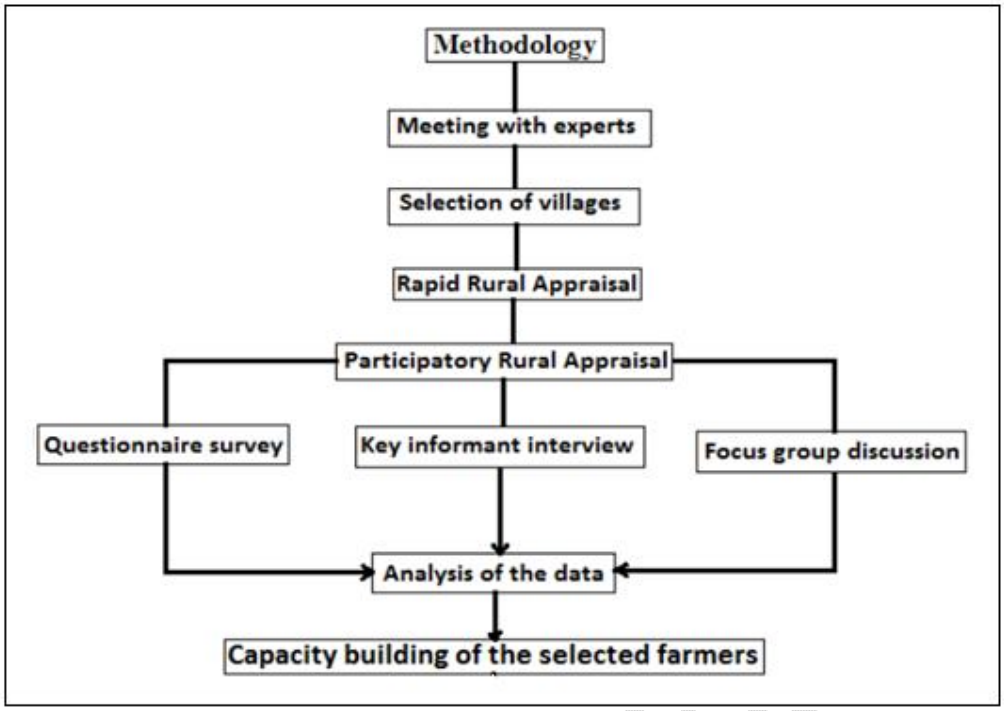



Fig. 4 Flow chart prepared for the methodological framework

**Secondary data**

Secondary data for the paper has been collected from various sources like books, journal papers, and various reports such as the economic survey of India,the Economic Survey of Assam, and the statistical handbook of Assam.

**Sampling**

Following Sing (2016), atwo-stagestratified sampling design was prepared and followed for conducting an in-depth investigation. In the first stage, sample villages were selected based on Schedule Caste concentration in a cluster. Thus, three villages under Tulashideuri Panchayat of the Nagaon district, Assam, Indiawere selected in the first stage. In the second stage, a Rapid Rural Appraisal (RRA) was conducted. Looking into the homogenous characteristics of the households, 40 fish farmers had been selected randomly from the selected villages. The parameters such as the size of the pond, cleanliness of the water surface area of the pond, exposure to sunlight, etc. were considered while selecting the households. The key informant was of great help in selecting the households and eliciting other required information.

**Questionnaire**

The collection of qualitative and quantitative data in the field requires an understanding of the social nuances that exist in a study region. This knowledge is essential in the planning phase around which the semi-structured interview is based (Ellis and Chen, 2013). Following Keeffe*et al.* (2016)and Fallon, (2008), a semi-structured questionnaire was designed and

administered to obtain information from the sample households regarding their socio-economic condition besides assessing their fishing practices. The field survey was conductedbetween December 2020 and May 2021. The questionnaire was administered to collect data regarding householdsthat deal largely with the socio-economic,and demographic information of the respondent's family,data relating to land and other resources of the households, details of human and cattle populations and data to assess the existing fishing practices of the respondents, i.e., size of the pond, years of practising fishery, species rear in their pond, source from where they procure the seed, quality of feed, growth of the fish, etc.

**Method demonstration**

It was realised during the primary survey that the precarious financial condition of the respondents did not allow them to procure quality seed, feed, and, other fishing equipment, etc. It was further understood that they were not exposed to any scientific methodology of fish farming. They were also not able to earn a profit because of constraints of the market, not having a proper harvesting net, etc.The growth of fish, for most of the farmers, was very slow. The analysis of baseline data put much-needed light on the constraints and it was found that hand-holding in the form of providing scientific knowledge and quality inputs could make a huge difference in the field of fish production in these villages and thereby their income. Based on the above primary information, a method demonstration was designedand implemented. The selected farmers were provided critical inputs like seed, feed, fertilizer, nets, etc. including technical demonstration based on the methodology of Das (2006).Water quality analysis, regular monitoring of growth every two months and health checks up were carried out during the demonstration for one year (APHA, 1989).

**Results and Discussion**

Demographic details of the selected 40 fish farmerswere analysed based on the primary survey conducted during the study and presented in Table- 1.

| | |
|---|---|
| Total households | 40 |
| Total population | 212 |
| Total male | 109 |
| Total female | 103 |
| Female-male ratio | 944 |
| Total literate population | 209 |
| Average household size | 5.3 |

**Table 1- Demographic details of beneficiary households**

The total population of the sample households is 212 out of which 51.4 per cent are male and 48.5 per cent are female. Analysis of the demographic dataelicited during the questionnaire survey showed that the average size of the household is 5.3 with a minimum family size of 2 members and a maximum of 13 members. The ratio of females per 1000 males is below the state average of 958 (national average of 944) according to the 2011 census. The occupational pattern of household heads was analysed during the period through a primary survey of the population and presented in Fig. 5. From the analysis it was revealed that 70% of the household heads report agriculture as their primary occupation.Further, 12% of the household heads have retired from government service, and 10 % of the sample heads manage their

livelihood from petty business. The main point that emerged from the survey was that the members of most of the families resort to more than one livelihood activity which is a positive sign in terms of reducing the risk.

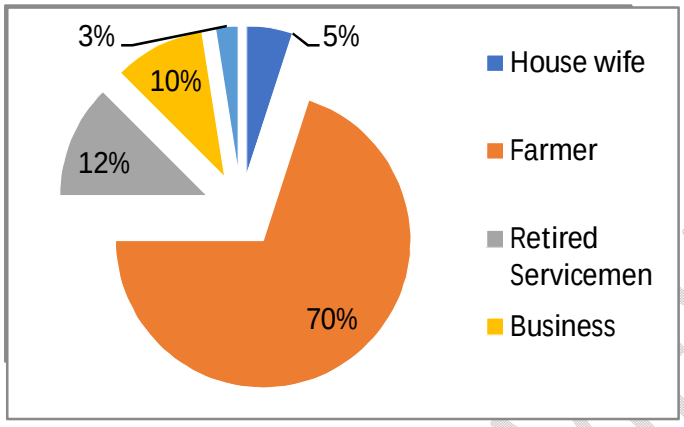



**Fig.5 Occupational pattern of households**

The working population of the selected respondents whoare economically active and express their willingness to work was documented through the primary survey of the study (Table 2). The results indicated that 72 % of the total population of the sample households are workingpopulation, i.e., in the age group of 15 – 65.

| Working population | | Dependent population | | | |
|---|---|---|---|---|---|
| Male (age 15 – 65) | Female (age 15 – 65) | Male (age 1 – 14) | Female (age 1 – 14) | Male (age 65+) | Female (age 65+) |
| 82 | 72 | 19 | 28 | 8 | 3 |

**Table 2 Working and dependent population of the SC villages**

The farmers in the study area have a practice of taking and giving land on lease and therefore, it was pertinent to observe their size of operational holding which determinesthe production of various crops grown. The distribution of the households according to their operational land holding was documented through a primary survey and presented in Table 3.It is evident from the study that the distribution of land holding of the selected SC fish farmersismuch skewed (the range being 0.16 hectares to 7.3 ha). The results showed that 35 per cent of the sample households account for 61.7% of the total operational holdings. On the other hand, 40% of the sample households possess 29.6% of the operational holding whereas 25 %of households possess only 8.5 % of the total operational holding. The average land holding is 2.12 ha highest being 7.3 ha. The analysis of the primary survey also inferred that the entire lands of the sample households were under various agricultural activities. There were no fallow orwastelands as multiple cropping is very much prevalent in the study area. Winter paddy and Bao paddy arethe predominant crops for the sample households followed by mustard. Apart from paddy people also grow a variety of vegetables such as potato, brinjal, lady's finger, bean, bitter gourd, cabbage, cauliflower, peas, etc. *Jika* and *Toroi*produced in this area are very high in demand in the market and thus almost all households grow both these vegetables in ample amounts.

| Category | No of Households | Amount of land (ha) |
|---|---|---|
| Marginal (Below 1 hectare) | 10 | 7.3 |
| Small (1 – 2 hectares) | 16 | 25.16 |
| Medium (2 – 10 hectares) | 14 | 52.48 |
| Average land holding size | 40 | 2.12 |
| Highest land holding size | 40 | 7.3 |
| Smallest land holding size | 40 | 0.16 |

**Table 3 Operational land holding of the sample households**

The land use pattern in the study area is like the following. 75 % of the household land was under agriculture. While the homestead area consists of 15 %, fishery comprises only 6 % of the total land use of the beneficiary (Fig.6).All forty households were practising fishery activities for the last several years. However, some households were relatively new to the fishery activity. 22 households werepractising fishery activities for the last five years only, while 11 households werepractising it for the last 6 to 10 years. The remaining 7 households were practising it for quite a long time, i.e., around 15 to 20 years. Though the households were practising it for quite some time, however, they were lacking in the scientific methodology of fish culture.

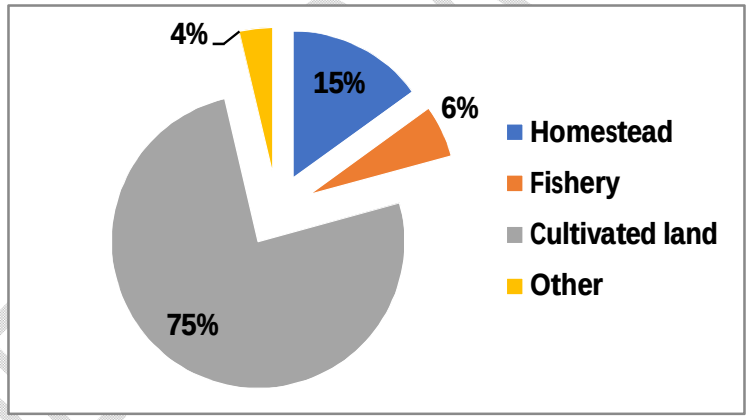



**Fig. 6 Land use of the sample households**

The farmers were provided fish seed @ 10000/ha based on the water spread area available with them, feed @ 1-2 % of the body weight(Godrej generic feed) one dragnet, and dry cow dung @ 3000 kg/ha/year. The evaluation was carried outafter one year among all the beneficiary households to assess the production and productivity,total income, and net profit from the fish stocked byall the households, and the result of the sameis presented in Table 4.

| Name of SC farmers<br><br>(40 nos.) | Amount of land | Type of fish stocked (Fingerling, 8-10 cm) | Initial stocking size in gm for all the fishes separately (species-wise) | Final weight gain in gm for all the fishes separately (species-wise) | Total production in kg/yr. ( round figure) | Total profit in the previous year* (Rs.) | Total income in the studied year (Rs.) | Netprofit in the studied year (Rs.) |
|---|---|---|---|---|---|---|---|---|
| Papu Das | 0.4 ha | Rohu (*Labeorohita*), Catla (*Catlacatla*), Mrigal ( *Cirrhinusmrigala*), Bhangon (*Labeobata*), Grass carp ( *Ctenopharyngodonidella*andKaliajar ( *Labeocalbasu*) | All are around 100 gm | Rohu (600-800gm)<br><br>Catla (1300-1500gm)<br><br>Mrigal (600-700gm)<br><br>Bhangon (150-170 gm)<br><br>Grass carp (1200-1500 gm)<br><br>Kaliajar (400-500 gm) | 686 kg | 20,000 | 102900 | 72030 |
| Jan Das | 1.0 ha | | | | 1653 kg | 24,000 | 247950 | 173565 |
| Maloti Das | 0.4ha | | | | 580 kg | 15,000 | 87000 | 60900 |
| Hongkong Das | 0.5 ha | | | | 760 kg | 33,000 | 114000 | 68400 |
| Krishnamoni Hazarika | 1.0 ha | | | | 1250 kg | 19,000 | 187500 | 93750 |
| Durlav Das | 0.5 ha | | | | 825 kg | 20,000 | 123750 | 74250 |
| Padmakanta Das | 1.0 ha | | | | 1435 kg | 26000 | 215250 | 129150 |
| Narayan Das | 0.4 ha | | | | 625 kg | 22000 | 93750 | 65625 |
| Bimal Das | 2.5 ha | | | | 3000 kg | 100000 | 450000 | 225000 |
| Momi Das | 0.6 ha | | | | 830 kg | 32000 | 124500 | 62250 |
| Rana Das | 0.8 ha | | | | 622kg | 30000 | 93375 | 56025 |
| Debakanta Das | 0.8 ha | | | | 900 kg | 40000 | 135000 | 81000 |
| Ghanakanta Das | 0.4 ha | | | | 640 kg | 36000 | 96000 | 57600 |
| Kamaleswar Das | 0.6 ha | | | | 895kg | 32000 | 134250 | 80550 |
| Ranju Das | 0.3 ha | | | | 250 kg | 10000 | 36750 | 25725 |
| Golap Das | 0.6 ha | | | | 700 kg | 22000 | 105000 | 52500 |
| Lakhikanta Das | 1.0 ha | | | | 1244 kg | 30000 | 186600 | 93300 |
| Jon Das | 0.6 ha | | | | 595 kg | 20000 | 89250 | 53550 |
| Dipamoni Das | 0.5 ha | | | | 600 kg | 14000 | 90000 | 45000 |
| Pitram Das | 0.6 ha | | | | 810 kg | 24000 | 129000 | 64500 |
| Bakul Das | 1.2 ha | | | | 1640 kg | 30000 | 246000 | 123000 |
| Bhola Das | 0.4 ha | | | | 448 kg | 16000 | 67200 | 40320 |
| Sarala Das | 1.4 ha | | | | 1400 kg | 30000 | 210000 | 105000 |
| Someswar Das | 1.2 ha | | | | 1200 kg | 24000 | 180000 | 90000 |
| Debaknta Das | 1.0 ha | | | | 1100 kg | 24000 | 195000 | 97500 |
| Dibyajyoti Das | 1.5 ha | | | | 1360 kg | 28000 | 204000 | 102000 |
| Bakul Das | 1.0 ha | | | | 1124 kg | 18000 | 168600 | 84300 |
| Aniram Das | 0.6 ha | | | | 865 kg | 14000 | 129750 | 64875 |
| Puniram Das | 1.0 ha | | | | 950 kg | 26000 | 142500 | 85500 |
| Dipa Das | 0.4 ha | | | | 360 kg | 14000 | 54000 | 37800 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Anil Das | 1.3 ha | | | | 1440 kg | 24000 | 216000 | 108000 |
| Mamoni Das | 1.1 ha | | | | 1000 kg | 22000 | 150000 | 75000 |
| Kabita Das | 0.8 ha | | | | 750 kg | 20000 | 112500 | 56250 |
| Prahlad Das | 0.6 ha | | | | 1400 kg | 20000 | 105000 | 52500 |
| Suren Das | 1.0 | | | | 1000 kg | 36000 | 150000 | 75000 |
| Sunil Kr Das | 0.4 ha | | | | 400 kg | 16000 | 60000 | 36000 |
| Rumi Hazarika | 0.8 ha | | | | 980 kg | 30000 | 147000 | 73500 |
| Ratikanta Das | 0.6 ha | | | | 900 kg | 36000 | 135000 | 67500 |
| Golap Das | 0.6 ha | | | | 810 kg | 26000 | 121500 | 60750 |
| Prafulla Das | 1.0 ha | | | | 1050 kg | 20,000 | 157500 | 94500 |

**Table 4** Productionand productivity,total income and net profitof the demonstrated scientific fish farming in the selected SC fish farmers

In the present studyRohu, Catla, Mrigal, Bhangon, Grass carp, and Calabasuwereselected as suitable species and stocked in the ponds of the farmers based on the availability of quality seeds in nearby locations and also the demand of the particular fish for human consumption. Based on the growth of the selected fishes recorded during the study, it can be found that the selected species performed well in that climatic conditions and can be considered as candidate fishes for the backyard farming practices of the region. Pond management was done based on the standard protocol of scientific fish farming. The farmers utilized 40-50% of their land available for agriculture in fish farming and sold the fish at @Rs.150/kg in a wholesale market. The productivity obtained from the stock pond was 2000-3000kg/ha. The total cost of production incurred varied from 30-50% due to the land holding size, input management and unforeseen error that occurred during the period of fish farming for the first time in a scientific method. However, the net profit earned by each of the 40 farmers was 2-4 times higher than the previous year. During the study, it was also observed that the fingerling stocked in the farmer'spond registered an encouraging growth in the pond environment as recorded in Table 4. *Catla*registered the maximum growth in that particular environment.

The water quality analysed during the study period was found to be more or less in optimum condition due to proper management of the pond in a regular manner by the respondents following the standard protocol (APHA, 1989). The water quality parameters were ranging from Temperature: 24-35$^{o}$C, DO: 4.5-6 mg/L, p$^{H}$: 6.5-7.5, Total Alkalinity: 140-200mg/L, and Total Hardness: 120-180 mg/L. One of the main causes of low fish production before the intervention was inadequate maintenance of the water quality of the ponds. The pH was acidic, DO was less than 4 mg/L, and Total alkalinity and Total Hardness were less than 80 mg/L which affect the low productivity of the pond as well as feed intake and lower metabolism of the fish. This also impairs the movement of the fish giving more opportunity to the pathogens to attack the fishes creating different fungal, parasitic and bacterial diseases ultimately affecting the total production and income of the farmers. The scientific management carried out by the selected farmers in a routine manner helps them to achieve higher production and income by reducing all the risks.

**Conclusion**

It is of utmost necessity that the vast fishery resources of the state spreading across the villages need to be properly and meaningfully exploitedto contribute significantly to the total fish production of the state. It will help augment the income of the small and marginal farmers in the line of doubling the farmers' income policy of the central government. It is observed from the present study that increased fish production and income may play a pivotal role in ensuring a sustainable livelihood for small and marginal farmers.

The majority of Assamese people love to eat fish which is the prime source of nutritious food for the household. Though they culture fish, they do it in an unscientific and faulty way in terms of stocking more or fewer fish seedlings, application of no lime and fertilizers to maintain water quality, and no surveillance for disease monitoring and control through regular netting, etc. Moreover, lack of capital and critical inputs, knowledge gap, and information asymmetry arefound to be the major constraints the farmers confront. Notwithstanding the above factors, it can be said that there are ample scopes to help farmers convert these traditional and low-yielding ponds into profitable ventures. It needs a simple and efficient hand-holding in terms of inculcating a scientific knowledge base to attain such a goal.



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