LAKES: A CHANNEL FOR SUSTAINING THE LIVELIHOOD OF THE VILLAGERS IN CURTORIM

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BY

Rhea Benedicta Marques

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Goa University

Under the guidance of

Ms. Avina Kavthankar

Assistant Professor in Economics

Goa Business School

GOA UNIVERSITY, GOA – 403206

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DECLARATION

I declare that the present thesis entitled **“** Lakes: A channel for sustaining the livelihood of the villagers in Curtorim” a consolidation of an original work which has been carried out by me under the guidance of Ms. Avina Kavthankar, Assistant Professor in Economics, Goa Business School, and the same has not been submitted to any other university or institution for the award of any other degree, diploma or other such titles.

(Rhea Benedicta Marques)

MA Part II Economics

Goa University

Panaji Goa

CERTIFICATE

This is to certify that Ms. Rhea Benedicta Marques has worked on the thesis entitled “Lakes: A channel for sustaining the livelihood for the villagers in Curtorim” under my supervision and guidance. This thesis being submitted to Goa University, Taleigao Plateau, Goa, for the award of the degree of Masters in Economics is a record of an original work carried out by the candidate herself and has not been submitted for the award of any degree, diploma, a scholarship or fellowship of this or any other university.

Ms. Avina Kavthankar

Assistant Professor in Economics

Goa Business School

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CHAPTER 1: INTRODUCTION

1.1. Introduction

Wetlands are among the world's most fertile and productive ecosystems. Wetlands have a substantial socio-economic and ecological importance in people's lives in many different ways. Wetlands are called 'natural kidneys of the landscape' as they can naturally treat waste water. According to the Ramsar Convention in 1971, wetlands are defined as "areas of marsh, fen, peat land or water, whether natural or artificial, permanent or temporary with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six meters'. Wetlands in India account for 4.7% of the total geographical area. India is a country of tiny wetlands. Almost 80% of the wetlands are small an area below 2.5 hectares. There are many types of wetlands like lakes, swamps, marshes, khazan lands, rivers, etc. Over the years, as Goa experienced climate change there is 49% of vulnerability in this regard, as wetlands play a great role during emergencies and wetlands are just beyond maintaining the purity of water.

Wetlands comprising lentic water bodies are diverse in nature. Lentic water bodies are those which are surrounded by land and have a unique natural property that collects rainwater from the surrounding hills and surface runoff. Goa has an excellent natural rainwater-harvesting structure and water conservation assets mainly lakes, which are a beautiful man-managed ecosystem. Lakescan be both natural well as man-made. Lakes offer not only scenic beauty to a place, but also provide economic value in sustaining the lives of the people. Farming being the major occupation, the fertile alluvial soil of Goa coupled with the warm, tropical climate allows a growing variety of crops. As cultivating paddy requires a huge amount of water, lakes offer irrigation facilities, therefore they are the main feeder for 'Rabi' farming in the post- monsoon season. Lakes are places where fresh water flourishes and different kinds of inland fish live. This allows the people to carry out fishing activities. Apart from these economic benefits, Lakes are said to be the "credal of life" for many terrestrial and aquatic ecosystems. As lakes offer food and shelter to this habitat, many residents, as well as migratory birds, are attracted to the lakes. As a result, lakes play a vital role in maintaining the ecosystem. Everyone should conserveand use these ecological resources efficiently for economic growth.

Lakes are a “storehouse of rainwater” which enables the aquifer to recharge naturally, thereby village wells serve the community with a perennial source of fresh water throughout the year. Lakes also provide climate security during heavy rainfall, lakes act as flood buffers by absorbing excess water in this process they capture sediments on the surface layer of the lake, ensuring higher agricultural productivity for the farmers.

1.2. Objectives

1. To compare and examine the performance of Curtorim village with its neighboring villages (Chandor, Macazana and Raia) in terms of its agricultural practices.

2. To understand if lakes serve as a channel for sustaining the livelihood of the residents of Curtorim village.

1.3. Significance of the study

1. This study will provide an insight in terms of the agricultural performance of Curtorim withits neighboring villages.
2. It will assist in understanding the relationship of lakes in sustaining the livelihood of the villagers of Curtorim.
3. It will serve as a baseline for future research.

1.4. Scope of the study

As lakes provide numerous ecological goods and services, conserving and using these ecological resources sustainably is important for economic growth. To be more specific, we can analyze how the lake ecosystem is converted into monetary values and various benefits received to the local community of Curtorim, as the lake serves numerous provisions such as irrigation for farming activities, practice fishery, and also provide fertile land for cultivating paddy and horticultural crops. This study will assist in understanding the villager’s dependence on the lake ecosystem for their livelihood and also examine the reasons why villagers have moved away from the farming practices even though there are lakes. The study also compares the agricultural productivity taking of Curtorim, with its neighboring villages in Salcete taluka.

1.5. Research Questions

- Do the lakes serve as a channel for sustaining the livelihood of the villagers of Curtorim?
- As the village Curtorim is known as the "Granary of Salcete" is the agricultural productivity better than its neighboring villages?

1.6. Methodology

The present study is based on primary and secondary sources of data. The primary data required for the study has been collected through Google form and the interview method. The information was gathered from villagers of Curtorim who rely on lakes for agriculture and allied activities to sustain their livelihood. Two separate Google forms were created for agriculture and pisciculture. The Random sampling technique was used to collect the data. The total sample size for the primary survey consisted of 120 respondents. Where 100 respondents were the villagers who cultivated paddy during Kharif and Rabi seasons in different parts of Curtorim. This Data has also tried to include the respondents who have moved away from farming activities for various reasons and are engaged in non-farm activities. The remaining 20 respondents were pisciculturists who harvested fish in the major lakes of Curtorim. Data was collected by interviewing the pisciculturist with a scheduled questionnaire. Secondary data has been collected from various reports and websites. ‘Mission Antyodaya Baseline Survey 2020’ is used to understand the village profile and make a comparison of Curtorim, with its neighboring villages in Salcete taluka. The primary and the secondary data were analyzed using descriptive analysis presented with the aid of tables, charts, and graphs. While the study also used narrative writing to portraythe functioning of the lakes.

1.7. Limitation

1. The primary study is confined to a single village in Salcete Taluka with lakes.
2. The study relies on the secondary data provided by the ‘Mission Antyodaya Baseline Survey 2020’.
3. Farmers may not have kept accurate records of a variety of factors, including the quantity and cost of inputs used, as well as money earned. As a result, the information they provide may be incorrect.

4. A detailed and in-depth study was not possible due to time constraints, as the project was time-bound.

1.8. Chapter Layout

Chapter 1: Introduction, objectives, significance, scope of the study, research questions, methodology, and limitations.

Chapter 2: Literature of review

Chapter 3: Socio-Economic aspects of Curtorim

Chapter 4: Data analysis and interpretation

Chapter 5: Finding, conclusion, and suggestions

Chapter 2: LITERATURE OF REVIEW

2.1. Introduction

The literature review discusses the research work carried out on the lake ecosystem providing numerous goods and services to the residents relying on lakes to sustain their livelihood. For this purpose journals and articles written on lakes are being studied.

2.2. Review of related literature

- **Sterner, R et.al (2019),** presented a paper on "Ecosystem services of Earth's largest freshwater lakes". The databases for the information were confined to 21 lakes. The goal of this research is to explain the measurable ecological services provided by a group of the world's greatest lakes. The data was collected using secondary data. The findings of the study indicate that fish were caught for commercial purposes, the lakes were used for power generation and cargo transportation, potable drinking water was extracted from major lakes on an annual basis, and additional water was extracted for agricultural purposes.
- **Dechasa, F et.al (2020),** carried out a study on "Economic value of wetlands services in the Central Rift Valley of Ethiopia". The study aimed to estimate the economic values of wetland services in the study area to examine socioeconomic factors that determine the preferences of households (HHs) for wetland management plans. Data were obtained using the primary method. The results further showed an increase in welfare measures with improved conditions of wetland resources, biodiversity, and water availability. The study suggests, taking rehabilitation and conservation measures to ensure sustainable use and management of wetland resources around this area.
- **Holmlund & Hammer (2004),** presented a paper on "Effects of Fish Stocking on Ecosystem Services: An Overview and Case study Using the Stockholm Archipelago". The major objective has been to analyze this management practice to increase fish catches for local resource users. The data was collected using primary and secondary data. The study found that monitoring and evaluating various fish stocking effects on ecosystem services is highly dependent on ecological and social contexts, such as where,

when, and what species are released, by whom, and which stakeholders use the fish and those ecosystem services the fish generation generates.

- **Gebremedhir & Belliethan (2019),** conducted a study on "Socio-Economic benefits of lake Ecosystem (In case of Lake ziway)". The objective of the study was to magnify the social and economic importance of Lake Ziway for the two major groups called fishermen and small-scale irrigation users to study the socioeconomic importance of the Lake. The data was collected using both primary and secondary methods. The primary data were collected by using a questionnaire, interviews and observation. The secondary source of data was collecting literature reviews, and organization documents. The findings of the study indicated Small Scale Irrigation Users got more amount of production and income than the fisherman.
- **Endebu, M et.al (2015),** carried out a study on '" Fisheries baseline survey describing the status of fisheries in lake zeway". The study aimed to update the Lakes fisheries baseline information such as fisherman's socio-demographic, fishing experience, fishing activities fish composition, and purpose of fishing, which will be used in fisheries management. Data was obtained using Primary & secondary sources of data. The study finds that fishery sustainability of Zeway Lake is reported under threat as changing patterns in fish composition and there is a reduction in total fish catch.
- **Amalu, T & Ajake, A (2018),** presented a paper on "Developing natural lakes for socio-economic development: the case of Nike lake Enugu state, Nigeria". The goal of the study was to investigate the lake's socio-economic influence on the people, as well as the income generated by various economic activities. The primary and secondary method was used to collect data. The study revealed that most of the locals within the study generated more income from economic activities. The study also recommends that efforts should bemade to beautify and improve the lake facilities to meet the expectations of the visitors.

- **Odongkara, k et.al (2005),** carried out a study on "Distribution of Economics Benefits from the fisheries of Lake Victoria". The aim of the study was to determine the primary economic benefits derived from Lake Victoria's fishery. Also, to explain why there is a difference in the distribution of benefits. Data was obtained using Secondary method. The finding of the study showed that the distribution of the lake between Uganda and Tanzania has a direct impact on production values, while cross-border fishing, fish trading, and price changes in the fish industry have an impact on Kenya's output values. The study also revealed discrepancies in benefits at the regional and local levels as a result of unequal distribution of production assets such as capital, limited market access, and other important information and a lack of data for distribution analysis to feed into the policy process.
- **Ozcelik, H et.al (2019)**, presented a paper on "Biodiversity in the lake region (Tukiye) and its agricultural importance". The objective was to study the flora of the natural area in the lake region and their vegetation grown in agricultural area. Data was collected using primary method. The findings of the study showed that Flora is more suitable for agriculture based industry.
- **Fiorella, J et.al (2014),** carried out a study on "Fishing for food? Analyzing links between fishing livelihoods and food security around Lake Victoria, Kenya". The aim of the study was to examine if fishing households ate more fish and had higher food security than non-fishing households around Lake Victoria, Kenya. The data collected for this study was primary method. The study revealed that households that relied on fishing activities did not report increased fish consumption or food security in comparison to non-fishing households. The suggested that for predicting household consumption of high-quality meals, socioeconomic characteristics may be more relevant than participation in food-producing livelihoods.
- **Panagopoulos, Y & Dimitriou, E (2020)**, conducted a study on " A Large-Scale Nature-Based Solution in Agriculture for Sustainable Water Management: The Lake Karla Case." The aim was to study the nature-based solution (NBS) in agriculture, the Karla

lake ecosystem which was dried and is now restored with the purpose to maximize the efficiency of water provision in agriculture and biodiversity enhancement. Data was collected using secondary source. The findings of the study showed that, with Lake Karla the irrigation requirements were fully covered and the effectiveness of the NBS in meeting agricultural water needs was maximized.

- **Julius, E et.al (2021),** presented a paper on "Socio-Economic determinants of net-income in the fish farming in Kainji lake basin, Nigeria."The aim of the study was to find cost and returns of fish farming systems, socio-economic factors of net-farm revenue, and the problems of fish farming in the area. Data was obtained using primary survey. The finding of the study showed that high feed costs, poor price, restricted access to funding, and chronic poaching were the challenges to fish farming, while age, experience, and household size were favorable and key socio-economic characteristics that influenced net-farm revenue
- **Ndetei, R (2006),** carried out a study on "The role of wetlands in the lake ecological functions and sustainable livelihoods in the lake environment: A case study on the cross border Lake-Jipe Kenya/Tanzania". The objective of the study to determine the environmental characteristics of the Lake Jipe-Lumi River and their importance to long-term socio-economic development and specific intervention strategies. Data was collected using Secondary source. The study revealed that lack of integration in planning, natural resource use in the lake catchment and the destruction of lake, resulted in biodiversity loss, increased siltation, and diversion of the feeder River Lumi.
- **Barman, P et.al (2021),** conducted a study on "Revealing of Socio-Economic Sustainable Livelihood importance of Rudrasagar Lake of Tripura, India". The aim was to focus on ecosystem services of Rudrasagar lake for pisciculture and agriculture in terms of socio-economic value to the local people. Primary source was used to collect data. The finding of the study showed that farming is getting more popular, despite the fact that the fishermen's society has no power over agricultural activity and only directly monitors fishing activities. The study also showed that there is a gradual shift in the occupation from fishing to agriculture.

2.3. Research Gap:

From the review of literature it can be noticed that there has been some amount of research done on lakes in India and around the world but there have been no studies undertaken to evaluate the economic benefits of the lakes for sustaining the livelihood at the village level in Goa.

CHAPTER 3: SOCIO-ECONOMIC ASPECTS OF CURTORIM

3.1. Introduction: Curtorim village

The village of Curtorim lies in a scenic landscape with a chain of hills and hillocks, lush green paddy fields and an array of coconut palm trees along the roadside. Curtorim is blessed with numerous natural water bodies such as lakes, springs, backwaters and khazan lands with River Zuari flowing along the village border giving an unique identity to the village.

Curtorim is primarily a rice-farming village and the majority of the villagers rely on agriculture as cultivating rice is a way of living life. Agriculture here is highly dependent on the water received from the lakes which are located at different places of the village. Lakes here represent the centuries-old traditional ecosystem of practicing agro- pisciculture sustainably. Fish farming in lakes is important to the tenants association since it generates a lot of revenue. Lake Ecosystem provides multiple economic benefits to the local community. Lakes serve as a perfect environment for the rich biodiversity for migratory birds, watering holes for cattle to rest, and lake water is utilized for various other needs such as growing kitchen garden and fish farming. With the massive success in producing large-scale agricultural output, Curtorim has earned the title “Saxtticho kuddo’’ means “The Granary of Salcete.”

Originally, the village was known as ‘Kuddtari’. ‘Kudd’ means a place to store grains during Kharif and Rabi season. Earlier these ‘Kudds’ were constructed on the ‘tari’ (banks) of River Zuari and were taken to Shiroda and Panchvaddi. The village of Curtorim is bounded by River Zuari in the north, a village of Sao Jose de Areal in the south, Macazana and Chandor in the east. Raia and Rachol to its northwest.

3.2. Five major lakes of Curtorim

1) Rai-tollem is the largest lake in Curtorim and has a considerable capacity for storing rain water by irrigating the fields of "Vaingonnode addi" for the Rabi crop and also this lake water is impounded into Angdi-tollem during the winter months. The lakes are interconnected right from Rai-tollem to river Zuari, through a proper irrigation system of bunds, sluice gates, and water

regulation has been practiced for centuries thus providing sufficient water requirement for paddy cultivation in both the lakes.

A large number of residents living in the nearby region use the fertile area on the borders of both sides of the lake in the post-monsoon to cultivate kitchen gardens. Vegetables of many varieties are cultivated, including lady finger, sweet corn, bottle gourds, brinjals, snake gourds, chilies, cluster beans pumpkin, and leafy vegetables are widely grown to provide a significant source of income for people. When the lake progressively fills with water during the monsoons, all of the vegetable plants are destroyed and unable to produce until the next season. A sluice gate is constructed in June to conserve water for the next harvest. Young fingerlings are purchased and placed into the lakes for pisciculture when the sluice gate is closed. In April/May, the freshwater fish is harvested and sold at a good price.

In Rai-tollem, two human-like cylindrical pillars are Gongee (female) can be seen horizontally, while Gounli (male) is placed vertically. It is believed that the vertical pillar never entirely gets submerged during the monsoon. According to tradition, the day they are completely covered by water, the village will be flooded and disappeared. People of all religions come to visit the Rai-tollem/lake and pay their tribute to Gongee by placing flowers on the border of the lake. It is strictly forbidden to eat meat, sliced fish, or alcoholic beverages near the lake as there have been instances where picnic-goers have proclaimed unwritten cases where they have met a tragic end at Rai-tollem.

2) Angdi-tollem, also known as "Curtorim Lake," is similar to the temple lake**,** where water management methods for agriculture and pisciculture have been used and practiced by the ancestors of the village, highlighting the age-old aqua-agri engineering system that is still used today. During the Kharif season, rice cultivation is undertaken on the lake's base area whose soil is marshy and very fertile, thus providing an excellent space for cultivating local variety rice.

During monsoons, rainwater gathered from the hill's slopes and surface runoff is insufficient to irrigate the "vaigon" crop of "Sirgem addi" (kherland) in the post-monsoon season. So, the main feeder of fresh water for Angdi tollem is Rai-tollem which is a larger lake located at 2 kilometers

distant. Water is released into one inlet of Angdi-tollem by an underground tunnel from Rai-tollem, which is controlled by a sluice gate. Thus, providing sufficient water to irrigate the rabi crop and excess water in the lake is released into the river Zuari through an irrigational channel as pisciculture becomes an important source of funding for the tenants association during this time as the process of auctioning generates a significant amount of revenue. The lake also offers a well. Before the availability of tap water, residents living near the lake used this well for the purpose of drinking and domestic use during the summer days.

3) Sonbem – Tollem, irrigates the fields of 'Maini addi'. In Goa, Farmers of 'Maini addi' claim to be only ones practicing 'community farming'. Till today, farmers still follow the traditional method of farming. The majority of the cultivation in Curtorim takes place here. All farmers collaborate with each other. The Comunidade has a person in charge of constructing the bundhs, sowing, harvesting paddy, and guarding the fields. He is called as 'Adell'. 120 Gaunkars are working for him, divided into 40 groups, and they all have to follow his orders. The month of August is the busiest month for the 120 members as they have the responsibility of constructing Handi (sluice gate) in the Sonbem-tollem as the rain water had to be conserved for the next crop (rabi). Here, all farmers have to sow the same variety of seeds. After harvesting paddy, it is shared equally with all the 120 Gaunkars that are members of the communidade.

There is a Religious significance attached to this lake that is, the miracle of water conservation is attributed to Handi Khuris (feast of cross hear the sluice Gate) or shetkarancho fest (farmers feast) is celebrated on 20th August annually. It witnesses farmers blocking the channel of the lake to the fields for blessing and once use the Channel is released it will bring a new harvest to the fields. As Handi khuris is believed to grant miracles, on this feast day thousands of devotees gather and Stand in a queue to offer prayers and place flowers on the cross at the sluice gate.

4) Mai – Tollem also known as 'Mothers lake', all farmers of 'Curgonnim addi' prefer to sow seeds on the edge of Mai- tollem lakes during the kharif season since in the monsoons, the rain water washes away the seeds sown in the 'Curgonnim addi' (kherland). Once they are grown at a remarkable size, paddy is transplanted to 'Curgonnim addi' one by one.

Pisciculture in Mai-tollem Lake receives a plentiful catch of freshwater fish in contrast to other lakes of Curtorim. As Curtorim is known for the traditional freshwater fish harvesting. Earlier, the right to harvest the freshwater fish was only with the farmers, but later they began to auction the lake. Auctioning was done only to one person that is a farmer and would have the right to harvest fish in the lake in that year. However, this year, for the first time, a group 57 farmers that are members of the tenants association of 'Curgonnim addi' took the responsibility of community fish farming, instead of auctioning and no outside laborers were hired for it. Each Farmer contributed Rs. 3,000 and contribution was invested in fish farming and total expenditure incurred for fish stocking was Rs. 80,000. Not all of the fish produced were sold in the market during the fish harvesting. A portion of the fish caught was distributed among the farmers who contributed to the fish farming and generated supernormal profits, which were used for the Mai-tollem lake's cultivation and preservation.

5) kum-tollem is the smallest lake in Curtorim located near Mai-tollem. During the monsoon, when the accumulated rain water level rises to a certain level, covering the stone, the sluice gate connecting the two lakes, Mai-tollem lake would deliver fresh water to the kum-tollem to irrigate the fields of 'Murondi Addi'. Hence, 'Kum tollem' is considered to be Mai-tollem's "daughter." Until recently, this lake is left barren and uncultivated only a few activities revolve around this lake and maintaining the lake comes at a considerable cost.

3.3. Agricultural Scenario of Curtorim

The total area of Curtorim is approximately 1735.5 hectares and the area under cultivation holds around 65%. The irrigated land occupies 386 hectares, unirrigated land for 699 hectares and waste land covers around 25 hectares. According to Village Panchayat records, the agricultural land under private holding is about 53% while the land under Comunidade is about 45% with 2% of the land being industrial and institutional. Rice is consumed in such large quantities in the village, that people's activities are mostly dependent on producing grain. Rice is grown in large quantity in curtorim. Most of the area is under cultivation.

Lakes play an important role in irrigating fields and sustaining soil fertility. Cultivation takes place twice a year. Hence, double cropping is prevalent in Curtorim. During the monsoon, the first crop, the 'kharif' crop or locally called 'sorodd,' is grown all over the village during this time

the hinterlands, kherlands and even the base area of Angdi tollem are undertaken for rice cultivation. The sowing season begins in May or June and is harvested in September. The low-lying khazan lands are cultivated in November. The second season is 'Rabi' crop locally known as 'vaingonn' which begins in the month of October and is harvested in April. Crops cultivated during rabi season are irrigated by the rain water collected from neighboring hills and surface runoff stored in the lakes. During the rabi season, crops are irrigated by fresh water stored in several lakes during monsoon from surrounding hills and surface runoff.

3.4. Curtorim's agricultural land classifications

The village of Curtorim is agricultural prosperous and agricultural land is divided into 4 topographical classifications.

1. **High lands** are areas on the slopes of the hills which comprises lateritic soil where water drains easily. High lands are rain-fed and are mostly used to grow various types of kitchen gardens such as lady finger, bottle gourds, brinjals, snake gourds, pumpkin, cucumber, and red and green leafy vegetables are grown at large.

2. **Hinterland** or locally called 'morod' are formed by cutting on the hill side which is locally called 'morod'. The soil in these areas is partly lateritic and alluvium. Hinder land is used to cultivate paddy for khariff (sorodd) crop during the monsoon with the help of rain water as its only source. Earlier, every three years, hinterland were manured with khazans mud-soil, which was believed by the farmers, would increase the productivity of their hinterlands.

3. **Mid-lands/ kher lands**, locally called as 'Addis' are are highly fertile and productive areas of land, having a high water table, found between hinderlands and Khazan lands. Kherlands play a major role in cultivating double-crop during Kharif season and Rabi season, alternating with each other. Every lake in curtorim has a kherland or locally called addis, located on the other side of the 'bandh'. Namely, 'Sirgem addi' at angoditollem, 'Maini addi' at Sonbem Tollem, 'vaingonnode addi' at Ralloi Tollem, 'Curgonnim addi' at Mai-Tollem and 'Murondi Addi' at kum tollem. During Rabi season, crops cultivated in the kherlands are irrigated by fresh water stored in the lakes.

Kherlands owns nearly 75 % of the paddy grown in the village. Apart from cultivating paddy, sweet potatoes, onion, red and green leafy vegetables, and groundnuts are also grown here.

4. **Low-lying areas / khazan lands** are northern side of village bordering the banks of river Zuari. Kkazan has deposited in them the eroded material washed by the rivers, which gives a saline quality and alluvial formation is typically centered in this region. There are six large khazan in curtorim that are at Kottambo, Maina, Nostra khazan, Ponkantor , Novor Khazan, Novkankontor, which are mostly used for pisciculture and cultivation of saline-resistant rice varieties such as xitto and asgo. However, farmers have recently started growing high-yielding paddy crops like jaya with great success.

3.5. Seeds used in agriculture

In the village of Curtorim, the local varieties of seeds sown are korgut in the kherlands, white or red pattni in morod lands, and khazrat and kendall (a local variety of curtorim) are grown at the base area of angodi tollem. The khazan lands are subject to inundation from the river Zuari which produces the asgo and shitto varieties. Now high- yeilding varieties such as joti, jaya, are in great demand. They are grown in huge quantities as they make up 80% percent of all grains produced, and have replaced the local variety of seeds which are grown in few quantities and make up the remaining 20 %. For instance, if the local variety korgut yields 2 to 2.5 tons per hectare, Jaya and Jyoti will yield 4 to 4.5 tons in the same area.

3.6. Techniques for cultivating

Traditional methods such as the bullock, hoe, and plough were employed in the past, but now individuals use tractors to plough as well as harvest the fields. As agriculture is labor-intensive in nature, villagers face a universal problem of unavailability of employers working on the farm but interestingly the number of people taking up farming has increased as a result of increasing awareness and technology. Mechanization reduces the cost. People currently generally employ modern equipment in agricultural operations, such as transplanters. During the time of harvesting,the village local Authority provides harvesters to all the farmers who have cultivated crops during‘kharif’ and ‘rabi’ season.

After harvesting the crop, rice grains are plucked, sorted, threshed, and boiled to separate the skin from the grain before being stored and this technique is normally carried out in metal pots over a wood fire.

3.7. Curtorim's lake system

The Farmers of the village have formed an organization where in every three years, a managing committee is formed, with a President, Vice President, Secretary, General Secretary, and Treasurer who were elected and appointed for each lake by the members among themselves and their election are ratified by the Government. The members of the tenants association are the farmers who cultivate the fields, and there are many meetings for auctioning of the lakes to rear fish, and the maintenance of the sluice gate, field channel, bund restoration by using traditional or eco-friendly techniques local material and other activities and auditing is done every year.

The committee selects a guide (pavnedor) from among the farmers through an auction process depending on the amount determined by the tenants association. Whoever bids the lowest price can undertake the tasks of releasing appropriate amounts of fresh water from the lake to the fields during the rabi season on a regular and correct basis, or he will be penalized if he is found not fulfilling his duties properly.

During the rainy season, when the water level rises, the ‘chok’ regulates the flow of water and is a component of fields. The addi's excess water drains into the ‘chok’. Every lake has ‘Manos’ to control the water if there is excess water in the fields, it is left in the river Zuari, which is constructed as salt water is present. The lake is 1 meter higher than it was when the ancestors planned it, the addi is I meter lower, and the chok is further 1 meter lower than the addi. The three have to work together and than only the system works well. This system is used across all fieldsin Curtorim. The Farmer turns off the water to the farms after 90-100 days. Harvesting the jyoti crop takes roughly 115 days. If water is needed, it can be used for another 5 days. Some farmers double-check everything.

3.8. Pisciculture in Curtorim's Lakes

Though the village largely depends on agriculture farming many of them are part-time pisciculturists and harvest not only rice but also fish. Due to the existence of lakes, Curtorim has a huge potential for inland fishing. The farmers and the Associations store the water for irrigation of the fields and also rear fish. Though Village largely depends on Agricultural practices many of them are part-time pisciculturists. The rights to harvest fish in these lakes are determined by the tenant's association/lake committee.

As the lake water slowly dries off, pisciculture has been given high priority along with agricultural practices in Curtorim, in the five lakes, Initially, Pisciculture practice started at Mai-tollem Lake. However, looking at the aspect of nutritional supplement of the lake and huge income-generating aspects it has widely experimented with for all other lakes at Curtorim. In Rai- tollem, Mai-tollem, and Angdi-tollem, pisciculture involves rearing juvenile fish to a marketable size. Due to the high demand for fresh water fish, they are sold at high prices and generate huge profits. The young fries or fingerlings are procured from 'Keri' and introduced in the lakes. The fishes grown are mostly catfish locally called Gold fish, Tigur, Catla, Rohu, Chonok and Pitol, Tilapa and other fishes. Harvesting the local variety of fish was hampered by the presence of moss in the lake.

The right to harvest different lakes is auctioned by the communidade at the rate of 50 thousand and above. Whoever bides the highest gets an opportunity to conduct pisciculture in that year. The fish harvesting is also practiced between the respective tenants association and the profit is distributed among the members of the association. Thus pisciculture presently becomes an important source of revenue for the tenants association. Originally, during the communidade system, the income earned from pisciculture was used to maintain the sluice gate and bunds in the fields. After communidade system was being replaced by the Tenants Act, pisciculture is taken over by the Tenants Association. Fishing techniques used for Fishing are a small canoe (ponel) and fishing nets (manxeche jale), traditional fishing net is used to catch fish and block the fish at the sluice gates. A Canoe is used for harvesting fish when the level of the water is very high.

3.9. Variety of fish stocked

Seed stocked such Rohu, catla, common carp and other fish are introduced into the lake during the month of September and are harvested in April and May. According to the Directorate of Fisheries, around 6 to 7 lakh is total demand in North and South Goa of the fisherman annually. For thousand fingerlings of Rohu, catla, and common carp are sold at Rs.450 and Rs.10 is the packing charge per bag. One fisherman stocks around 40,000 to 50,000 fingerlings, the survival rate is around 10%, and harvests around an average of 1 to l.5 tones of fish. Income earned by selling fish will be around 1.20 lakh to 1.80 lakh per lake if its area is 1 to 2 hectares. For Big lakes, it is around 5- 6 lakh, if its area is around 2 to 5 hectares.

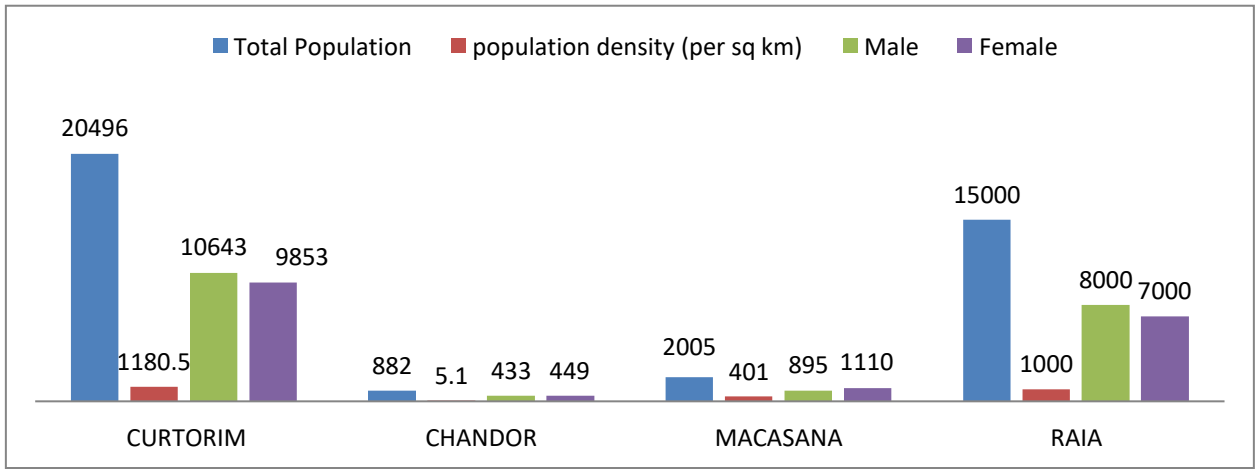
CHAPTER 4: DATA ANALYSIS AND INTERPRETATION

4.1. Curtorim's agricultural performance in contrast to its neighboring villages

According to the secondary source, 'Mission Antyodaya Baseline Survey 2020' which capture the socio-economic profile of Curtorim with its neighboring villages namely, Chandor, Macazana and Raia in Salcete. Mission Antyodaya is a convergence and accountability framework aimed at making the best use and management of resources granted by 27 ministries and departments of the Indian government under various rural development programmers.

4.1.1. Total population, Density and Gender

Chart No. 4.1.1. Total Population, density and Gender



Source: Mission Antyodaya Baseline Survey 2020

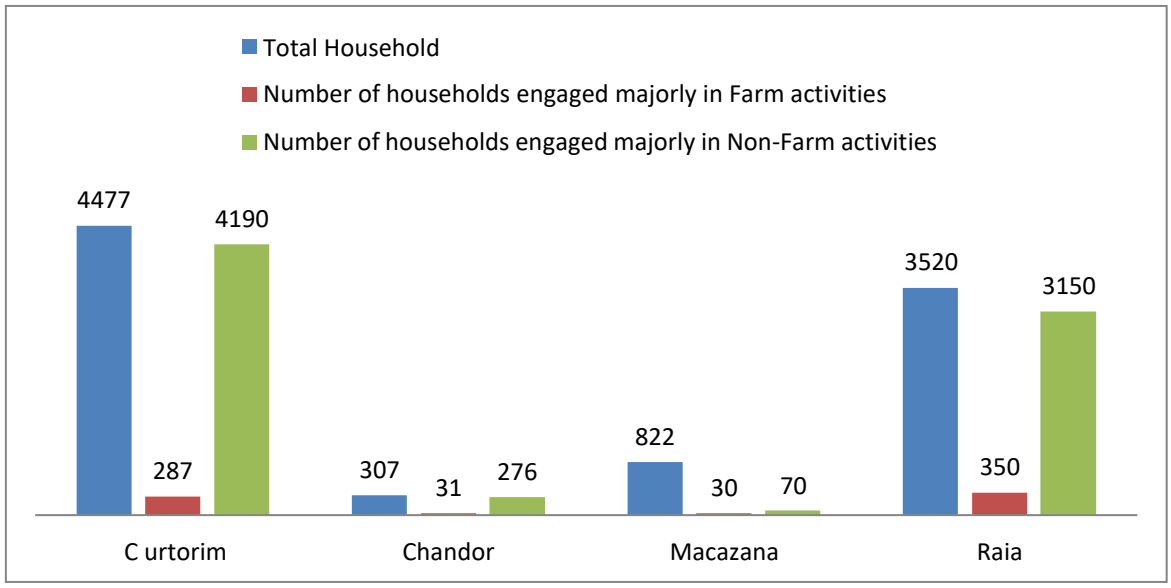
The above graph shows the total population size, density and gender of the villages which are having lakes in Salcete. The results reveal that majority of the population is in Curtorim with 20496 while the village of Raia is the second highest with a total population of 15000. Whereas, we can identify the village of Macasana with a population of 2005 and Chandor has the least population of 882 individuals.

Population density can be used to describe the location, growth, and migration of many individuals in their geographical area. The population density of curtorim is higher with 1180.5 sq km followed by Raia, Macazana and Chandor with 1000 sq km, 401 sq km and 5.1 sq km respectively.

Gender is an important variable given in Indian society. The results of the study also reveal that the village of Curtorim and Raia has the highest proportion of male than female whereas the villages of Chandor and Macazana has the lowest proportion of male than female.

4.1.2. Households engaged in farm and non-farm activities

Chart No. 4.1.2. Households engaged in farm and non-farm activities



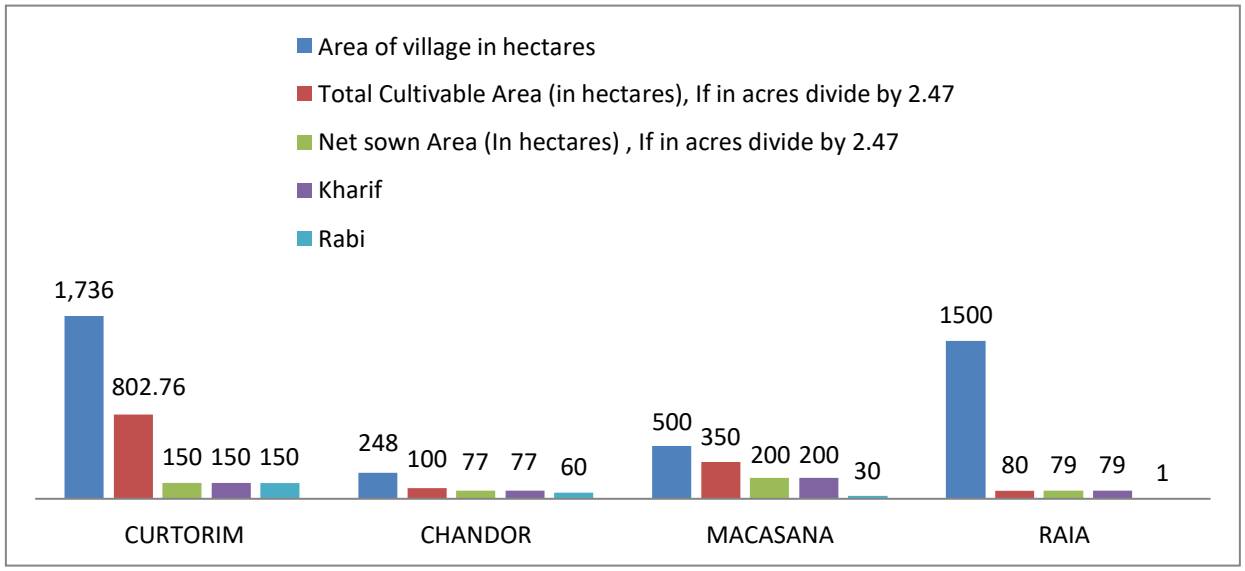
Source: Mission Antyodaya Baseline Survey 2020

The column graph shows the total household, number of households engaged majorly in Farm and non- farm activities of each village with lakes in Salcete taluka. A household can be defined as members of the family who occupy a single housing unit. The above graph indicates, Curtorim comprises the highest number of households of 4477 families. While Raia stands secondhighest consisting of 3520 families followed by the villages of Macasana and Chandor.

Farm activities include agriculture, animal husbandry forestry, and logging and fishing, etc. whereas the non-farm sector includes all other activities like handicrafts, small-scale manufacturing construction, mining, quarrying, repair, transportation, community service. It is been noticed that in all villages majority of the villagers are engaged in non-farm activities.

4.1.3. Total area under cultivation

Chart No. 4.1.3. Total area under cultivation



Source: Mission Antyodaya Baseline Survey 2020

The above graph shows the area of the village, total cultivable area (hectares), divided by 2.47 and the net sown area (hectares), and divided by 2.47 of the villages, which have lakes in Salcete. It can be seen from the data, the village of Curtorim has the highest area in terms of the size of the village with 1,736 hectares followed by Raia, Macasana and Chandor with the area of the village as 1500 hectares, 500 hectares and 248 hectares respectively. Total cultivable area or agricultural land that is worked by ploughing, sowing and harvesting crops. The results reveal that Curtorim village occupies the highest cultivable area (hectares) with 802.76 (hectares) while it's the net sown area (hectares) is only 150 (hectares). Whereas village of Macasana is second highest in terms of cultivable area (hectares) with 350 (hectares) while its net sown area (hectares) is 200 (hectares).followed by Chandor and Raia with a total cultivable area (hectares) of 100 (hectares) while it's net sown area (hectare) is 77 (hectares) and with a total cultivable area (hectares) of 80 (hectares) while it's net sown area (hectare) is 79 (hectares) respectively. Hence, we conclude even though curtorim has the highest cultivable area its net sown area is much lesser while the raia village is been performing better in terms of cultivable area than its net sown area.

Rabi crops are grown toward the end of the monsoon season or at the start of winter. They are also called winter crops. Kharif crops, also known as monsoon crops, are sown at the start of the rainy season. Other crops are food crops, such as fruit and vegetables, groundnuts, etc. The above graph indicates in the study, Macasana village has the majority of the area is undertaken for cultivation during Kharif season that is 200 hectares while the area for cultivation during Rabiseason is only 30 hectares. Whereas curtorim village cultivates the same area of land during Kharif and rabi season which is 150 hectares. The results also indicate chandor village's cultivable area for Kharif crop is 77 hectares which is much higher compared to its area cultivated during the Rabi season which is 60 hectares. While the village of Raia, the total cultivable area during Kharif season is 79 hectares whereas during Rabi season only 1 hectare is undertaken for cultivation. Hence, we can conclude that Macasana village has the majority of the area is undertaken for cultivation during Kharif season and Curtorim village has the majority of the area is undertaken for cultivation during the Rabi season.

4.1.4: Total number of farmers

Table No. 4.1.1. Total number of farmers

Villages of salcete	Total number of farmers
Curtorim	550
Chandor	20
Macazana	55
Raia	350

Source: Mission Antyodaya Baseline Survey 2020

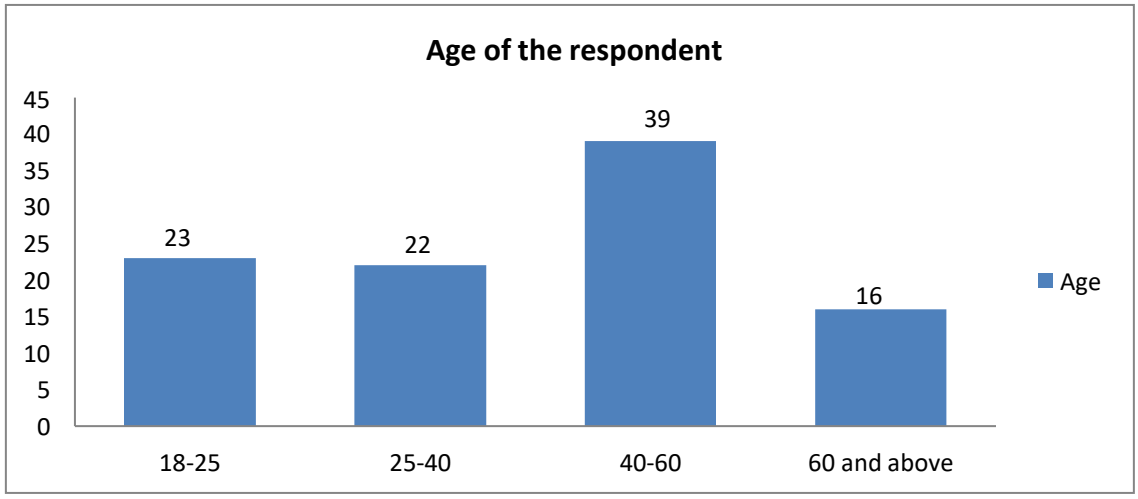
The above table shows the total number of farmers in the villages of Salcete. The results show that majority of the farmers are from Curtorim which accounts for 550 farmers. While there are around 350 farmers in Raia. About 55 farmers are from Macasana and only 20 farmers are from Chandor, according to the data. We can conclude that most of the farmers are from Curtorim as there are various facilities available for agricultural activities such as the presence of the lake, free harvesters, and other subsidies availed by the farmers which motivate the households from the village to practicefarming activity.

4.2. SOCIO-ECONOMIC ACTIVITIES OF CURTORIM VILLAGERS

The socio-economic activities of the respondents are essential in a study since it reveals the respondent's preference for the village activities. The primary survey was conducted which focuses on the twin aspect of lakes in terms of agriculture and pisciculture in providing economic benefits. Thus, offering tremendous scope for harnessing natural resources of lakes for sustainable livelihood management for the villagers in Curtorim.

4.2.1. Age distribution of respondents

Chart No. 4.2.1. Age distribution of respondents

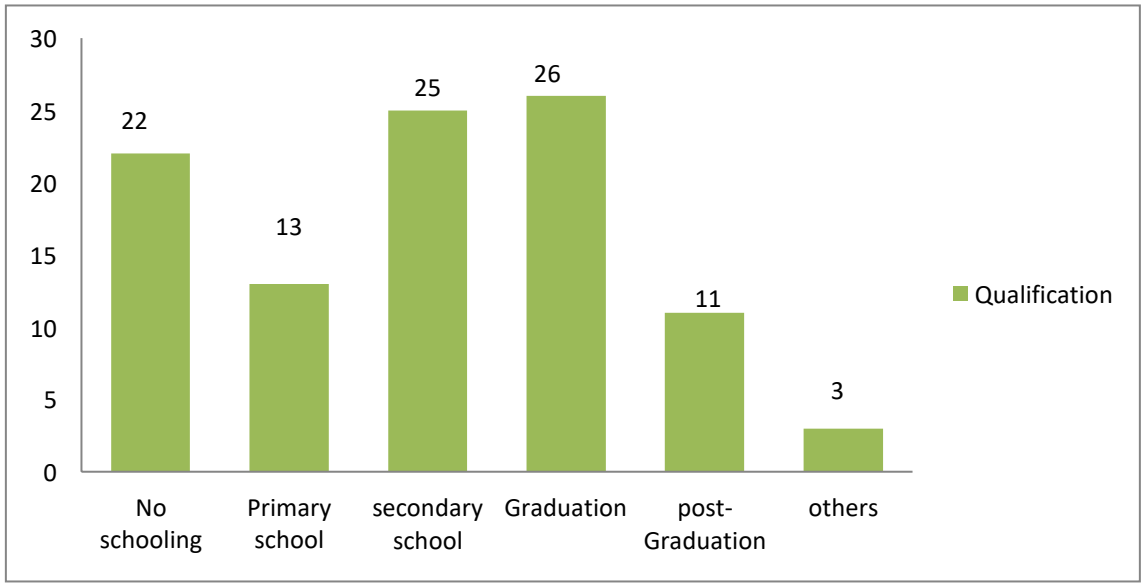


Source: Primary survey

The age of the respondent is one of the most important characteristics in determining the level of maturity of respondents. The above graph depicts the age category of respondents who are engaged in farm and non-farm activities. The results revealed that the majority of the respondent belongs to the age group 40-60 i.e. 39 percent followed by the 18 to 25 age group. The study also revealed that 22 percent and 16 percent of respondents belong to the age category of 25-40 and above 60 years respectively. Therefore, we can conclude that bulks of respondents in the study area are from the working group.

4.2.2. Respondents Qualification level

Chart No. 4.2.2. Respondents Qualification level



Source: Primary survey

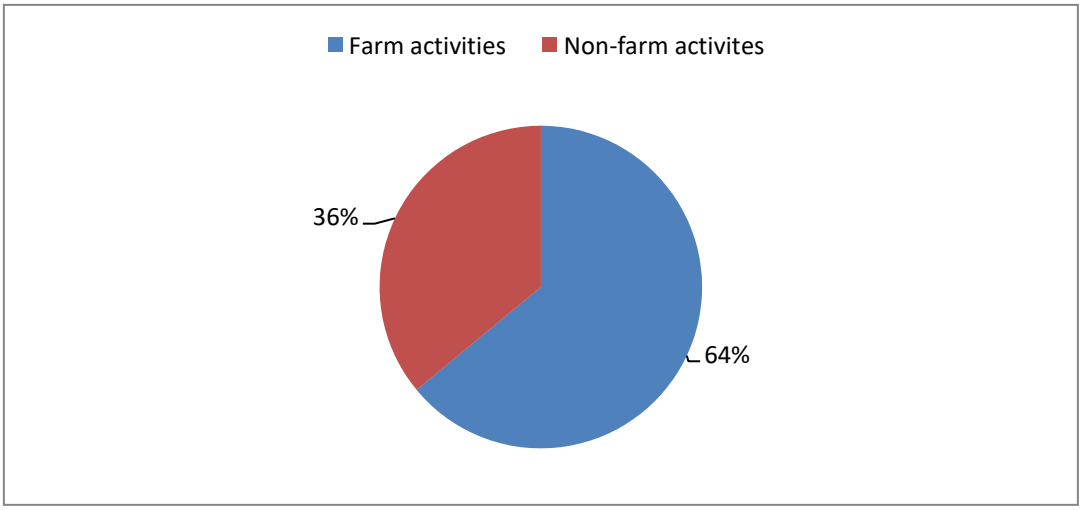
Education is one of the most essential factors that can influence a person's attitude, thought process, and behavior, among other things because an individual's opinion is most likely to be influenced by their educational background, it is necessary to know the respondents' educational status. The above graph shows the distribution of the educational qualification of the respondents of Curtorim. It can be seen from the chart that around 22 percent of respondents didn't attend school at all. This may be due to the poor financial background prevailing in the family. Whereas 13 percent of them, have completed their primary education. The study also reveals that respondents' education qualification for secondary school and post-graduation accounts for 25 percent and 11 percent respectively. The majority of them i.e. 26 percent have completed their graduation and very few that is 3 percent have completed other qualification such as tailoring, electrician, catering, etc.

4.2.3. Monthly income of the respondents

Income provides economic means that shape choices for housing, schooling, child care, food, medical care, and other decisions to carry out day-to-day activities. The majority of respondents earned monthly income from all the sources around 36 percent less than 15 thousand while there were few i.e 13 percent earned monthly income above 70 thousand. Whereas there were 31 percent and 20 percent of respondents earned between 15-30 thousand and 30 to 70 thousand respectively.

4.2.4. Respondents engaged in farm and non-farm activities

Chart No. 4.2.3. Respondents engaged in farm and non-farm activities



Source: Primary survey

The above pie chart shows the number of respondents engaged in farm and non-farm activities. The study reveals that the majority of the respondents that is 64 percent are engaged in farming activities while 36 percent of the respondents preferred non-farm activities to sustain their livelihood.

4.3. Farming activities in Curtorim village

4.3.1. Reasons for choosing farming

Agriculture is the backbone of the economic system as it supplies food to the people. Many villagers continue cultivating paddy as an inheritance practice which holds around 58percent of the respondents and they hope that the younger generation also takes up farming as an occupation and to continue the chain of agricultural sustainability and the term "Granary of Salcete" in Curtorim. Many households are depending on agriculture directly or indirectly for sustaining their livelihood accounting for 23 percent of the respondents. Also, there is 10 percent of the respondents who have a passion and interest in conserving the traditional pattern of agricultural practices prevailing in the village. While 9 percent of the respondents had other reasons for choosing farming it may be due to various facilities available for cultivation such as the presence of lakes hugely helping the farmers to irrigate their crops during the "rabi" season.

4.3.2. Type of Agricultural land utilized to cultivate Paddy

Chart No. 4.3.1.Type of Agricultural land utilized to cultivate Paddy

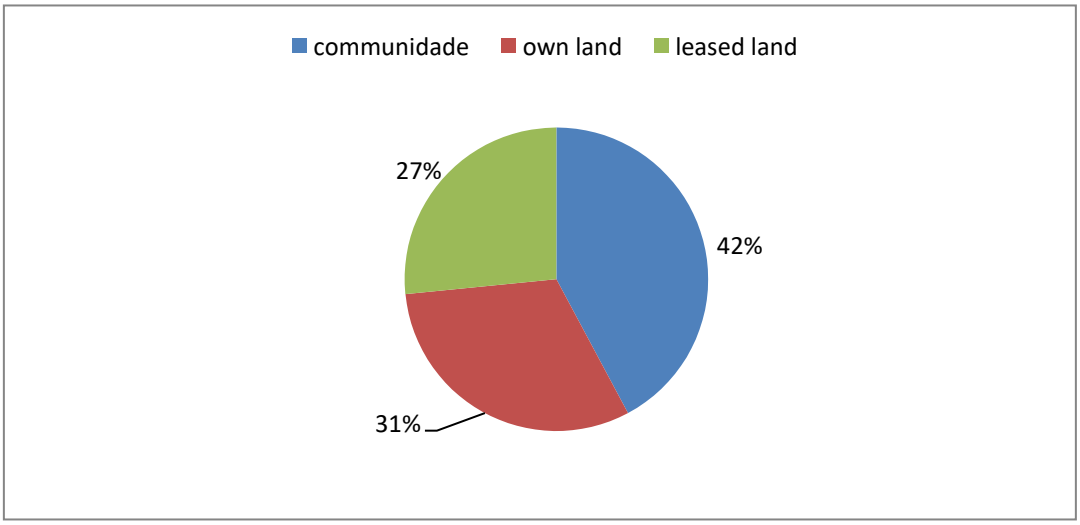
Agricultural land utilized to cultivate Paddy	Respondents
High Zone Upland (Morod)	18
Kher land (Addi)	70
The base area of the lake	12
Low Lying area (Khazan land)	0

Source: Primary survey

From the above table, we can see that majority of the respondents that is 70 percent of the respondents cultivate paddy in the kherland. These are the only place in the village the where two paddy crops are cultivated in the year. While 18 percent of the respondents cultivate paddy in high zone uplands which are cultivated only during the Kharif season with the help of rainwater. Whereas 12 percent of the respondents utilize the base area of the lake as it consists of fertile soil that makes it convenient to cultivate the local variety of seeds in Curtorim. While there are no respondents who cultivate in the low-lying area as there is no scope of using machinery and high cost involved in hiring labors for farming activities.

4.3.3. Distribution based on ownership of land

Chart No. 4.3.1. Distribution based on ownership of land

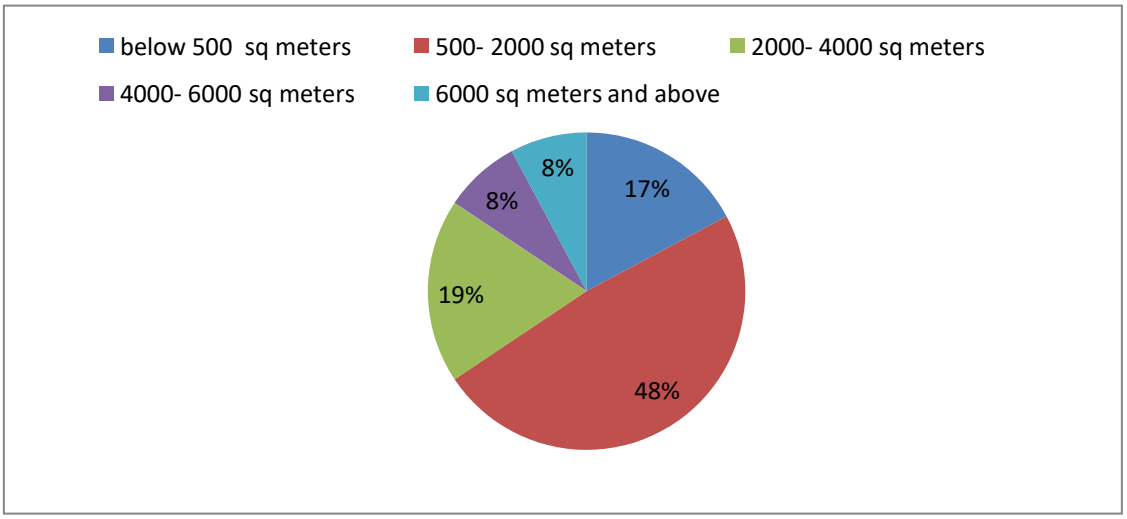


Source: Primary survey

Ownership of land is an important character as it shows us the farmer's status in the agricultural economy of Curtorim. The data from the above pie chart reveals that the majority of the farmers that is 42 percent cultivate rice on the communidade land. While 27 percent of the farmers are cultivating paddyon leased property where farmers have to pay the landowner in cash or in-kind in the form of sharecropping and 31 percent of the farmers cultivate on their own land.

4.3.4. Total area under for rice cultivation

Chart No. 4.3.2. Total area under for rice cultivation

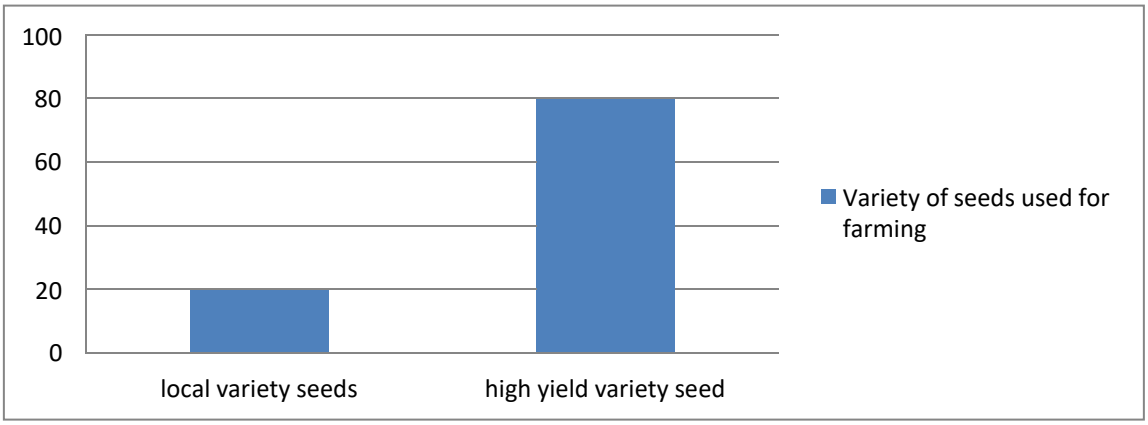


Source: Primary survey

The above pie chart shows the total area undertaken for rice cultivation by each farmer. Majority of the farmers i.e 48 percent farmers cultivated paddy in the area between 500- 2000 sq meters. While 17 percent of the respondent cultivated below 500 sq meters. This group of farmers cultivated mainly for their subsistence consumption. whereas, there was 19 percent of farmers who had an area between 2000- 4000 sq meters. There was 8 percent of the farmers shared the same response for the area of agricultural land undertaken for cultivation between 4000- 6000 sq meters and above 6000 sq meters. This group of respondents mainly cultivated rice for the purpose of selling it in the market.

4.3.5. Variety of seed used for cultivating paddy

Chart No. 4.3.3. Variety of seed used for cultivating paddy

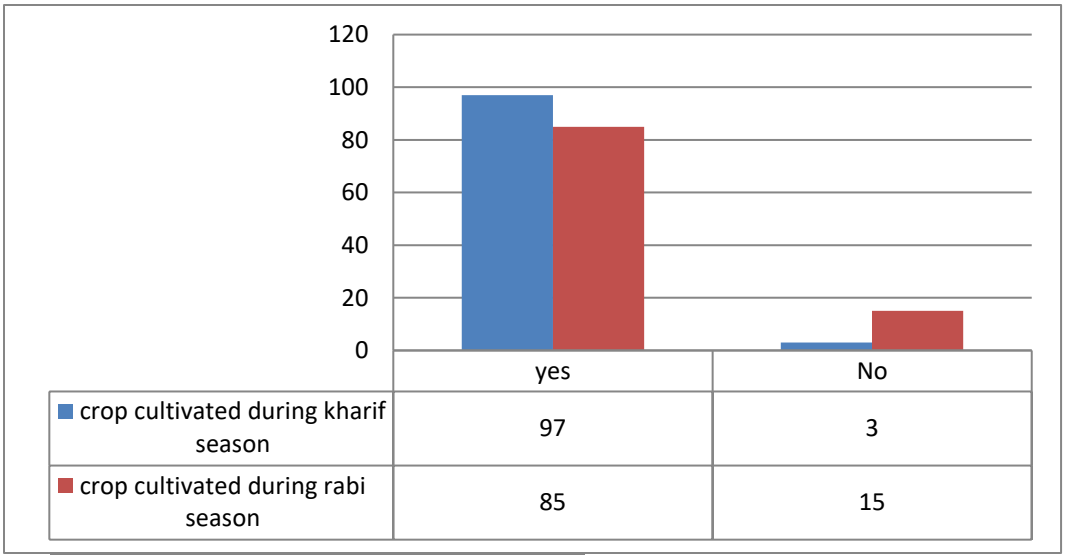


Source: Primary survey

The above column chart represents the variety of seeds used to sow paddy. Majority of respondents i.e 80 percent used high variety seeds as they are resistant to insect and diseases andit provides higher yielding capacity. While there are 20 percent of the respondents who still continue to cultivate crops through the local variety seeds.

4.3.6. Distribution based on cultivating rice during Kharif and Rabi season

Chart No. 4.3.4. Distribution based on cultivating rice during Kharif and Rabi



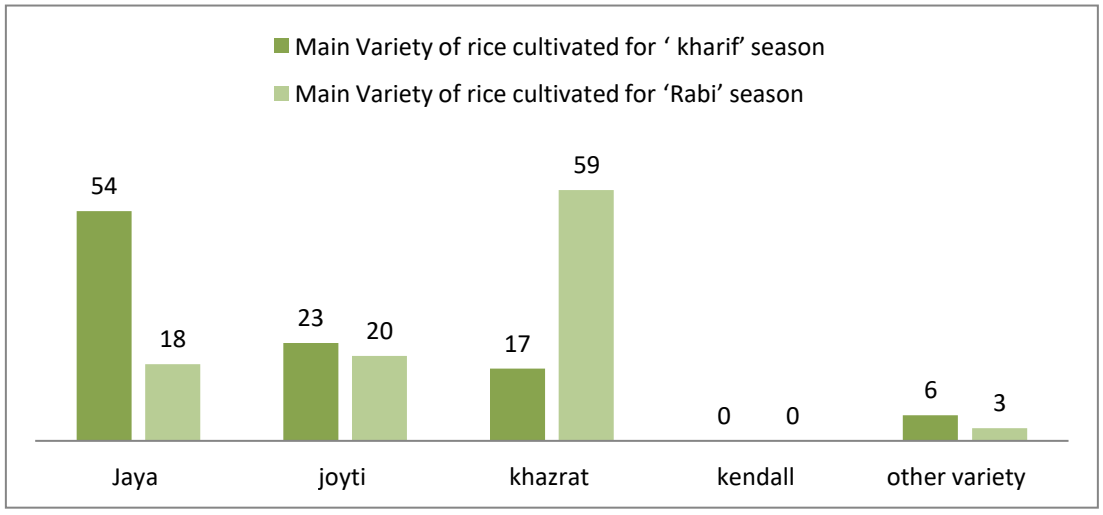
	yes	No
crop cultivated during kharif season	97	3
crop cultivated during rabi season	85	15

Source: Primary survey

Most of the agricultural land is cultivated during the Kharif season which is rain-fed therefore we see a larger proportion of farmers that is 97 percent cultivate crops during the Kharif season while only a few that is 3 percent of the respondents didn't cultivate paddy during Kharif season as they may have encountered various problems such as crop failure due to climatic constraint. Whereas during the rabi season only kherlands are undertaken for cultivation as the lakes provide irrigational facilities to cultivate paddy and double cropping is prevalent and there is about 85 percent of the farmers who cultivate crops in these agricultural land. While there is 15 percent ofthe farmers, didn't cultivate during the rabi season mainly due to the absence of land available for the farmers to cultivate in the kherlands.

4.3.7. Main variety of seeds used for the Kharif and Rabi season

Chart No. 4.3.5. Main variety of seeds used for the Kharif and Rabi season



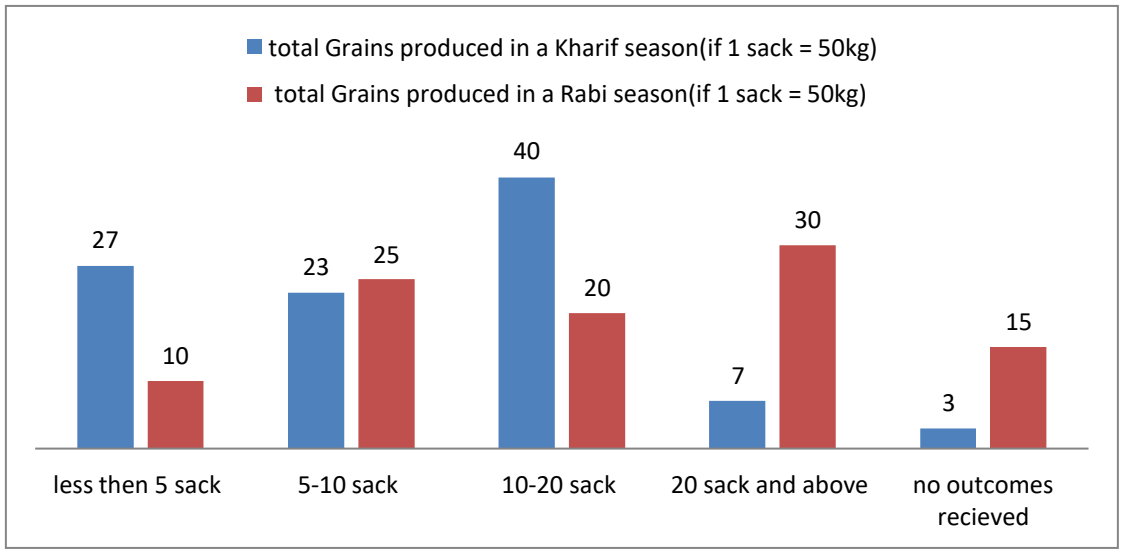
Source: Primary survey

As we can see from the above column chart majority of the farmers during the Kharif season use high variety seeds such as jaya and joyti of 54 and 23 percent farmers respectively. As it requires a huge amount of water but in return, they give a higher yield compared to the local variety. 17 percent of the farmers use khazrat while a few farmers that are 6 percent of them use other varieties such as patni, babri and asgo while there are no farmers in this study who use kendall, which is a local variety of rice of Curtorim.

The study also reveals that during the rabi season, most of the farmers that is 59 percent, grow khazrat, the local variety. 20 percent and 18 percent of the farmers grow jaya and joyti respectively. Whereas only 3 percent of the farmers cultivate other variety of crops and during the rabi season also there are no farmers who undertake cultivation for the kendall variety of seed in the study. This shows the use of the local variety of seed is slowly losing importance and high variety seeds have been a prevalent use among most of the farmers in Curtorim.

4.3.8. Total grains produced during Kharif and Rabi season

Chart No. 4.3.6. Total grains produced during Kharif and Rabi season

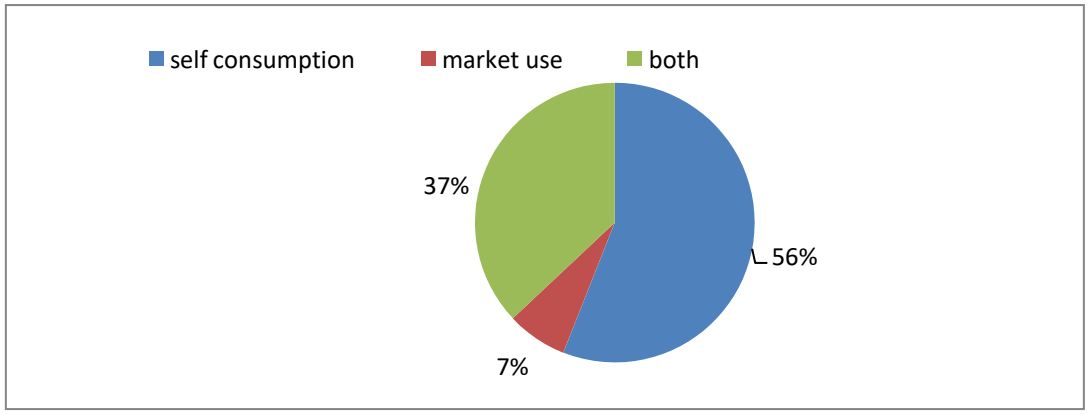


Source: Primary survey

In this column chart, an attempt has been made to examine shows total grains of sack produced in Kharif and Rabi season if 1 sack consists of 50 kg. The majority of the farmers produced 10-20 sacks during the Kharif season while 27 percent of the farmers produced less than 5 sacks. There were 23 percent and 7 percent of the farmers who received outcomes between 5-10 sacks and 20 sacks and above respectively whereas only 3 percent of the respondents didn't receive any outcome as they didn't cultivate any crop during the Kharif season. The results also reveal that, the majority of the farmers during the rabi season produced 20 sacks and above when 1 sack produced was 50 kg.While 25 percent and 20 percent of the farmers produced grains between 5-10 sacks and 10-20 sacks respectively. In the study, there were 15 percent of the farmers who didn't receive any outcome as they didn't cultivate during the rabi season.

4.3.9. Purpose for cultivating crop

Chart No. 4.3.7. Purpose for cultivating crop

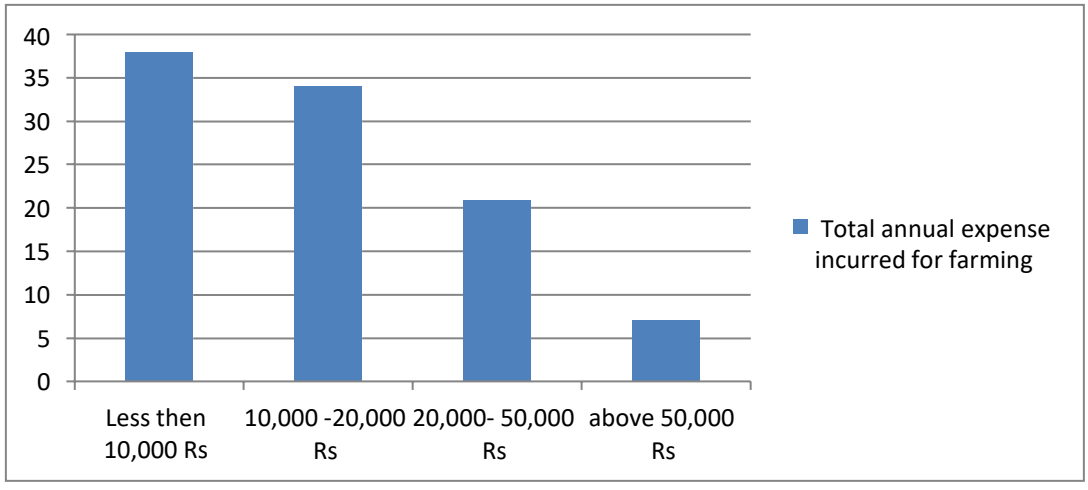


Source: Primary survey

As rice is the staple diet of most of the residents of Curtorim, the majority of the farmers i.e. 56 percent of them cultivate paddy for self-consumption whereas 7 percent of respondents cultivated for market use. Whereas 37 percent of the farmers cultivated crop for self-consumption as well as for market use, in this way they earn income and also sustain their livelihood.

4.3.10. Total expense incurred for cultivating crop per harvest

Chart No. 4.3.8. Total expense incurred for cultivating crop per harvest

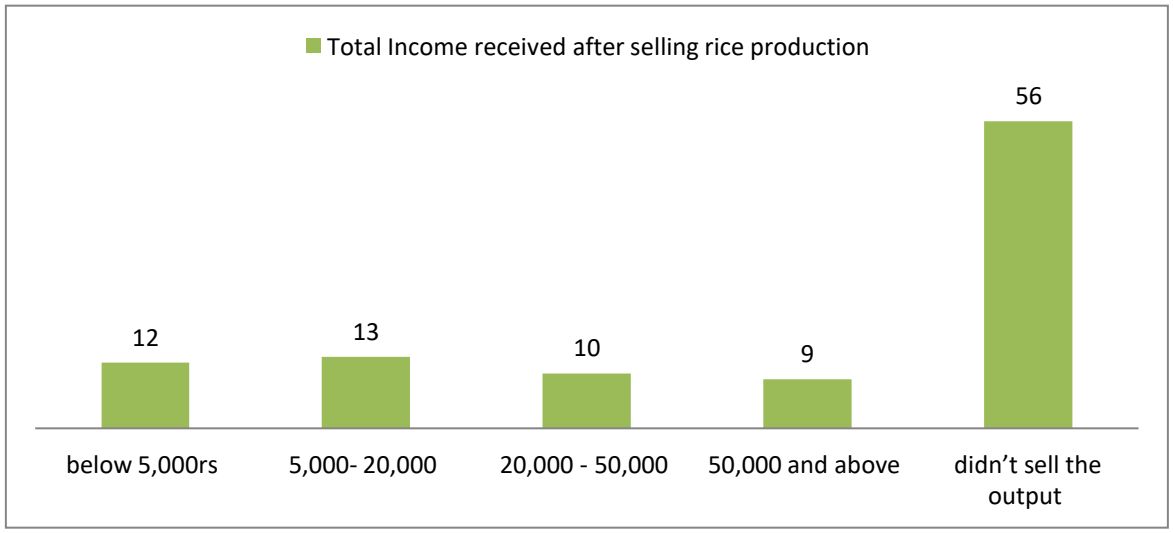


Source: Primary survey

Earlier, “Farming was a community-driven thing”, as families, and neighbors worked together and there was no overhead cost and the concept of a daily-wage labourer didn’t exist. But when family members got educated and started migrating from the village for better economic opportunities, laboures had to be hired for farming. Another cost of production involved in farming includes buying seeds, fertilizers, and the use of rented machinery for ploughing. As farming involves cost, it mainly depends on the area of agricultural land undertaken for cultivation. Majority of the farmers in the study that is 38 percent of them revealed that the total expense incurred for cultivating a crop that is considering all the aspects of farming was less than Rs. 10,000 per harvest. While 34 percent and 25 percent of the farmers responded that the cost involved in farming was between Rs. 10,000-20,000 and Rs. 20,000-50,000 respectively. There were every few farmers whose expense was above Rs. 50,000. These farmers usually cultivate a large area of agricultural land to sell the output in the market.

4.3.11. Total revenue received after selling rice production per harvest

Chart No. 4.3.9.Total revenue received after selling rice production per harvest



Source: Primary survey

Revenue plays an important role in indicating the success of agricultural productivity. People mostly cultivate paddy for self-consumption and excess output is sold in the market. The above chart shows that the majority of the farmers that is 13 percent earned income between Rs.5,000-20,000 while there was 12 percent of the farmers received income below Rs. 5,000. 10 percent

and 9 percent of the farmers earned income between Rs. 20,000-50,000 and Rs.50,000 and above after selling the output of rice in the market. Whereas there was a majority of the farmers thatis 56 percent of farmers who didn't sell their output as and a large amount of rice cultivated is used for self-consumption.

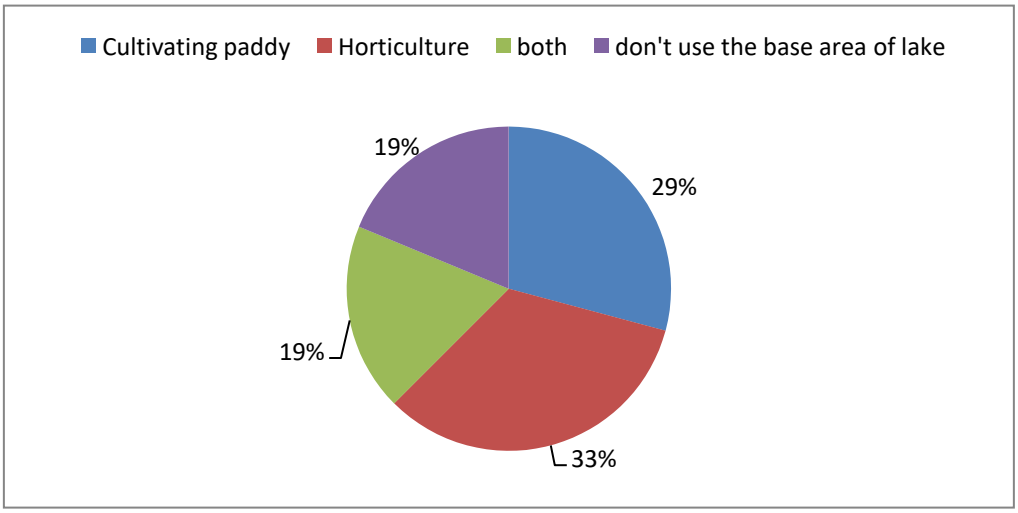
4.3.12. Benefits of lakes

Curtorim is blessed to have numerous lakes having the ability to store sufficient water, which allows the locals to produce a double crop. lakes are said to be the 'life-lines' of curtorim as a majority of the farmers depend on lakes as the main source of irrigating the rabi crop where paddy is cultivated in the low-lying areas surrounding the lake enabling to derive economic and natural benefits Lakes do not only give beauty to a place, but they also serve various benefits. The village is resourcefully abundant and well managed. Ancestors of our village have created an old age fresh water management eco-system highlighting the old aqua-agri-engineering system practiced even today for the major economic primary activities that are agriculture and pisciculture. These lakes are beautiful man-managed rainwater reservoirs.

As crops require a large amount of water, during the rabi season lakes provide perfectirrigation facilities with a sluice gate for regulating the flow of water for the entire agricultural land (kherland) and circulating fresh water through an irrigation channel. The only area in the village where two paddy harvests were cultivated at the same time is the Kherlands. This process leads to maximizing their agricultural output and practicing double-cropping. As the village of Curtorimis also known as the Granary of salcete, the presence of lakes can be attributed to the agricultural production. The extent to which villagers derive massive benefits from lakes can be considered sustainable. The majority of the farmers that is 85 percent of the farmers depend on the lakes, therefore,we see the importance of the lake benefiting the farmers largely for irrigating their fields. Other sources of irrigation available are wells and ponds with 10 percent and 5 percent used respectively by the farmers to irrigate fields.

4.3.13. Distribution based on the utilising the base area of the lake

Chart No. 4.3.10 Distribution based on the utilising the base area of the lake

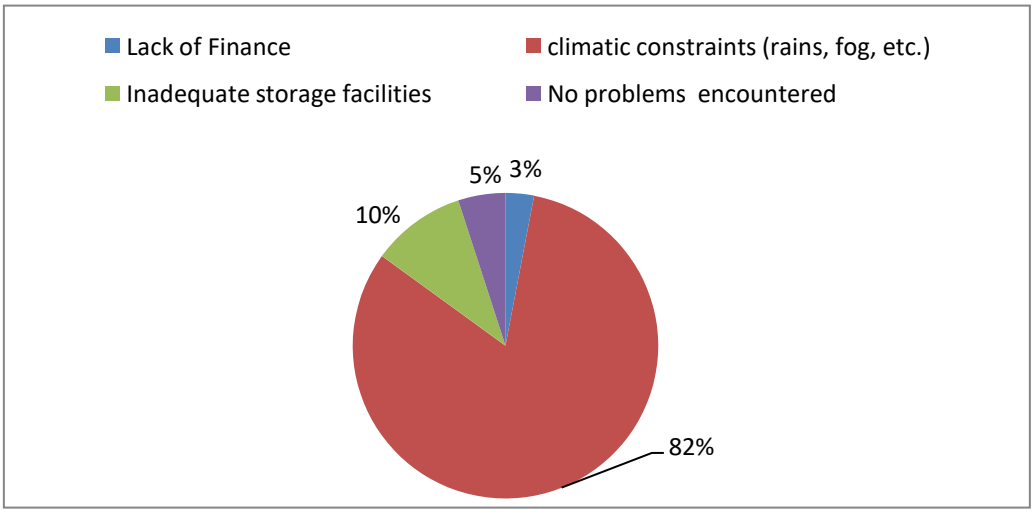


Source: Primary survey

Curtorim's lakes are used for more than only storing water, the lake's base area is also used to grow vegetables. 33 percent of the farmers grow horticulture in Rai-tollem lake in the post-monsoon. whereas during the monsoons, the bottom area of the angdi tollem lake is utilized to cultivate paddy by 29 percent of the farmers in the study. The study also reveals, that 19 of the farmers cultivated both paddy as well as horticulture. While 19 percent of respondents didn't utilize the base of any of the lakes as farmers were cultivating on other agricultural lands available in the village for farming.

4.3.14. Problems encountered during crops cultivation

Chart No. 4.3.11. Problems encountered during crops cultivation

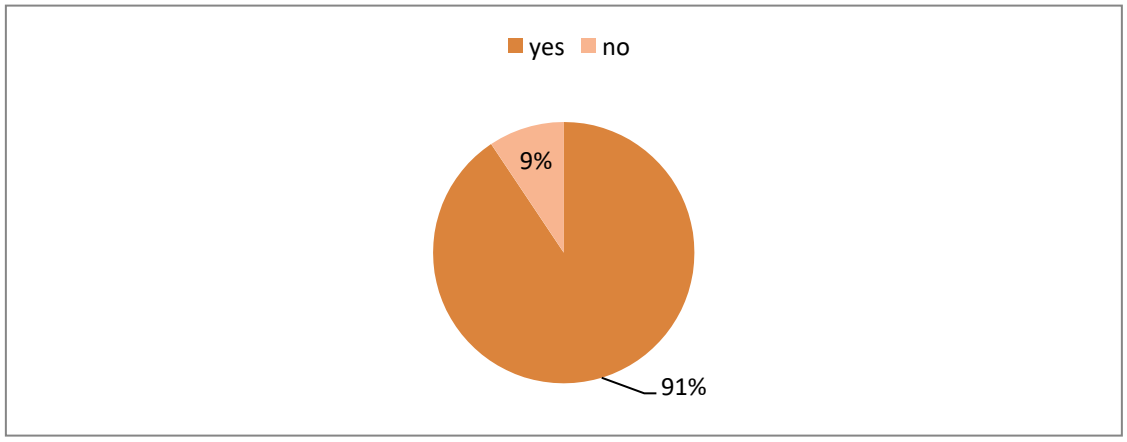


Source: Primary survey

The major reason for low agricultural productivity is the various problems encountered while cultivating paddy. Most of the farmers that is 83 percent of them responded, suffered heavy losses due to the erratic weather conditions such as heavy rains, fog, etc. have been a major problem faced while cultivating paddy. While there were 10 percent farmers didn't have proper storage facilities to store grains. 3 percent of the farmers didn't have enough finance as a result they had to borrow money from friends, relatives, and banks, etc. Whereas 5 percent of the farmers didn't encounter any problem while cultivating paddy.

4.3.15. Loan taken for agricultural purpose

Chart No. 4.3.12. Loan taken for agricultural purpose

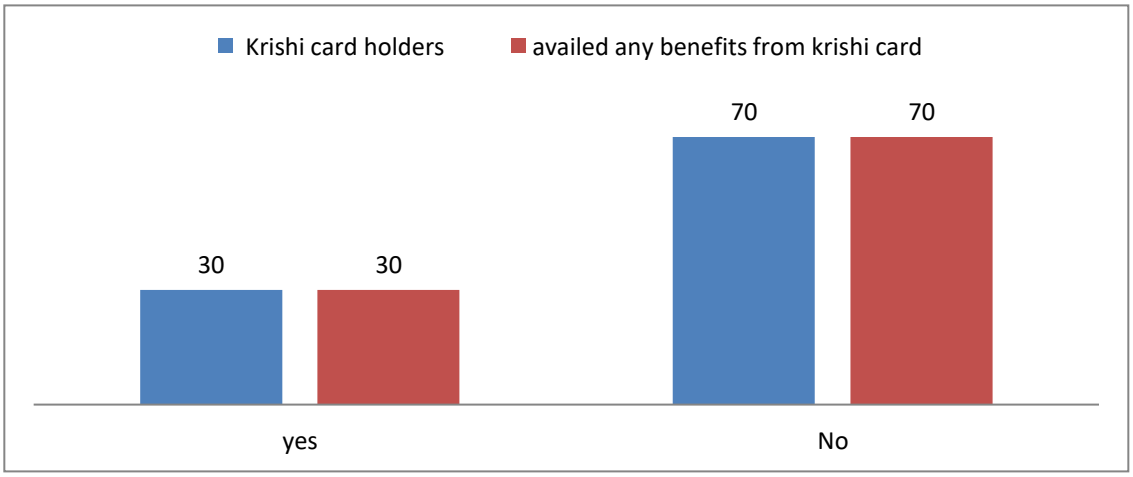


Source: Primary survey

The above pie chart shows the majority of the farmers i.e. 91 percent of them have not taken any loan for cultivation so the farmers used their own money for agricultural purposes. While some farmers 9 percent of them had taken loans for farming activity.

4.3.16. Government schemes

Chart No. 4.3.13. Government schemes



Source: Primary survey

From the above chart, we can see that majority of the farmers that is 70 percent of them don't have a Krishi card and have not availed any benefits as they don't own agricultural land and farmers cultivate either on leased or communidade land for cultivating the crop. While there is 30 percent of the farmers have a Krishi card and have availed of various benefits pertaining to agricultural functioning. Farmers take the loan for an agricultural activity for various reasons, which help them to buy inputs such as fertilizers, seeds, etc.

4.3.17. Type of Allied activities practiced by the farmers

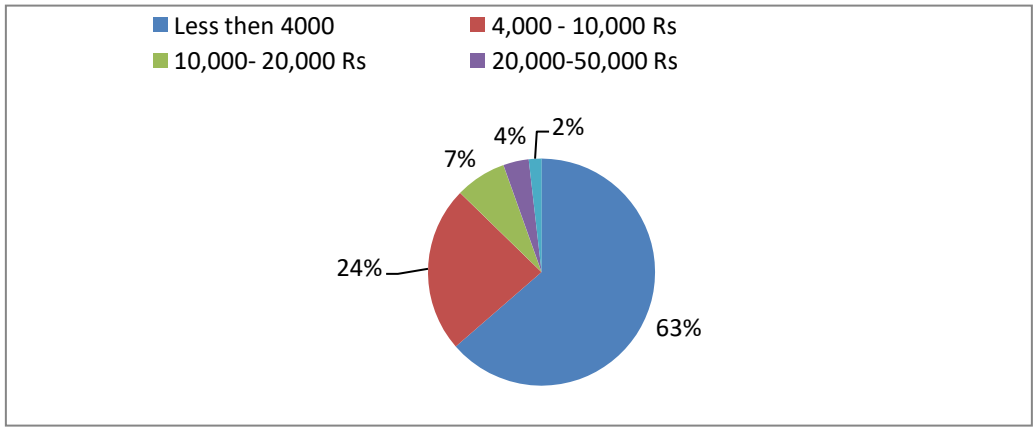
The primary occupation of the villagers is mainly agriculture, farmers are also engaged in allied activities for their sustainable living as it generates additional income for them. The important allied activities practiced in Curtorim by the villagers are horticulture, animal husbandry, fishery and dairy farming, etc. Among these activities, horticulture is majorly being a primary booster for most of them that is 59 percent of the farmers in the entire study.

As the area undertaken for cultivating kitchen garden is increasing day by day and it is highly profitable to the farmers. During the winters, when the water level is low, in the Rai-tollem lake, the fertile soil is apt for growing vegetables. Vegetables such as green chilies, brinjals, cluster beans, cucumber, pumpkin, ridge gourd, bottle gourd, ladyfinger, long beans, and various other pulses like baby corn, sweet corn and other leafy vegetables are highly cultivated due to the growing demand. These vegetables, which are usually sold near the road side have found their place in the market as vendors selling these vegetables are doing speedy business due to their high demand. Early in the morning at around 4.00 am farmers sell the locally produced vegetables aresold to the wholesaler which is highly demanded at the Margao market.

Another allied activity undertaken by the farmers is pisciculture which is another very important economic activity carried out in all the lakes of curtorim that accounts for 13 percent of the farmers and least that is 9 percent of the farmers are practicing animal husbandry in the study. Whereas 21 percent of the respondents are not engaged in any allied activities besides agriculture.

4.3.18. Total annual expense incurred for allied activity

Chart No. 4.3.14.Total annual expense incurred for allied activity

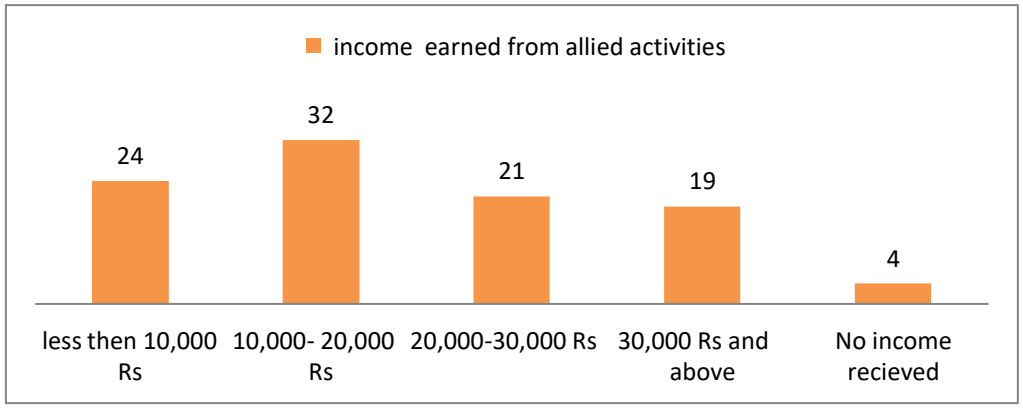


Source: Primary survey

The above table shows the total annual expenditure incurred on allied activities. Majority of the farmers i.e. 63% incurred total expenditure below Rs. 4000 followed by 24 percent of respondents whose expense from all sources was between Rs. 4,000-10,000. The study also reveals that 7 percent and 4 percent of the farmers spent Rs. 10,000-20,000 and Rs.20,000-50,000 respectively.While there were few farmers i.e 2 percent total expense incurred on allied activities is above Rs.50,000.

4.3.19. Revenue received from allied activities

Chart No. 4.3.15. Revenue received from allied activities



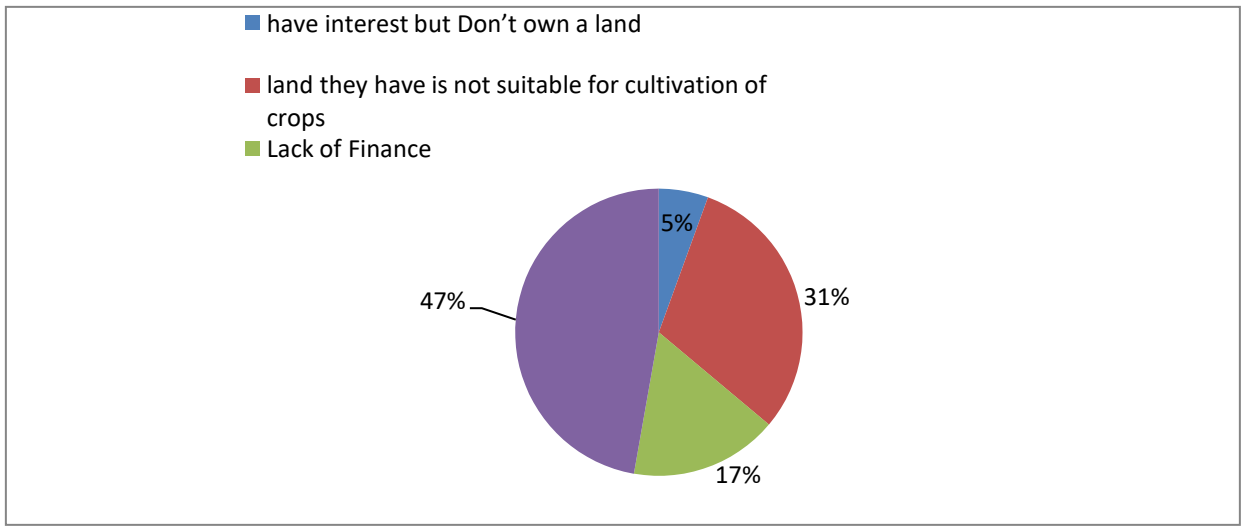
Source: Primary survey

From the above column chart, we notice that majority of the farmers that is 32 percent in the study earned income between the range of Rs.10,000 -20,000 while there was 24 percent of the farmers received revenue less than Rs.10,000. The study also reveals that 21 percent and 19 percent of the farmers earned income between Rs.20,000-30,000 and Rs. 30,000 and above. There were 4 percent of the respondents who didn't receive any income as they have been engaged in allied activities for self-consumption. As a result, allied activities like fisheries, horticulture, and animal husbandry have become more significant determinants of overall growth in the village where the farmer has a stable source of income.

4.4. Non-farming activities in Curtorim village

4.4.1. Reasons for not engaged in Agriculture

Chart No. 4.4.1. Reasons for not engaged in Agriculture



Source: Primary survey

As years have passed by there has been a gradual shift from primary occupation to other "white collar" jobs. The above pie chart shows the reason for not engaging in agricultural and related activities. The study found that around 47 percent of the respondents prefer non- farm activities whereas 5 percent of the respondents had an interest in cultivating a crop but they own land. While 32 percent of the respondents had agricultural land but it was not suitable to cultivate for various reasons such as the soil is not fertile enough which leads to crop failure. 17 percent of the respondents didn't engage in farming activity as they didn't have enough finance

required for cultivating.

4.4.2. Sector-wise preference for non-farm activities

Table No. 4.4.1. Sector-wise preference for non-farm activities

Sector-wise distribution	Respondents
Service	56
Industry	19
Not specified	25

Source: Primary survey

The table shows the sector-wise distribution of the respondents engaged in non- farm activities for a better standard of living. 19 percent of the respondents are working in industries who prefer farm activities while a majority of the respondents that is 56 percent are engaged in services suchas a nurse, teachers, housekeeping, etc. Whereas 25 percent of respondents' activities were not specified in the list. Therefore, they are house-makers, students, and unemployed individuals inthe study.

4.5. Pisciculture

Pisciculture is the artificial breeding, raising, and transplantation of fish through commercial fish breeding in the lake. Fishing is a very important economic activity in Curtorim. The majority of the villagers engaged in fish farming are as a side activity and they have improved their socioeconomic status through pisciculture. Freshwater fish farming offers livelihood opportunities. Pisciculture is given more importance in the pre-monsoon as the lake steadily dries off, as it yields a considerable amount of money.

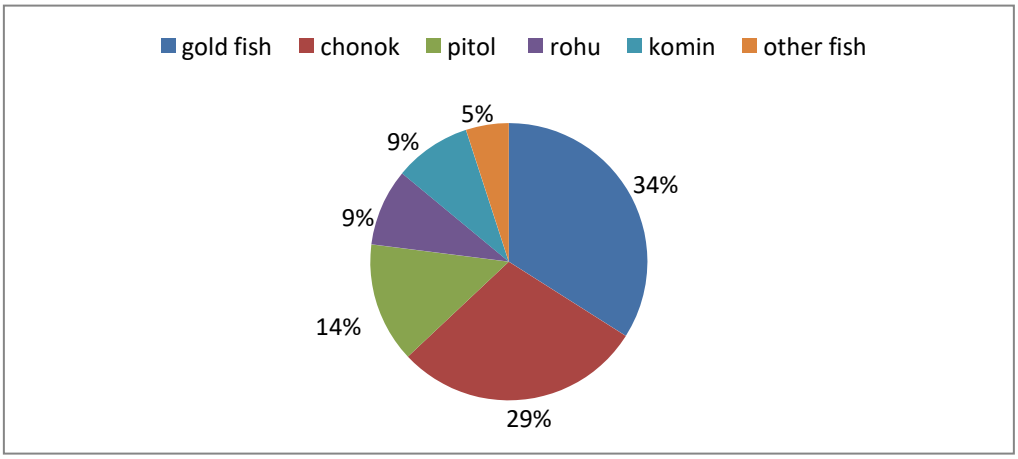
4.5.1. Lake auction

The right to harvest fish in the different lakes of Curtorim is auctioned by the lake committee. Most of the lakes are auctioned to the farmer of the tenants association while a few lakes are auctioned to the resident of the village and none of the lakes were auctioned to anyone outside the village. The lakes were auctioned at the rate of Rs.50,000 and above. The Rai-tollem and Angdi tollem lake were auctioned for above 3 lakhs. While the rate which sobnem tollem was auctioned was below 1 lakh. In the Mai-tollem lake, there was no bidding., instead of the farmers of 'curgonnim addi' took the initiative to practice fish farming among the members of the association by each member contributing money to the expense of fish farming in the lake because they believed it would benefit them individually in a huge way and the profit could be distributed and everyone would earn money.

Therefore, auctioning a lake is important but the lake committee must decide whether to auction the lake or harvest fish among the association's members. In either case, it generates a large amount of money for the lake committee, which is then used for various lake functions in the reconstruction of bundh, sluice gate, and other maintenance in the fields.

4.5.2 The demand for fish

Chart No. 4.5.1. The demand for fish

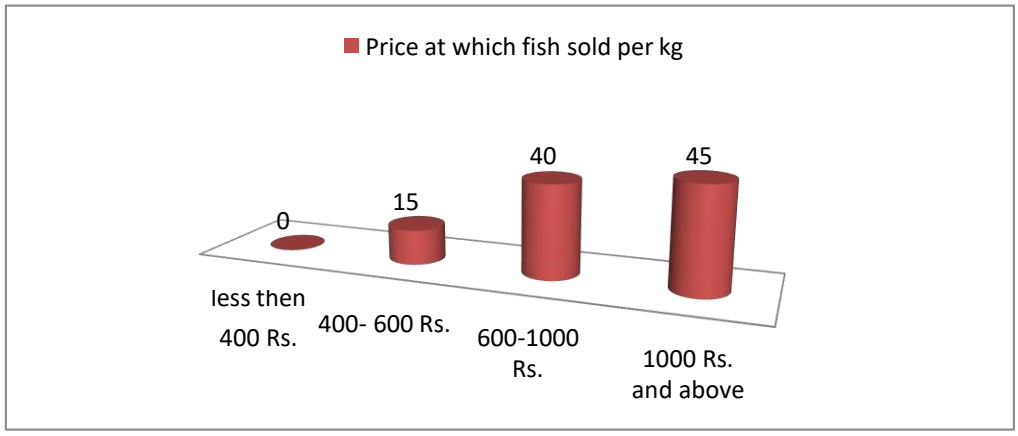


Source: Primary survey

Earlier the village lakes were stocked with wild fish seeds collected from riverside waters. Then later when the new techniques were adopted to provide quality fish seed by induced breeding of fish, it has provided better quality fish and sustainable income for the pisciculturist. The pie chart shows goldfish has the highest demand with 34 percent. While chonak holds 29 percent of the total demand of fish production. Whereas the demand for pitol accounts for 14 percent and rohu and comin were also in demand for 9 percent of the total fish production. A very few that is5 percent had demand for other fish such as tigur and kalu. The study shows that most of the freshwater fish were in demand but goldfish had the highest demand.

4.5.3 Price of fish sold per kg (highest demand fish)

Chart No. 4.5.2. Price of fish sold per kg (highest demand fish)

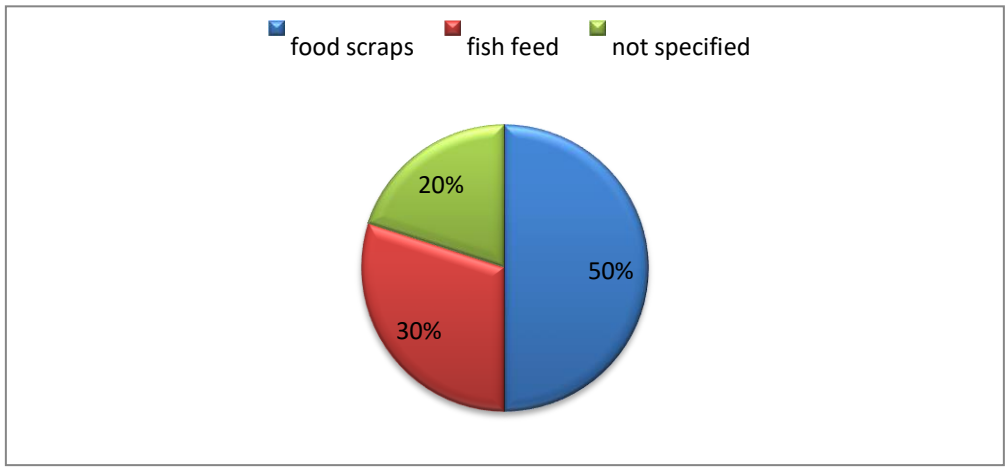


Source: Primary survey

While overall if we look at the price of the fish sold in kgs, we find that the fish which had the highest demand was sold at the rate of above Rs. 1,000 per kg shows huge market demand which is comparatively greater than the production rate. While in some lakes the price of the same fish was Rs. 600-1000. Only 15 percent of the respondents sold at the rate of Rs.400- 600 Per kg. None of the fish which had the highest demand was sold at the rate of less than Rs.400.

4.5.4. Source of feeding fish

Chart No. 4.5.3. Source of feeding fish

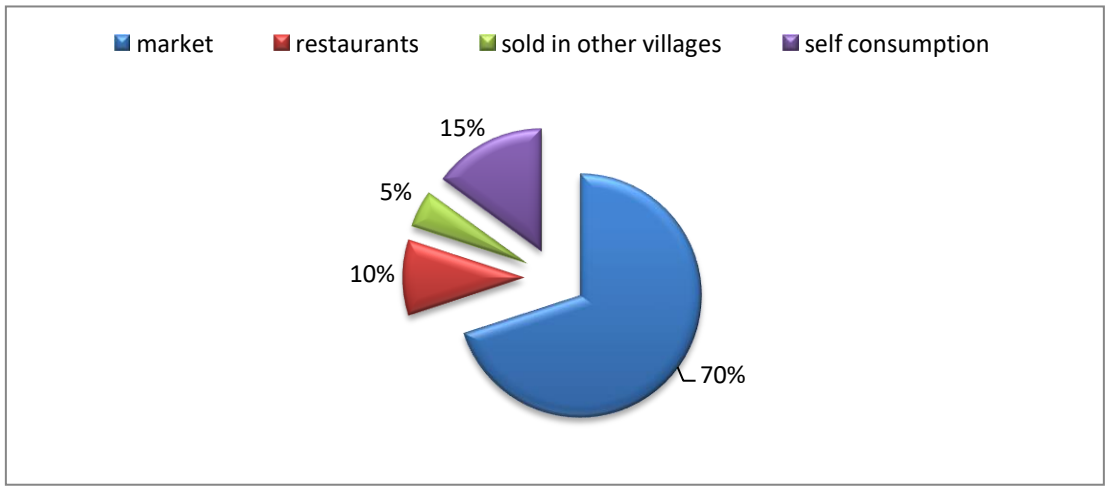


Source: Primary survey

The pie chart reveals that for commercial breeding of fish, the main source of feeding fish is food scraps which accounts for 50 percent in the study. While 30 percent of the respondents preferred to offer fish feed as it is important to increase fish production. Fish food is essential for the fish's survival. While 20 percent of the respondent didn't specify. This means they give other sources of feeding fish as natural available food (moss) so there is no need of using any source of feeding fish.

4.5.5. Destination of fish produced

Chart No. 4.5.4. Destination of fish produced



Source: Primary survey

The pie shows the destination where the pisciculturist sells harvested fish. When there are lots of freshwater fish accessible and a good fish harvest, the results show that just 5% of the pisciculturists sell fish in the other village. While 15 of the pisciculturist keep some fish for self-consumption from the share received after harvesting. Whereas the majority of the pisciculturist that is, 70 percent prefer to sell in the market and the rest 10 percent sell fish at the restaurant where they earn a good price for the high demand fish.

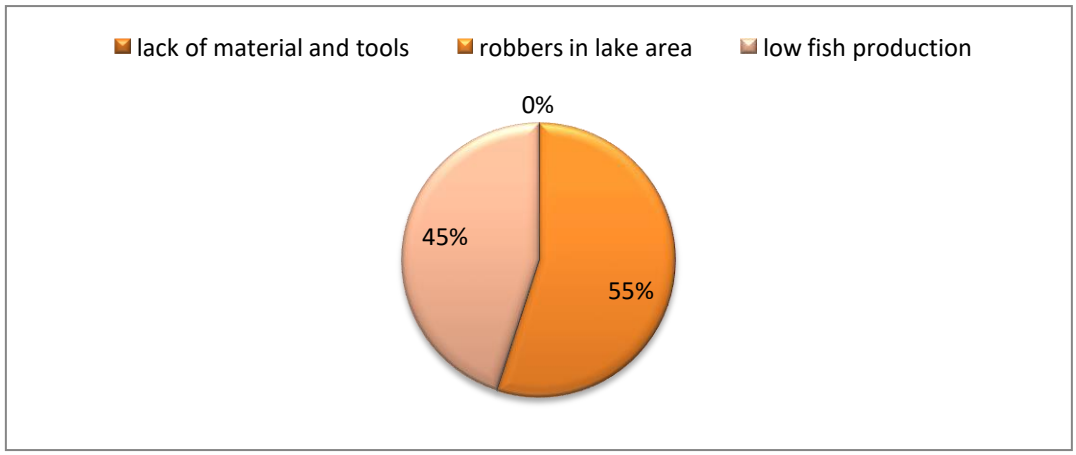
4.5.6. Total profits generated through fish farming

Fish farming is profitable because it produces large quantities of fish, allowing farmers to make a steady income by raising various types of fish in great demand. A lake is an excellent place for fish breeding, with local varieties of fish seeds stocked in July and August.

Most of the pisciculturists in the study who harvested fish in the lake earned a profit below 2 lakhs per harvest while few of them earned above 5 lakhs. When there is a massive fish output produced, pisciculture proves to be a more profitable business. The profit in fish farming was found relatively higher in the study area.

4.5.7. Major Problem encountered

Chart No. 4.5.5. Major Problem encountered

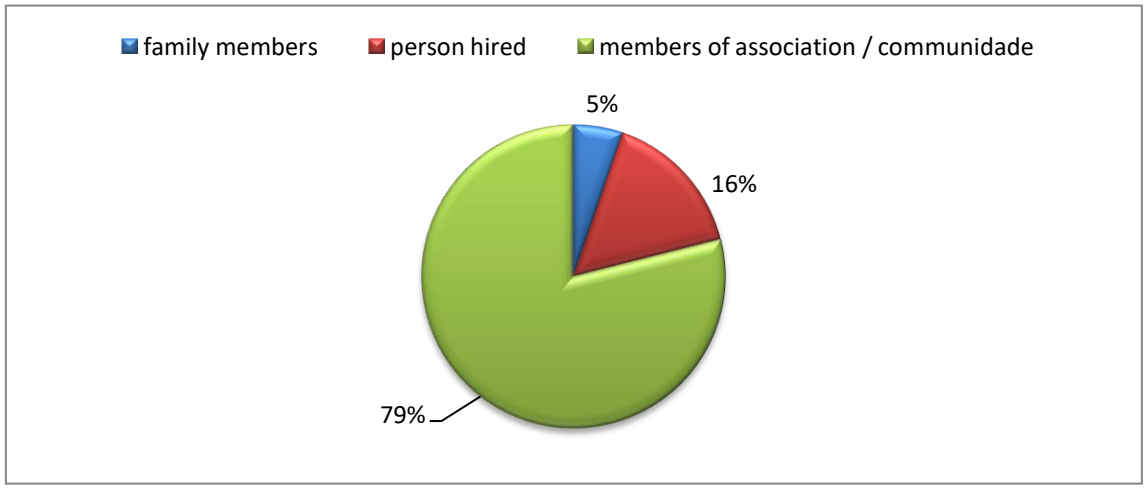


Source: Primary survey

As can be seen, the above graph shows the major problems encountered by the pisciculturist. The majority of the respondents faced the problem of robbers in the lake area which accounts for 55 percent. In the lake, the bigger fish eats the smaller fish hence resulting in low fish production. Which holds 45 percent. None of the respondents lacked material and tools so the pisculturist had sufficient material and equipment for fishing. While in the lake there were big fish that would eat the small fish as a result their survival rate of the fish production would reduce.

4.5.8. People involved in fish harvesting

Chart No. 4.5.6. People involved in fish harvesting

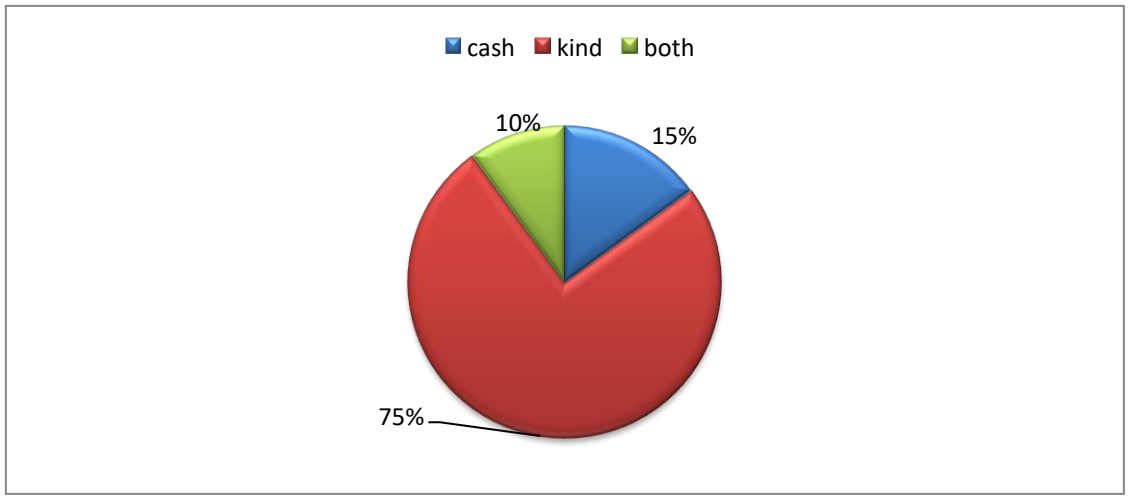


Source: Primary survey

The above pie chart shows People involved in fish harvesting. The results show, that 79 percent involved in fish farming are members of the association while 16 percent responded, that they are hired laborers and only 5 percent replied, that family members were involved in fish harvesting.

4.5.9. Procedure for paying hired laborers

Chart No. 4.5.7. Procedure for paying hired laborers

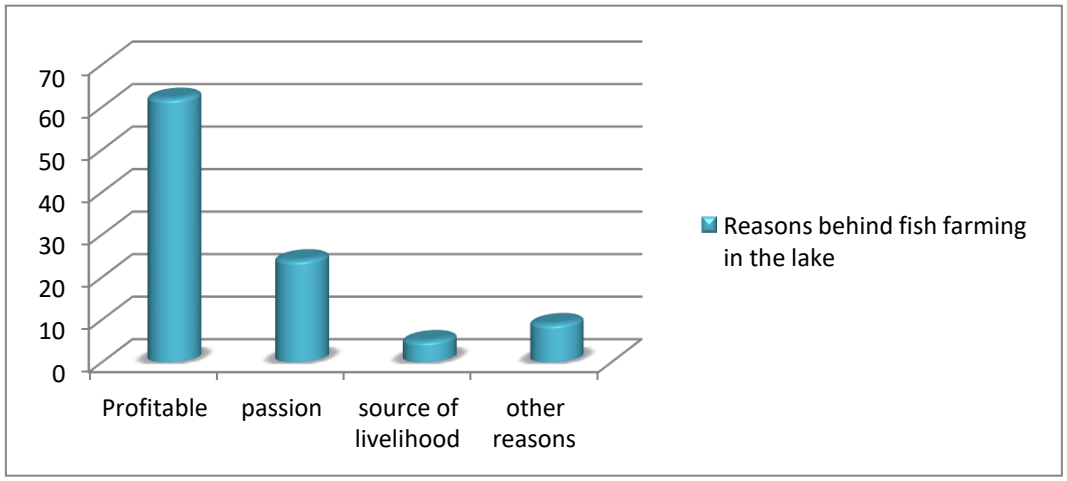


Source: Primary survey

It can be seen from the pie chart, the procedure for paying hired labourers and the members of the tenants association. The results of the pie chart reveal that 10 percent of the pisci-culturist pay the labourers and the members of the tenants association in cash while a majority of the pisciculturist paid in the form of a kind. On the other hand, 10 percent of the pisci-culturist, paid in form of cash as well as in kind.

4.5.10. Reasons for opting pisciculture

Chart No. 4.5.8. Reasons for opting pisciculture

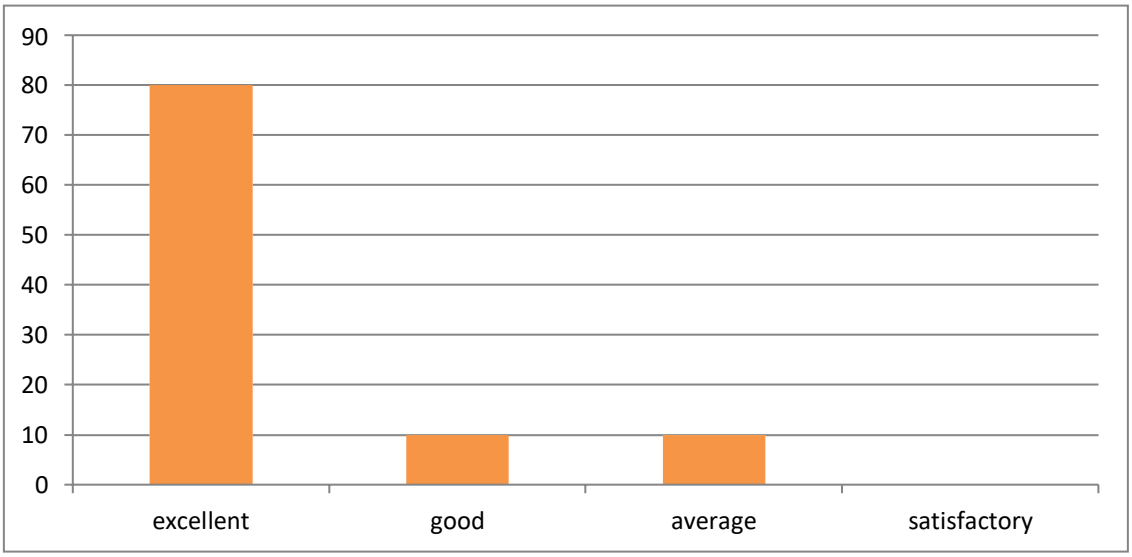


Source: Primary survey

It can be seen from the above table that 62 percent of the majority of pisciculturists find fish farming profitable. While 24 percent of the pisciculturist had a passion for fish farming. whereas 9 percent of the pisciculture had other reasons and 5 percent of pisciculturist responded as it was their source of livelihood. As we can see, the majority of them find pisciculture a profitable option as there is low investment and high profitable farming. The demand for fish in the market is also high and so selling fish can give a better income.

4.5.11. Level of success for lake harvesting

Chart No. 4.5.9. Level of success for lake harvesting



Source: Primary survey

From the bar graph, it can be seen that 80 percent of the respondents feel pisciculture is excellent even though there is lots of hard work but in the end, they seem to earn a good profit as the demand for the freshwater fish is very high. While 10% of pisciculturists consider fish fishing is good and also average as they believe that even after investing a lot of money, they often obtain moderate fish yield.

Chapter 5: FINDINGS, CONCLUSION AND SUGGESTIONS

5.1. Findings of the study

Based on the study findings the following conclusions have been drawn.

1) The majority of the population was in Curtorim followed by Raia.
2) Curtorim had the highest population density with more proportion of males than females.
3) The majority of the household engaged in the non-farm activities were in curtorim
4) Curtorim had the highest area in terms of the size of the village with 1,736 hectares
5) Most of the cultivable area to its net sown area was in Raia and most households engaged inthe farm activities.
6) The majority of the area undertaken for cultivation during the Kharif and Rabi seasons was inMacasana and Curtorim respectively.
7) Most of the farmers in the study are from Curtorim.
8) The age category of 40-60 years made up the highest involvement in the study.
9) A greater percentage of the respondents have completed their graduation.
10) The majority of respondents earned monthly income from all the sources, less than 15 thousand.
11) Most of the respondents have engaged in farming activities and the majority of them choose farming as an inheritance practice.
12) The majority of the farmers cultivate rice on the communidade land and most of the area undertaken for cultivation is between 500-2000 sq meters.
13) A greater percentage of farmers used high variety seeds and a majority of the farmers cultivated rice on kherland.
14) A larger proportion of farmers that is 97 percent cultivate crops during the Kharif season while these same 85 percent of the farmers cultivate paddy during the Rabi season.
15) The majority of the farmers during the Kharif season use high variety seeds such as jaya while in the rabi season, most of the farmers grew khazrat, the local variety.
16) A larger proportion of the farmers produced 10-20 sacks during the Kharif season while during the rabi season majority of the farmers produced 20 sacks and above when 1 sack consisted of 50 kg grains.
17) Most of the farmers cultivated rice to sustain their livelihood.

18) For the majority of farmers, the overall cost of cultivating a crop, including all aspects of farming, was less than Rs. 10,000 for every harvest.
19) The majority of farmers did not sell their products since they consume a substantial amount ofthe rice they grow.
20) Most farmers rely on lakes to irrigate their fields, and the importance of lakes can be attributed to the farmers.
21) A larger proportion of the farmers use the base area of the lake to grow horticulture in Rai-tollem lake in the post-monsoons.
22) Due to irregular weather circumstances such as heavy rains, fog, and other factors, most farmers have experienced significant losses resulting in a major challenge with paddy cultivation.
23) The majority of farmers did not take any loans to cultivate their fields, instead, they utilized their own savings.
24) Most farmers do not have a Krishi card and have not received any benefits.
25) Larger proportions of the farmers were engaged in allied activity with horticulture being a major contributor.
26) The majority of the farmers' total expense incurred for allied activities is below Rs.4,000 while onaverage farmers earned income between the range of Rs.10,000 -20,000.
27) The majority of the villagers who preferred non-farm activities were engaged in the service sector.
28) Major lakes at Curtorim that is, Rai-tollem and Angdi tollem lake were auctioned at a rate above 3 lakhs.
29) The majority of respondents considered that auctioning among the association's members would benefit them greatly.
30) Gold fish has the highest demand and was sold for above Rs. 1,000 per kg.
31) Food scraps are the most common source of fish food.
32) The majority of pisciculturists prefer to sell fish in the market, followed by selling at a good price at a restaurant.
33) The total expense was Rs. 80 thousand and above when the lake was auctioned. When fish washarvested twice in the lake, the profit was over 5 lakhs.
34) Most of the pisciculturist faced the problem of robbers in the lake area followed by low fish production.

35) The majority of them involved in fish farming were members of the association.
36) Most of the pisciculturists preferred to pay in the form of a kind.
37) The larger proportion of pisciculturist finds fish farming a profitable business. While few of the pisciculturists responded it was their source of livelihood.
38) Most of the pisciculturist are engaged in some or the other activities apart from fish farming.
39) The majority believe pisciculture is excellent because it helps them to earn substantially and there is a significant demand for freshwater fish.

5.2. Conclusion

As this study is conducted basically to get an insight into the agricultural scenario with special reference to Curtorim with its neighboring villages in salcete taluka. This study helps to fulfill the main objective of the study. The study assesses the significance of lakes taking into account the dual aspects of agriculture and pisciculture whether serve as a channel for sustaining the livelihood of Curtorim villagers.

In the study, based on the secondary data, Curtorim being the largest village in terms of area and population density had more males than females engaged in non-farm activities. Raia has the majority of cultivable land to net sown land with households involved in agricultural activities. In the Kharif and rabi seasons, the majority of the area under cultivation was in Macasana and Curtorim, respectively. The presence of lakes in Curtorim can be attributed to the higher performance of agricultural production during the rabi season.

The study also focuses on socio-economic activities revolving in the village of curtorim by analyzing the distribution based on socio-economic characteristics of the villagers who are engaged in farm as well as non-farm activities. In the study, most of the villagers were belonging to the working-age group, were literate and earned sustainable income to support their families.

Villagers that choose non-agricultural activities to agriculture work in the service sector. While the villagers were engaged in farming activities, produced rice largely on communidade lands, primarily on kherlands, as a hereditary practice of cultivating. The agricultural production was higher in the rabi season as the farmers relied on the lake to irrigate their fields and farmers cultivated mainly to support their livelihood.

In the monsoon, farmers use the base area of Angdi-tollem lake for paddy cultivation, while in Rai-tollem, the base land is used to cultivate horticulture by the majority of the farmers who are involved in allied activities. Some farmers face irregular weather constraint and were without a krishi card, so they are unable to receive compensation for grain yields lost.

The study also analyses the existing pisciculture practices in the village. lakes were auctioned at different rates by the lake committee. Gold fish had the highest demand and was sold at the rate above Rs.1,000 per kg pisciculturist involved in fish farming as part-time activity, an expense incurred for fish farming was Rs. 80 thousand and revenue generated was over 5 lakhs. Fish farming is an excellent activity as is profitable and there is a significant demand for freshwater fish. In the study area, the success of fish farming was shown to be relatively high.

In conclusion, the villagers benefited greatly, either directly or indirectly, from the lakes located around Curtorim, which offered a source of revenue to the villagers.which proved to become a channel in sustaining the villager's livelihood.

5.3. Suggestions

- The lakes can be beautified to attract visitors and turn them into tourist destinations.
- Educating the Villagers about the benefits of lakes and ways to protect the environment around them.
- New varieties of fish can be introduced into the lake, as the demand for freshwater fish is high.
- Pisciculture should be expanded in a broader sense, not just among tenant associations, but also among villagers as well, allowing a higher number of individuals to earn revenue.
- Government schemes can launch various schemes to support the farming activities and subsidies should be granted to all farmers and not only to those who have Krishi cards.
- As farming is decreasing in the present era, youth can be encouraged to pursue a career through various awareness programs.
- Promoting rice seed development that can adapt to changing climatic conditions could enable farmers to overcome rice cultivation problems during the Kharif season.

ANNEXURE

Questionnaire for households in Curtorim village

1. Age : a)18-25 b) 25-40 c) 40-60 d) 60 and above
2. Qualification: a) No schooling b) Primary school c) Secondary school d) Graduation e) Post- Graduation f) Others qualification
3. Monthly income from all sources: a) less than 15 thousand b) 15 - 30 thousand
   a. 30 -70 thousand d) 70 thousand and above
4. Are you engaged in agricultural farming activity? : a) Farm activity b) Non-farm activity

   If you are engaged in agriculture
5. Why did you choose 'farming '? : a) Inheritance b)Source of Livelihood c) Have passion/interest d) Other reasons
6. Specify the ownership of land used for Farming: a) communidade b)own land c)leased land
7. Total Area of Farm cultivated: a) below 500 sq meters b) 500- 2000 sq meters
   a.2000- 4000 sq meters d) 4000- 6000 sq meters e) 6000 sq meters and above
8. Variety of seeds used for farming: a) local variety seeds b) high yield variety seed
9. Main source of irrigation used for cultivating crops: a) Lake water b) wells c)Tanks d) Ponds f)others source
10. Type of Agricultural land utilized to cultivate Paddy: a) High Zone Upland (Morod) b) Kher land (Addi) c) Base area of lake d) Low Lying area (Khazan land)
11. For what Purpose do you utilize the base area of the lake? a) Cultivating paddy b) Horticulture c) both d) don't use the base area of lake
12. Do you cultivate Kharif crop ? a) Yes b) No
13. Main Variety of rice grown during ' kharif' season: a) Jaya b) joyti c) khazrat d) kendall e) other variety
14. After harvesting, total Grains (bath) produced in a Kharif season(if 1 sack = 50kg): a) less than 5 sack b) 5-10 sack c)10-20 sack d) 20 sack and above e)No outcome received
15. Do you cultivate Rabi (vaigon) crop?: a) Yes b) No

16. Main Variety of rice cultivated for ‘Rabi’ season : a) Jaya b) joyti c) khazrat d) kendall f) Other variety didn’t cultivate Rabi crop
17. After harvesting, total Grains (bath) produced in a Rabi season(if 1 sack = 50kg) a) less than 5 sack b) 5-10 sack c)10-20 sack d)20 sack and above e)No outcome received
18. Do you utilize lake water for ' Rabi' season ?: a)Yes b) No
19. Besides lake water, do you use any other source of irrigation for ' Rabi' crop?: a) wells b) Tanks c) ponds d)Not specified
20. In what other ways does the lake benefit you? a)fishing b)Household Consumption c)horticulture d)other benefits
21. Main Purpose for cultivating crop ? a) self consumption b) market use c) both
22. Total annual expense incurred for farming: a) Less than 10,000 Rs b) Rs. 10,000 - 20,000 c) Rs. 20,000- 50,000 d) above 50,000
23. Total Income received after selling rice production: a) below 5,000rs b) 5,000- 20,000 c) 20,000 - 50,000 d) 50,000 and above e) No income received
24. Problems encountered, in cultivation of crop: a) Lack of Finance b) climatic constraints (rains, fog, etc.) c) Inadequate storage facilities d) No problems encountered

Allied Activities

25. Type of allied activities you practice, besides agriculture? specify if any: a) horticulture b)fishery c) animal husbandry d) Other activities
26. Total annual expense incurred for allied activity: a)Less then Rs. 4000 b) Rs.4,000 - 10,000 c) Rs. 10,000- 20,000 d)Rs.20,000-50,000 e) Above Rs.50,000
27. Income earned from allied activities: a)less then 10,000 Rs b) 10,000- 20,000 Rs c) 20,000-30,000 Rs d) 30,000 Rs. and above e) No income received
28. Beside agriculture, In which other sector are you currently engaged in?: a) service b)Industry c) not engaged in any other sector
29. Do you have a Krishi card? a)Yes b) No
30. Have you availed any benefits from it? a)Yes b)No
31. Have you taken, any loan for agricultural purpose (buying seeds, fertilizers etc.)? a) yes b) No

If Not engaged in Agriculture

32. If not, specify the reason? a) have interest but Don't own a land b) land they have is not suitable for cultivation of crops c) Lack of Finance d) Prefer non-farm activities
33. If Not agriculture, in which sector are you currently engaged in? a) service b) Industry c) Not specified

Questionnaire for pisciculturist relying on Lakes

1. Whom was the lake auctioned to? a) resident of curtorim b) members of the tenants association c) non- resident of curtorim.
2. what was the price of the lake when it was auctioned off? a) less then 1 lakh b)1- 2 lakh c) 2-3 lakh d) 3 lakh and above
3. Total income of generated in that year (total profit): a) below 1 lakh b) below 2 lakh c) below 3 lakh above
4. Which fish has highest demand: a) Gold fish b) Rohu c) Komin d) Chonok e) Pitol f)other fish.
5. At what Price is fish sold per kg: a) less then 400 b) Rs. 400- 600 Rs. c)600-1000 Rs. d) 1000 Rs. and above
6. Source of feeding: a) fish food scraps b) fish feed c) not specified
7. Destination of fish produced: a) market restaurants b) sold in other villages c)self consumption
8. Total Expense incurred: a) less than 20 thousand b) 20-40 thousand d) 40- 80 thousand e) 80 thousand and above
9. Major Problem encountered: a) low b) technical assistance c) lack of material and tools d) robbers in lake area e) low fish production
10. What is the procedure for paying hired laborers? a) cash b) kind
11. Why did you choose to become pisciculturist? a) Profitable b) passion source of livelihood c) other reasons
12. Apart from fishing, are you engaged in any other activities ? a)Yes b) No
13. Is lake fishing success to you? a) excellent b) good c) average d) satisfactory

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