SOCIO-ECONOMIC IMPACTS OF COASTAL EROSION IN CHELLANAM

PROJECT SUBMITTED

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FOR THE AWARD OF THE DEGREE OF

BACHELOR OF ARTS IN ECONOMICS

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CERTIFICATE

This is to certify that the project titled **"Socio-Economic Impacts of Coastal Erosion in Chellanam"** submitted in partial fulfillment of the requirement for the award of the degree of Bachelors of Arts in Economics to **St. Teresa's College (Autonomous) (Affiliated to Mahatma Gandhi University, Kottayam)** is a bonafide record of the work done by the project group under my supervision and guidance.

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Dr. Mary Liya CA	Dr. Pearly Antony O

DECLARATION

We hereby declare that the project **"Socio-Economic Impacts of Coastal Erosion in Chellanam"** submitted by us for the Bachelor of Arts Degree in Economics is our original work.

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CHAPTER 1

Socio Economic Impacts of Coastal Erosion in Chellanam

1.1 Introduction

Along the nearly 356,000 km of the world's coastline, coastal regions serve as boundaries. They contain a spectrum of marine and terrestrial ecosystems, from naturally occurring to severely altered environments. Coastal areas provide important elements for socio-economic development of people, especially in less developed coastal states. Humans derive many benefits from coastal areas. At the same time, increasing environmental and human pressures have a negative influence on coastal systems, necessitating immediate action in many coastal regions around the world. The 2030 Agenda includes coastal areas in two of its targets for Sustainable Development Goal (SDG) 14 that aims to conserve and sustainably utilize the oceans, seas, and marine resources (14.2 and 14.5). These encourage a strong sustainability idea by focusing on the preservation, management, and protection of coastal ecosystems and resources. Targets 14.2 and 14.5 should act as limitations on this depletion in any future talks. Such a rule-based framework does, however, provide difficulties and traps that must be avoided during the implementation and policy-making processes. Rock, soils, and/or sands close to the coast are worn down or carried away during the process of coastal erosion, which is triggered by localized sea level rise, powerful ocean waves, and coastal flooding. The major threats to coastal ecosystems include habitat loss or conversion brought on by coastal environment, agricultural production, or fisheries; habitat degradation brought on by agricultural runoff, pollution, and contamination; and resulting changes in silt and water supply brought on by humans along the coasts and in upstream watersheds.

Coastal erosion is a growing environmental problem that poses a significant threat to communities worldwide. It occurs when the natural processes of erosion and sedimentation are disrupted due to human activities, sea level rise, and climate change. The consequences of coastal erosion are significant and can have far-reaching impacts on the environment, economy, and society. In India, coastal erosion has become a growing problem due to factors such as sea level rise, climate change, and human activities. Chellanam, a coastal town in Kerala, India, is no exception to this problem. Chellanam, a small coastal village located in the southern state of Kerala, is particularly vulnerable to coastal erosion due to its location on the Arabian Sea coast. The coastal village is situated on the Arabian Sea coast and is home to a large fishing community

that depends heavily on the sea for their livelihoods. Coastal erosion has been a significant issue for the community, leading to the loss of property and land and affecting the town's economic development. The coastal village is located on a low-lying coastal plain that is highly susceptible to frequent flooding and erosion.

The impact of coastal erosion in Chellanam is not limited to the physical loss of property and land. It has far-reaching socio-economic impacts that affect the community's overall well-being. Coastal erosion has had a significant impact on the community, leading to the loss of property, land, and a decrease in fishery production. The fishing industry, which is the primary source of livelihood for many residents, has been severely affected by the erosion of the coastline. The coastal village also has many beaches that attract tourists, but coastal erosion has led to a decrease in the quality of these beaches, affecting the tourism industry. It has far-reaching implications for the overall well-being of the community, including increased vulnerability to natural disasters, loss of cultural heritage, and social and psychological impacts. The purpose of this study is to analyze the socio-economic impact of coastal erosion in Chellanam and to identify potential policy solutions to address the problem.

The importance of understanding the socio-economic impact of coastal erosion in Chellanam lies in developing effective policy solutions to address the problem. The policies must take into account the environmental and economic factors that contribute to the problem and provide sustainable solutions that protect the community's economic interests while addressing the environmental issue.

The research is of great significance as it provides insights into the complex interplay between environmental and economic factors that contribute to the problem of coastal erosion. The study is important not only for Chellanam but also for other coastal communities facing similar issues. It is essential to understand the socio-economic impact of coastal erosion to develop effective policy solutions to address the problem and protect the community living nearby coastal areas.

This study also aims to analyze the socio-economic impact of coastal erosion in Chellanam and identify potential policy solutions to address the problem. The study is crucial in highlighting the importance of balancing economic development and

environmental conservation and protecting the livelihoods and well-being of affected communities.

Coastal erosion is a widespread problem that has affected around 70% of the world's sandy coastlines as of the present. Seawater is engulfing coastal land, forcing coastal villages and homes inland, which reduces human living space, destroys beach biodiversity and ecosystem balance, and negatively impacts both human life and the environment in direct or indirect ways. As a result, coastal erosion has gone from being a normal aspect of the environment to a major threat. The Ministry of Earth Sciences recently informed the Lok Sabha that a sizable portion of the 6,907.18 km long Indian mainland coastline is experiencing varied degrees of coastal erosion. About 34 percent of the coast is eroding to varied degrees, while 26 percent of it is accreting, and the rest 40 percent is stable. Between 1990 and 2018, the coastline of West Bengal degraded by about 60.5%. (323.07 km). Tamil Nadu (42.7 percent) and Kerala (46.4 percent) are the next two states, respectively. The Indian National Centre for Ocean Information Services historically produced and released Coastal Vulnerability Index (CVI) maps of India's entire coastline (INCOIS).

Chellanam in Kerala has been the most severely affected coastal community by erosion. Homes throughout a 17.5 km2 region are decimated and ultimately destroyed by large waves that tear down the already dilapidated sea wall. People are compelled to take shelter at one of the village's schools because of the erosion, which worsens during the monsoon season. Researchers assert that marine erosion in Chellanam became more severe after the Cochin Sea Port opened in 1928. Two organizations, Care Chellanam (established by the Kerala Regional Latin Catholic Council) and Chellanam-Kochi Janakeeya Vedi (group of locals and activists), have completed in-depth research on the coastline length and have submitted their findings to the government bodies.

1.2 Review of Literature

According to TIMES OF INDIA (July. 5.2021), Chellanam in Ernakulam district in the worst seashore erosion hit coastal villages in Kerala. Huge waves overtop the already - damaged the sea wall and destroy houses in the 17.5 KM stretch. The erosion intensifies during the monsoon months, forcing people to seek refuge at a school in the village. Experts say that the sea erosion in chellanam intensified after the construction of Kochi Sea port in 1928. Rock mining will also prove to be possible if sea walls or levees (groins) are constructed. With the state government conducting a detailed study to find a permanent solution to the sea erosion in Chellanam, a team of researchers, naval architects, shipbuilders and people working in the field of sustainable development came up with a new idea. They propose to build T-shaped groins using a floating structure which can prevent seashore erosion and wave-related destruction of the coastal area and at the same time harness energy using waves.

According to an article in The Hindu (Kochi July 14 2020), Due to the heavy flooding in the coastal village of chellanam two houses were severely damaged and around 50 homes were under dangerous condition. Three wards of panchayat have been classified as red zones to contain covid spread. KV Thomas, former head of the coastal processing group at the national center for earth and science studies said that both immediate and long-term measures were needed to save the residents of chellanam. According to him, geotextile tube laying is only a temporary measure. And a long-term study can be made over two years of study and data collection. There have been substantial changes in the flow of current and tides. Severe coastal erosion and flooding have several reasons. Dr Thomas made ideas like recreation of the natural beach and this has been experimented in places like pondicherry and Cuddalore and depositing dredged materials in an area needed to be explored.

According to Manorama (18 August 2021), Thushar Nirmal of Janakeeya Vedi states, neither the government nor the port have studied the dredging’s effects. “The public has brought up this matter with the government. However, the problem is not being addressed by the Cochin Port officials. They’re not even prepared to accept blame for coastal degradation, he claimed. Through a Right to Information Act request, Thushar recently requested Cochin Port’s response regarding the environmental effects of

dredging. The RTI Act 8 (1) A clause, which exempts information if its publication would negatively impact India’s sovereignty and integrity or the country’s security, strategic, or economic interests, was cited by the port officials as their justification for declining to respond. The Chellanam fishing harbor also contributes to coastal erosion. The harbor halts the normal movement of sand towards the north, according to Dr. Ramana Murthy, director of the National Centre for Coastal Research, who made this statement during the online consultation noted previously in the article. He said, “This deprives the Chellanam shore of sediments.”

According to Supriya Vohr, (5 may 2022)"Chellanam is a narrow strip of low-lying land nestled between the Arabian sea and the backwaters of Vembanad Lake, the largest freshwater lake in Asia in the Ernakulam district of central Kerala. Cochin port lies to its north. The 17.5 km coastline has a harbor and a coastline that is partially covered with a seawall in dilapidated condition. Approximately 16,000 families live in the 812-hectare area. Large stretches of revenue land and property owned by the local community have been eroded over a period of 40-50 years in this area. Hundreds of families have lost their homes."

In November 2018, a study by the national center for earth science studies showed that 60 percent of Kerala's coastline is under erosion; it underlined that coastal development in the form of urbanization, tourism, an "unscientific shoreline protection methods "has led to the coastline becoming unstable. Part of a local non-profit forum Kochi Chellanam Janakeeya Vedi, were protesting the loss of their homes and livelihoods to coastal erosion and demanding that the government take proper action to protect their coastline their coastline their protest in chellanam began on October 28,2019 shortly after the village started experiencing severe erosion, and continues till date.

A study conducted by T.A Ameerudheen (18 August 2021) states that, many years ago, the distance from the coast and the sea in Chellanam was more than three kilometers. Large swathes of sandy beach separated the sea and the villages. Over a period of time, the sea started advancing to the villages. Coastal land began to erode due to the removal of sand and sediments from the shoreline. Documentary and scientific evidence suggest that sea erosion in Chellanam intensified after the construction of

Kochi Sea Port in 1926. The shipping channel for the Kochi port disrupts this cyclical process. Ships arrive and depart the port through the shipping channel. The channel is being dredged regularly to maintain its depth. The sand and sediments from Chellanam get trapped in the channel. Later, this will be dredged and deposited in the deep sea. This changes the sand movement ecosystem and causes erosion.

“The KUFOS officials have interacted with us regarding the project and sought our suggestions. We told them that prime importance must be given to protect the coast and a permanent solution to the sea erosion that is destroying our houses. Without ensuring a solution to the sea erosion, all other development projects will be unsuccessful,” said Fr John Kandathil Parambil, coordinator of Care Chellanam and vicar of Velankanni Church, Chellanam.

Based on an article from the Deccan Chronicle, (12 June 2021) Sand being removed from Chellanam fishing harbor area to be filled in geo tubes for seawall construction. With monsoon a couple of weeks away, the district is facing a threat of coastal erosion in the absence of seawall. Though the state government has allocated funds to the tune of Rs 8 crore soon after the Okhi disaster for seawall construction using geo tubes made of synthetic fiber tubes filled with sand, the works stalled midway. As per the agreement, the contractor had to finish work by November 2018. But the works were stopped citing unavailability of sand and other necessary equipment. Residents of Chellanam took out a protest march to the district collectorate the other day seeking the authorities’ immediate intervention to complete seawall construction. Various organizations have been conducting protest programs for the last several months seeking its resumption. “If the wall remains unfinished before the monsoon, several families will be affected as their houses will have severe damage in sea erosion,” said T.A. Dalfine, convener of Paschima Kochi Theera Samrakshana Samithi or West Kochi Coastal Protection Forum.

According to TIMES OF INDIA, (20 October 2021) With the state government planning to implement its Model Fishing Village for the first in Chellanam coastal hamlet, where sea erosion often wreaks havoc, the residents of Chellanam are giving their opinions about their priorities. Care Chellanam, an initiative of the Kerala Region Latin Catholic Council,

has submitted suggestions to the Kerala University of Fisheries and Ocean Studies (KUFOS), which is entrusted with conducting a study report for the Model Fishing Village project. The proposal submitted by the association talks about eight sectors: coastal conservation, sustainable housing, employment opportunities, education, health, infrastructure development, tourism and culture. In the five-page document, the residents have made some suggestions regarding each sector.

According to Asianet News, (3 August 2021) the coastal erosion in Chellanam, Kochi is a matter of great concern for the local people. In 2020, the Chellanam panchayat had commissioned a study to assess the situation of coastal erosion and its impact on the local population. The study was conducted by the Thiruvananthapuram Centre of the National Institute of Oceanography (NIO). The study revealed that the erosion of the coastline in Chellanam was caused by a combination of factors such as erosion due to wave action, sedimentation, and coastal construction. The study also highlighted that the shoreline was receding at a rate of 4-5 meters per year due to the natural processes. The study also revealed that the coastal erosion in Chellanam was a long-term phenomenon, which had been going on for several decades. In March 2021, Asianet News reported that the Chellanam panchayat had undertaken an initiative to protect the coastline from further erosion. The initiative involved installing groins, which are structures built to protect the shoreline from wave action. The installation of the groins was expected to reduce the rate of coastal erosion in the area. In April 2021, Asianet News reported the installation of groins.

According to District Disaster Management, (31 July 2018) The District Disaster Management Plan of Kochi highlights the vulnerability of Chellanam to coastal erosion. In particular, it mentions the erosion of the western coast near Chellanam which has caused the displacement of several families. The plan notes that the erosion was caused by the combined effect of the sea level rise, cyclonic storms and coastal currents. The plan recommends the implementation of coastal protection measures such as revetments, groins and beach nourishment to reduce the impact of coastal erosion. It also suggests the development of a coastal erosion monitoring system to assess the effectiveness of the protective measures. Studies conducted by various

institutions also point to the need for effective management of coastal erosion in Chellanam. For example, a study conducted by the Indian Institute of Science concluded that the impairment of the Chellanam coast was due to the combined effect of sea level rise, cyclonic storms, high energy waves and coastal currents. The study also noted that the construction of a breakwater would provide adequate protection from high energy waves.

In addition, the National Institute of Oceanography has reported that the Chellanam beach has been subject to several years of erosion. It has identified the erosion of the beach and the sea walls as the main factors contributing to the problem.

1.3 Problem Identification

The problem identification for the project "socio-economic impacts of coastal erosion in Chellanam" is to understand the adverse effects of coastal erosion on the socio-economic well-being of the local community in Chellanam, a coastal village in Kerala, India. The study aims to identify the key factors contributing to the erosion of the coast, assess the economic losses incurred by the local population due to erosion, and explore potential solutions to mitigate the impacts of coastal erosion. The project seeks to raise awareness about the severity of the problem and provide data-driven insights that can inform policy decisions to address the issue.

1.4 Objective of the study

1. To analyze the economic loss incurred by the people of Chellanam due to coastal erosion.
2. To measure the impact of coastal erosion on the access to basic amenities of the people of Chellanam.

1.5 Need of the study

The following project is undertaken in order to understand the devastating impact of coastal erosion and in order to inculcate the seriousness of the issue faced by the local communities in Chellanam. Many years ago, the distance from the coast and the sea in Chellanam was more than three kilometers. Large swathes of sandy beach separated the sea and the villages. Over a period of time, the sea started advancing towards the villages, coastland began to erode due to the removal of sediments from the shoreline. Documentary and scientific evidence suggest that sea erosion in Chellanam intensified after the construction of the Kochi port in 1926. The shipment channel of the Kochi port disrupts the cyclical process.

So far, we came to understand that there has been a number of studies regarding the causes of the above problem, and neither the government nor the port has conducted an impact assessment study of dredging. The Cochin port officials refuse to own up the responsibility for the coastal erosion.

Many of the residents at Chellanam worry for their lives and property. More than 15,000 people living on the 17.5km coastal stretch in Chellanam live under seashore erosion threat round the year. The sea walls which were built in order to withstand the huge waves required periodic maintenance that was not done regularly. During harsh climate, people at chellanam find difficulty in transport, their homes get destroyed, children find it hard to receive education, people who consider fishing and tourism as means of daily income are unable to find any, waterlogging, food shortage etc. are some of the many problems faced by this village. Through this project we would like to raise the economic impact of coastal erosion with regard to the residents in Chellanam, contribute our findings and also come up with solutions to the problem.

1.6 Methodology

The study is based on both primary and secondary data and further a systematic and theoretical analysis is done from the data collected. For primary data collection, stratified random sampling technique was used. Stratified random sampling is a method of sampling that involves the division of a population into smaller sub-groups known as strata. The whole community of Chellanam is divided into 22 wards, hence we decided to collect samples from one ward member and one resident of each ward. Direct personal interview with a questionnaire is utilized in order to derive information from the people. So, we intend to collect a total of 70 samples. The questionnaire is designed in such a manner to gather information regarding the general information, income and work status, livelihood activities, education, impact of coastal erosion on family members and property, transport, health status etc. Secondary data used for the research are the study done by DR MV Ramana Murthy, The Director of Chennai based National Centre for Coastal Research and Kerala University of Fisheries and Ocean Studies (Restoration of Chellanam Panchayat). Data is also collected from panchayat Care Chellanam and Chellanam Kochi Jana Keeya Vedi, articles from Malayala Manorama, Indian Express, The Hindu and videos from YouTube.

1.7 Area of study

The area of study is confined to Chellanam, a beautiful coastal village in the Ernakulam district of Kerala. Chellanam village comes under Kochi assembly constituency & Ernakulam parliamentary constituency.

1.8 Type of analysis

The present study is both descriptive and analytical.

1.9 Period of analysis

The data for the study were collected during the period 2022 -23.

1.10 Theoretical Framework

Coastal erosion in Chellanam, from an economic perspective, can be analyzed using the theoretical framework of environmental economics. Environmental economics is a sub-discipline of economics that studies the interaction between economic activities and the natural environment.

In the case of coastal erosion in Chellanam, economic factors such as property values, tourism, and fishing industries can be impacted by the erosion. Therefore, the economic costs and benefits of various strategies to address the problem of coastal erosion should be considered.

One theoretical approach that could be used to analyze the economic impact of coastal erosion is the cost-benefit analysis (CBA). CBA is a method for comparing the costs and benefits of different policy options. The CBA can be used to estimate the costs of coastal erosion, such as loss of property value, loss of tourism revenue, and loss of fishery production, and compare them to the costs of implementing various erosion management strategies, such as tetrapod's or beach nourishment.

Another theoretical framework that could be applied is the concept of externalities. Coastal erosion is an example of a negative externality, where the cost of erosion is not fully borne by those who cause it, but instead by society as a whole. This can lead to inefficient outcomes, such as overuse of natural resources or underinvestment in erosion management strategies. Therefore, the concept of externalities could be used to analyze the economic incentives for individuals and businesses to engage in behaviors that contribute to coastal erosion and identify policy interventions that can address these incentives.

The theoretical framework of environmental economics provides a useful lens for analyzing the economic impact of coastal erosion in Chellanam and identifying potential

policy solutions to address the problem.

1.11 Limitations

- **Limited sample size**: The size of the sample was limited to 70 respondents since the data collection was time consuming and expensive, making it difficult to obtain a larger sample.
- **Social Desirability Bias**: Some of the respondents were reluctant to give honest answers as they feared their responses could be judged negatively.
- **Time and resource constraints:** Availability of time and resources for the study has always been a challenge throughout the preparation process

1.12 Scheme of the study

The scheme of the study was organized in the following way:

Chapter 1 – Introduction

The first chapter deals with introduction, review of literature, concepts and definitions, significance of the study, problem identification, methodology, objectives, period of study and limitations.

Chapter 2 – Overview

The second chapter gives a brief outlook about the economic conditions of people living in the coastal areas of Chellanam, due to the recurring coastal erosion.

Chapter 3 – Analysis and Interpretation

The third chapter deals with analysis on the economic and environmental impacts of coastal erosion in Chellanam.

Chapter 4- Findings, Suggestions and Conclusion

The fourth chapter presents findings, suggestions and conclusions drawn from the analysis of primary data.

CHAPTER 2

AN OVERVIEW OF SOCIO-ECONOMIC IMPACTS OF COASTAL EROSION IN CHELLANAM

2.1 Coastal Erosion

Coastal erosion refers to the process of the gradual wearing away and removal of soil,

sand, and rock from the coastline due to the action of waves, wind, and other natural factors. Coastal erosion can be a significant economic issue because it can lead to property damage, loss of infrastructure, and even displacement of communities living near the coast.

Chellanam district, located in the Indian state of Kerala, is one of the areas that has been severely affected by coastal erosion. The district is home to several small fishing villages that rely heavily on the sea for their livelihoods, and the erosion of the coastline has had a significant impact on their economic well-being. Chellanam village is a thickly populated fishing village that is part of Chellanam gram panchayat. It lies on a sliver of land, with the Arabian Sea to the west and Kerala's backwaters to the east. Because of its location, the whole area is highly susceptible to coastal erosion and was marked as such by the state government in 1986. More than 13,000 people reside in Chellanam village, with around 1,000 houses situated very close to the sea. Its residents have been demanding for many years that the state government strengthen the existing sea wall and construct a breakwater.

2.2 Causes of Coastal Erosion

Wave action: The movement of waves and currents can cause erosion of the coast, particularly during storms or high tides.

Sea level rise: As sea levels rise, the coastline can become more vulnerable to erosion.

Human activities: Human activities such as sand mining, dredging, construction of structures like jetties and breakwaters, and coastal development can alter the natural balance of sediment and disrupt coastal processes, leading to erosion.

Natural factors: Natural factors like earthquakes, volcanic eruptions, and landslides can also cause coastal erosion.

Climate change: Climate change, particularly global warming, is causing changes in ocean temperature and chemistry, which can affect coastal ecosystems and contribute

to coastal erosion.

Deforestation and upstream land-use changes: Changes in land-use upstream can affect the sediment supply to the coast and accelerate coastal erosion.

2.3 Causes of Coastal Erosion in Chellanam

Many years ago, the distance from the coast and the sea in Chellanam was more than three kilometers. Large swathes of sandy beach separated the sea and the villages.

Over a period of time, the sea started advancing to the villages. Coastal land began to erode due to the removal of sand and sediments from the shoreline. Documentary and scientific evidence suggest that sea erosion in Chellanam intensified after the construction of Kochi Sea Port in 1926. Beaches along Kerala's 580-km coastline face erosion during the south-west monsoon months from May to September, and minor erosion during the north-east monsoon in December and January. During this time, high-energy storm waves pull sediment and soil away from the shore. After the monsoon is over, low energy waves bring back the eroded sediment and soil. The cyclical process of erosion and accretion ensures that beaches remain intact.

The shipping channel for the Kochi port disrupts this cyclical process. Ships arrive and depart the port through the shipping channel. The channel is being dredged regularly to maintain its depth. The sand and sediments from Chellanam get trapped in the channel. Later, this will be dredged and deposited in the deep sea. This changes the sand movement ecosystem and causes erosion.

Dr M V Ramana Murthy, director of the Chennai-based National Centre for Coastal Research who has studied the seashore erosion in Chellanam, is of the opinion that management of the Kochi Port is important in reducing coastal erosion in Chellanam. "Kochi Port has its own impact on Chellanam," he said while participating in an online consultation on coastal erosion in June this year. "Cochin coast has northern sediment transportation. The sand moves into the shipping channel that gets periodically dredged.

So, no sand returns back from this area," he said. The dredged sand is being deposited in the deep sea. That is why Murthy suggested management of the port is important in controlling sea erosion in Chellanam. "Port management is important in controlling sea erosion," he said.

Fishing harbor's role

The fishing harbor in Chellanam too contributes to coastal erosion.

National Centre for Coastal Research Director Dr Ramana Murthy stated during the online consultation (that was mentioned earlier in the story) that the harbor stops natural movement of sand towards the north. "This deprives Chellanam coast of sediments," he said.

The harbor has two, 150-meter-long breakwaters. The gap between the breakwaters is 350 meters, what happens at the moment is that the breakwater on the south side blocks sand and sediment transportation to the north. This results in sand and sediment deposit on the south. "So, there is no sea erosion in areas that lie on the south side of the breakwater. But the northern areas are experiencing severe erosion," said Sebastien of Janakeeya Vedi.

The villagers say that the height of the existing sea wall – a 3-meter-high structure built of rocks – has reduced considerably as the waves have gnawed away at the sand at the foot of the wall.

Sea walls are embankments erected to prevent waves from encroaching upon or eroding coastal land, while breakwaters are offshore structures constructed parallel to the shoreline, which, among other things, are meant to prevent beach erosion.

Chellanam is a coastal village located on the Arabian Sea coast of Kerala. The town is home to a fishing community that relies heavily on the sea for their livelihoods. Coastal erosion has been a significant issue for the community, with many households experiencing loss of property and land due to the erosion.

2.4 The socio-economic impact of coastal erosion in Chellanam

Property Values:

Coastal erosion has caused significant damage to the property values of residents in Chellanam. Properties situated close to the coast are particularly vulnerable to erosion, leading to a decrease in their value.

Fishing Industry:

The fishing industry in Chellanam has been significantly impacted by coastal erosion. Erosion has led to a decrease in fishery production, which has affected the livelihoods of the fishing community in the town.

Tourism:

Coastal erosion has also impacted the tourism industry in Chellanam. The town has many beaches that attract tourists, but erosion has led to a decrease in the quality of these beaches, reducing their appeal to tourists.

Policy Interventions:

Several policy interventions can be implemented to address the problem of coastal erosion in Chellanam. The following are some potential solutions:

Coastal Management Plan:

The government could implement a comprehensive coastal management plan that

includes measures such as beach nourishment, building seawalls, and planting vegetation to prevent erosion.

Property Buyout Program:

The government could also implement a property buyout program for residents who are in areas prone to erosion. This program would compensate residents for their property and help them relocate to safer areas.

The village residents even resorted to protests to press for their demands. They went on a hunger strike at the Cyclone Okhi relief camp in December, and the Chellanam Coast Protection Committee organized a hartal in May. Both protests were withdrawn after the villagers' received assurances from the government.

Though the government has sanctioned the sea wall project, the irrigation department, whose job it is to build the structure, has not started construction yet.

Officials in the department blamed the delay in construction on the unavailability of rocks. The executive engineer Abdul Shukoor stated that restrictions on quarrying have reduced the availability of rocks in the state and would soon be piloting a project to build a sea wall using geo tubes. In this method, massive tubes filled with sand are placed near the high tide line to help reduce the impact of waves on the coast.

The delay in the construction of the sea wall has prompted the Chellanam gram panchayat to look for a temporary solution. Last week, it hired earth movers to make piles of sand in front of all houses near the sea wall, meaning the sand buns. But an official with the irrigation department said the bunds were a waste of public money and would not last for more than three days.

The government has other plans to address the problem. It is encouraging people who live less than 50 meters from the shore to relocate. In January, it announced a rehabilitation package for those willing to do so. Under this proposal, Rs 10 lakh will be given to each family – of which Rs 6 lakh will be to purchase land and Rs 4 lakh to construct a house. But the offer has had few takers. Panchayat president Josey said

only 20 people have opted for the plan so far.

Jacob, 33, a fisherman who lives less than 50 meters away from the sea in a neighborhood near Karthyayani temple, said he would not accept the offer and stated that It was impossible to buy land and construct a new house with Rs 10 lakh and said he would think about it if the government increases the package. Otherwise, he would stay here until he dies. He also added that the government should build a breakwater and seawall without wasting time in announcing such irrelevant packages.

Experts in coastal management, however, said that the breakwater Jacob and other villagers are so keen on will further exacerbate the problem. They said that sea erosion in Chellanam started after the construction of the Kochi port in 1926, and that the periodic dredging to remove sand from the bottom of the port added to the erosion. The port lies 16 km north of Chellanam. It changed the sand movement ecosystem and caused erosion, said AJ Vijayan.

The social and psychological impacts of coastal erosion in Chellanam are also significant. The loss of property and land due to erosion has led to a sense of insecurity and instability among residents. The community's cultural heritage is also at risk due to the erosion of the coastline. The loss of historical structures and cultural sites due to coastal erosion has significant implications for the community's sense of identity.

The socio-economic impacts of coastal erosion in Chellanam are significant and far-reaching. The loss of land and property, the impact on the fishing industry, tourism industry, and the community's vulnerability to natural disasters are some of the main factors that contribute to the problem. The study of coastal erosion in Chellanam is crucial in identifying potential policy solutions that address the problem while balancing economic development and environmental conservation.

2.5 Assistance groups during devastation

Two organizations - **Care Chellanam and Chellanam-Kochi Janakeeya Vedi** have conducted thorough studies on the coastal stretch and put forward their suggestions to

government agencies. Care Chellanam has been formed by the Kerala Regional Latin Catholic Council while the Chellanam-Kochi Janakeeya Vedhi is a collective of residents and activists.

Other voluntary groups may include local community organizations, **non-governmental organizations (NGOs), Palliative care units such as The Karunalayam Charitable trust,** environmental groups, and emergency response teams. Additionally, local NGOs and community organizations may provide support by mobilizing resources, raising awareness, and providing relief materials such as food, water, and shelter to the affected people. Organizations such as the National Disaster Response Force (NDRF), State Disaster Response Force (SDRF), and Coast Guard provide relief and assistance to affected communities.

In terms of community development, organizations like the **Kudumbashree Mission**, which is a poverty eradication and women's empowerment program that operates throughout the state, helped in the assistance of disaster relief and financial support to the people of Chellanam. The organization works to provide education, training, and support to women and their families in order to promote economic self-sufficiency and improve overall quality of life.

The **'Save Chellanam' campaign** was initiated in our college during the aftermath of the devastation. Our students joined hands with E- Unnathi, an NGO in filling sandbags and building a temporary sea wall along the sea coast at Chellanam on June 12th 2019.

2.6 Disaster management measures taken

Sea walls are embankments erected to prevent waves from encroaching upon or eroding coastal land, while breakwaters are offshore structures constructed parallel to the shoreline, which, among other things, are meant to prevent beach erosion.

After several protests by the residents of Kannamaly, the eighth ward of Chellanam where the disaster was most severe, the authorities have started installing **geobags** as

a temporary measure, under the supervision of the Chellanam panchayat. The residents said that the strong flow of water cannot be checked by geobags and what is needed is the starting of the second phase of the Chellanam seawall project in these areas. Chellanam panchayat president K L Joseph said that around 42 geobags have been installed and they sought the help of the irrigation department to fill the bags scientifically.

The newly installed **tetrapod-based seawall** seems to have brought much needed relief to the residents of sea erosion-prone Chellanam in Ernakulam district during the latest episode of rain fury. Areas, which used to get flooded by the marauding waves over the last many years, remain more or less protected since the monsoon intensified. Coastal conservation works worth Rs. 344 crore are now underway in Chellanam. The construction of seawall using tetrapod seemed to have helped to secure the stretch between Chellanam harbor and Puthenthode from the threat of sea erosion.

Tetrapods are laid on a 2.50-meter foundation of granites and at a height of 6.10 meter from the sea level. Uralungal Labour Contract Co-operative Society is engaged in the production of tetrapods based on the study conducted by the Chennai-based National Centre for Coastal Research. Tetrapods weighing two tonnes and five tonnes are being made. So far, 20, 235 tetrapods have already been produced using 3.50 lakh metric tonne boulders.The project is being supervised by the Anti Sea Erosion Project Management unit under the irrigation department.

The aim is to complete the construction of 7.32-km-long seawall before April 2023. So far, 40% of the work has been completed. The construction of a walkway along the areas where the seawall construction has been completed will resume after the monsoon. A three-meter-wide walkway will be laid over the tetrapod seawall along 6.60 km in the first phase.

2.7 People’s Responses

The residents in Chellanam were very cooperative during the process of data collection, they were ready to share their experiences and hardships they faced during the occurrence of the calamity. Many had suffered extreme loss in property and lack of stable source of income, they were forced to evacuate from their homes during severe sea intrusion into their homes. The compensation they received from the government was not enough to cover up their losses. Majority of the respondents relied on primary sector work as a source of income, primarily considered fishing as an occupation and hence many were hesitant to shift to urban areas and seek other job opportunities. They had a sense of belonging towards the locality as the majority of the sample population so considered lived in the area for more than 30 years.

2.8 History of coastal erosion in Kerala

Kerala, located on the southwestern coast of India, has a long history of coastal erosion. The state's coastal areas have been experiencing erosion for several decades, and it has intensified in recent years due to various human activities and natural processes. Coastal erosion in Kerala is mainly caused by natural factors such as strong winds, waves, and tides. However, human activities such as sand mining, construction of seawalls and urbanization have also contributed significantly to the problem. In addition, climate change and rising sea levels are exacerbating the issue of coastal erosion.

The Kerala coast is divided into three regions: the northern region (Kasaragod to Kozhikode), the central region (Thrissur to Alappuzha), and the southern region (Kollam to Thiruvananthapuram). Each region has its unique characteristics and experiences different levels of erosion. In the northern region, coastal erosion is mainly caused by the movement of sand along the coast due to longshore currents. In the central region, the construction of seawalls has disrupted the natural flow of sand and exacerbated erosion. In the southern region, erosion is mainly caused by the rise in sea level and the intrusion of seawater into freshwater bodies.

2.9 Impacts of coastal erosion in Kerala

Coastal erosion is a serious problem in Kerala, India, and has a number of negative impacts on the region's environment, economy, and population. Some of the main impacts of coastal erosion in Kerala include:

Loss of land: Coastal erosion results in the gradual loss of land, which can be particularly devastating for the people living in coastal areas. As the shoreline recedes, homes, businesses, and other infrastructure can be damaged or destroyed.

Soil degradation: As the soil is eroded away, it becomes less fertile and less capable of supporting crops and other vegetation. This can have a significant impact on local agriculture and food security.

Increased risk of flooding: Coastal erosion can increase the risk of flooding in low-lying areas, as there is less natural protection from storm surges and high tides.

Damage to coastal ecosystems: Coastal erosion can also have a negative impact on the region's ecosystems, including mangrove forests, coral reefs, and wetlands. These ecosystems provide important habitat for a variety of plants and animals, and their loss can have cascading effects on the broader environment.

Economic losses: Coastal erosion can also result in significant economic losses, particularly for the fishing and tourism industries. As the coastline recedes and ecosystems are damaged, fish populations may decline and tourist attractions may be lost, leading to reduced income for local businesses and communities.

2.10 Preventive measures of coastal erosion

Coastal erosion is a major problem in the state of Kerala, India. Some preventive measures that can be taken to minimize the effects of coastal erosion are;

Building seawalls: These structures can help protect coastal areas from erosion by absorbing the energy of waves and reducing their impact on the shoreline.

Beach nourishment: This involves adding sand to beaches in order to restore eroded areas and increase their size. This method can also help absorb the impact of waves.

Planting vegetation: Coastal vegetation such as mangroves and beach grasses can help stabilize soil and prevent erosion.

Regulating development: Regulations can be put in place to limit development in high-risk coastal areas in order to protect them from erosion.

The government of Kerala has taken several initiatives to prevent coastal erosion, including:

Coastal Regulation Zone (CRZ) notification: This regulation restricts development activities within a certain distance of the coastline in order to protect it from erosion.

Beach Management Programme: This program aims to manage the state's beaches by restoring and maintaining them, as well as promoting eco-tourism and sustainable development.

Coastal erosion monitoring: The government has established a coastal erosion monitoring system to track the extent and impact of erosion along the state's coastline.

Mangrove conservation: The government has implemented programs to conserve and restore mangrove forests, which can help prevent coastal erosion.

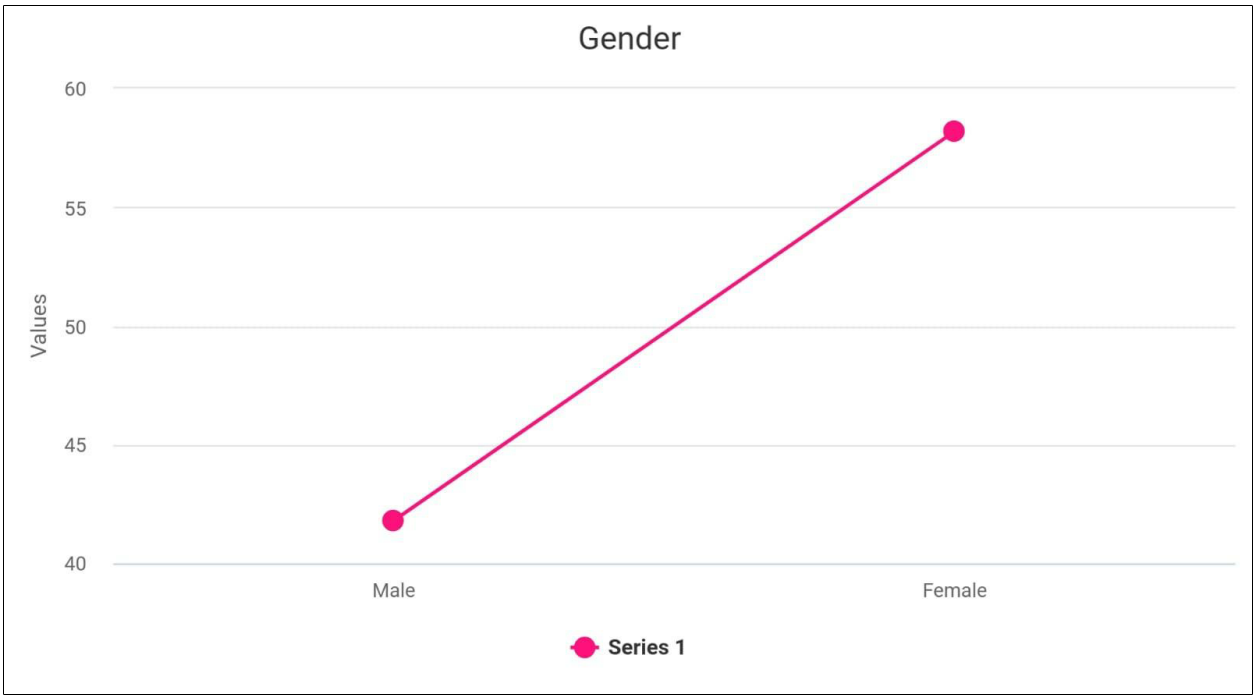
CHAPTER 3

ANALYSIS AND INTERPRETATION OF SOCIO-ECONOMIC IMPACTS OF COASTAL EROSION IN CHELLANAM.

This section provides the analysis and interpretation of the data collected from the respondents in the coastal erosion hit area of the Chellanam panchayat, through

scheduled questionnaires. Initially, direct personal interviews were conducted among the target respondents and the questions were prepared based on their responses. The authorization for direct data collection from the households were granted by the panchayat officials. The questions so prepared covered their personal and work profile.

3.1 Gender Distribution



Source: Primary Data

Fig 3.1

62.3 percent female and the rest 37.7 percent computed the gender distribution of the sample. Most of the respondents were females because males in the households were fishermen and they were out in the sea for their work. This also reveals the fact that the majority of the females are homemakers. The male respondents were mostly the ones who were unable to go for their work due to ill health or old age. A part of the male respondents lived on pensions and other grants from the government. The female respondents were more cooperative with the study, they provided us with enough and more data about the sufferings that they had to go through at the time of coastal erosion.

3.2 Size of Household

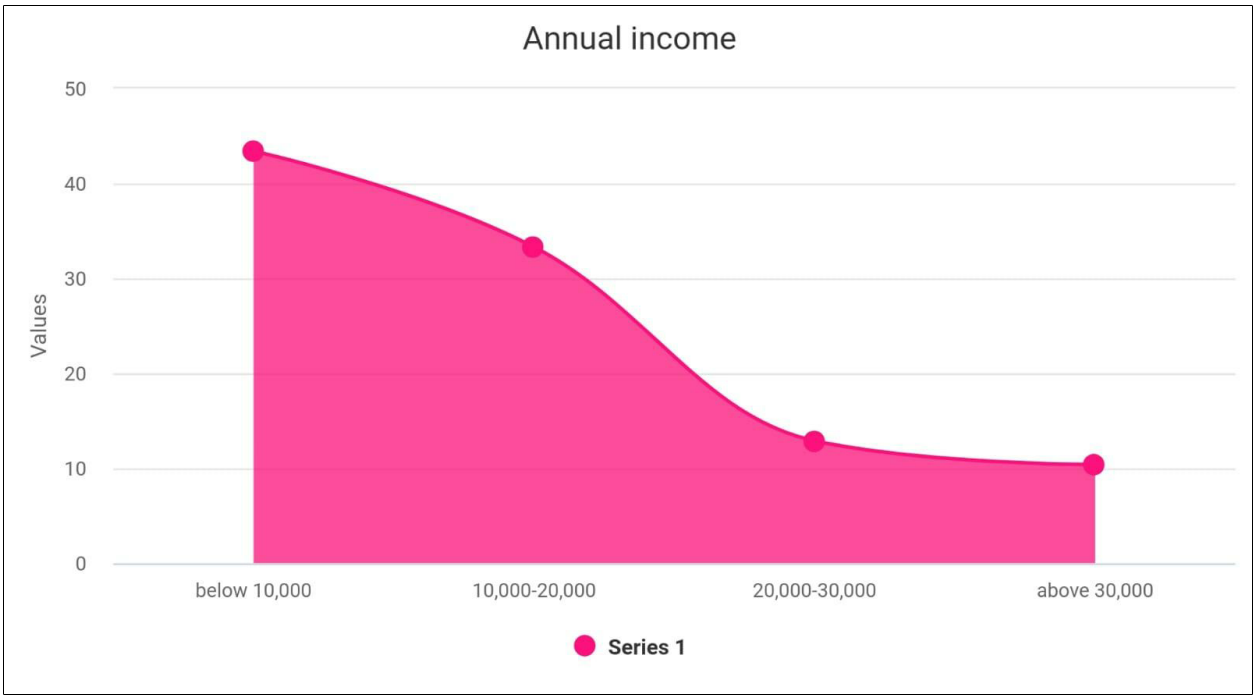
Source: primary data

Fig 3.2

35.7 percent of the sample live in families consisting of 4 members, 28.6 percent live in families consisting of 5 members and 12.9 percent live in families consisting of more than 5 members. The data reveals that most of the respondents live in nuclear families, the next major share consists of people living in families that consist of 5 members and the least share of the respondents live in joint families. The reason for people living in joint families is that either they

have only a sole bread earner or their financial condition does not permit them to own a separate land and home. They follow a system of collectivism instead of individuality.

3.3 Annual Income

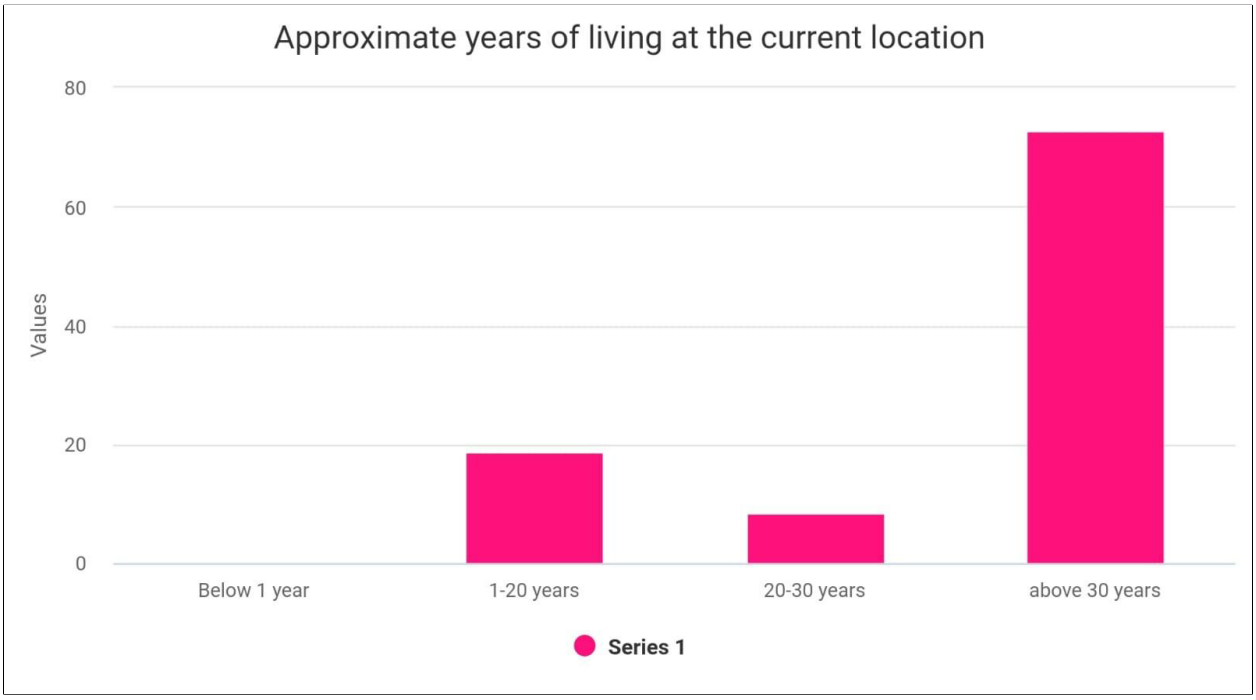


Source: primary data

Fig 3.3

Out of the respondents, the majority of the sole earners earn income below Rs 10,000 per year which constitutes 43.4 percent of the total population. 33.3 percent earn between 10,000 - 20,000 a year, 12.1 percent earn between 20,000 - 30,000 and only 10 percent of the sample collected earn above 30,000 a year. The level of income was validated based on their ration cards. A predominant share of the informants wishes to earn more but the problem is that the only skill they have mastered is fishing. This shows that most of the residents in Chellanam are below the poverty line and live on subsidies and grants. The state of occupational mobility among the residents in the community is narrow, Current bread earners follow the same source of occupation of their ancestors, they are reluctant to migrate into other localities seeking better opportunities. Consequently, they are stuck in the same level of income and live in the vicious circle of poverty.

3.4 Length of Residency



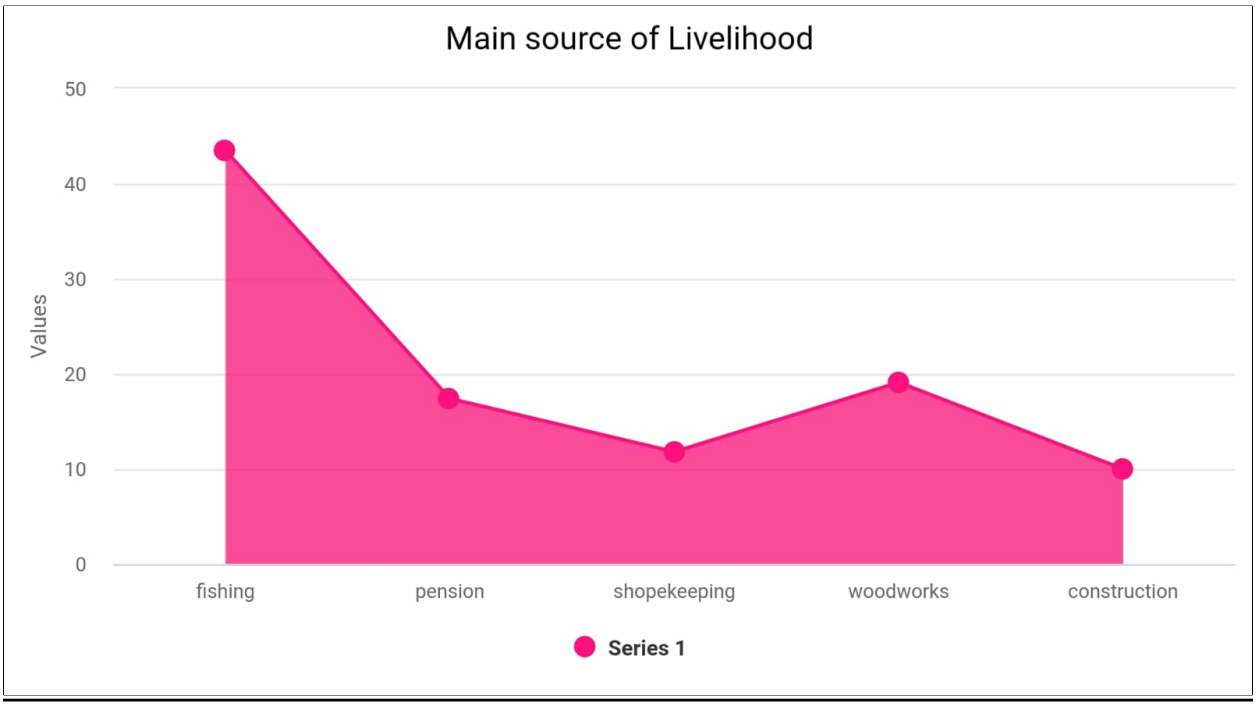
Source: primary data

Fig 3.4

The data illustrates that most of the residents have been residing in Chellanam for more than 30 years for now. This constitutes around 72.9 percent of the sample population. 18.6 percent of the population have only lived for 1-20 years and 8.6 percent have been living in Chellanam for 20-30 years. The land owned by a leading share of the people are ancestral properties that are inherited from their forefathers. Living in the same location for these many years despite the troubles caused by the sea is also because they don't have enough money to relocate to a better place. The data shows no percent of the

population shifted to chellanam in the past year which demonstrates that the citizens do not find chellanam an ideal or suitable place for relocating.

3.5 Main Source of Livelihood



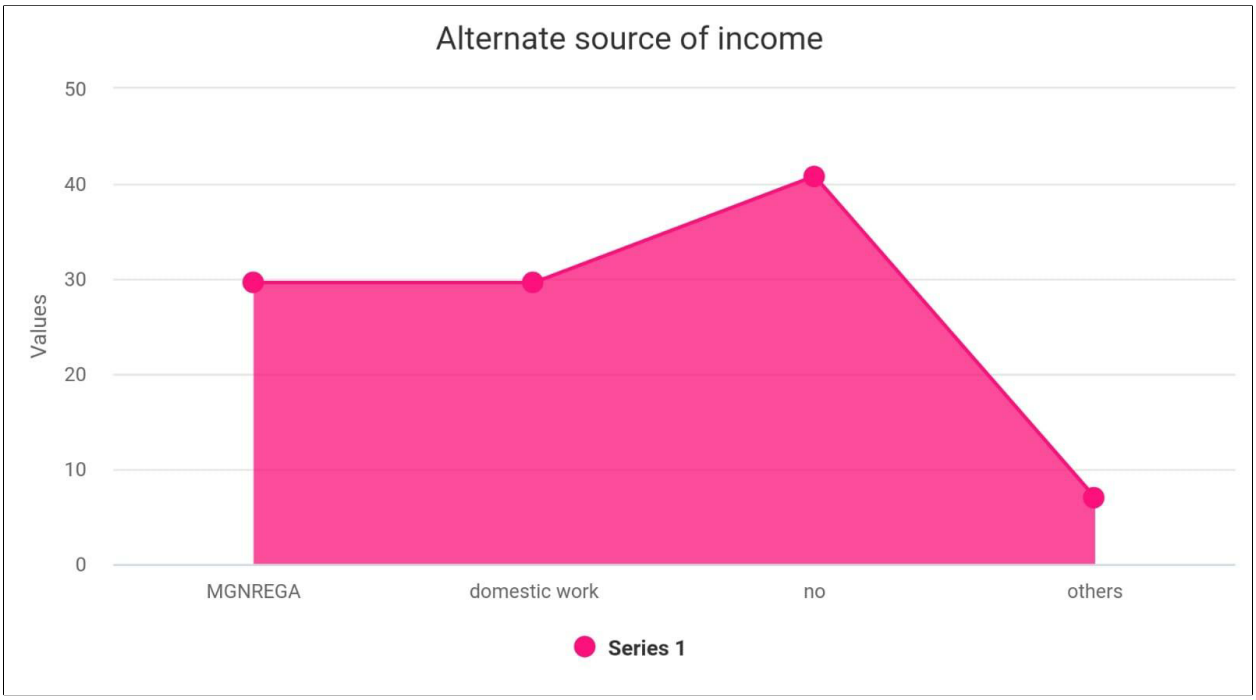
Source : primary data

Fig 3.5

It is evident from the data that the ultimate source of livelihood of a prevailing number of the population in Chellanam is fishing because of their geographical location, cultural traditions, economic opportunities and the limited alternative options.. Most sole earners of the households are fishermen which constitute around 43.5 percent of the total population. 17.4 percent of the population live on pensions, 11.8 percent run small

shops, 19.1 percent are engaged in carpentry including furniture shops or as independent contractors. The rest 10 percent work on construction sites. People used to be engaged in pokkali farming prematurely, but the aftermath of coastal erosion showed adverse effects in this field making it non profitable. The greatest part of the senior citizens (above 60 years) finances their basic amenities through pensions and other grants provided by the government, but they find the meager amount being insufficient to meet their ends. This data reveals that the majority of the laborers are employed in the primary sector.

3.6 Alternate Source of Income



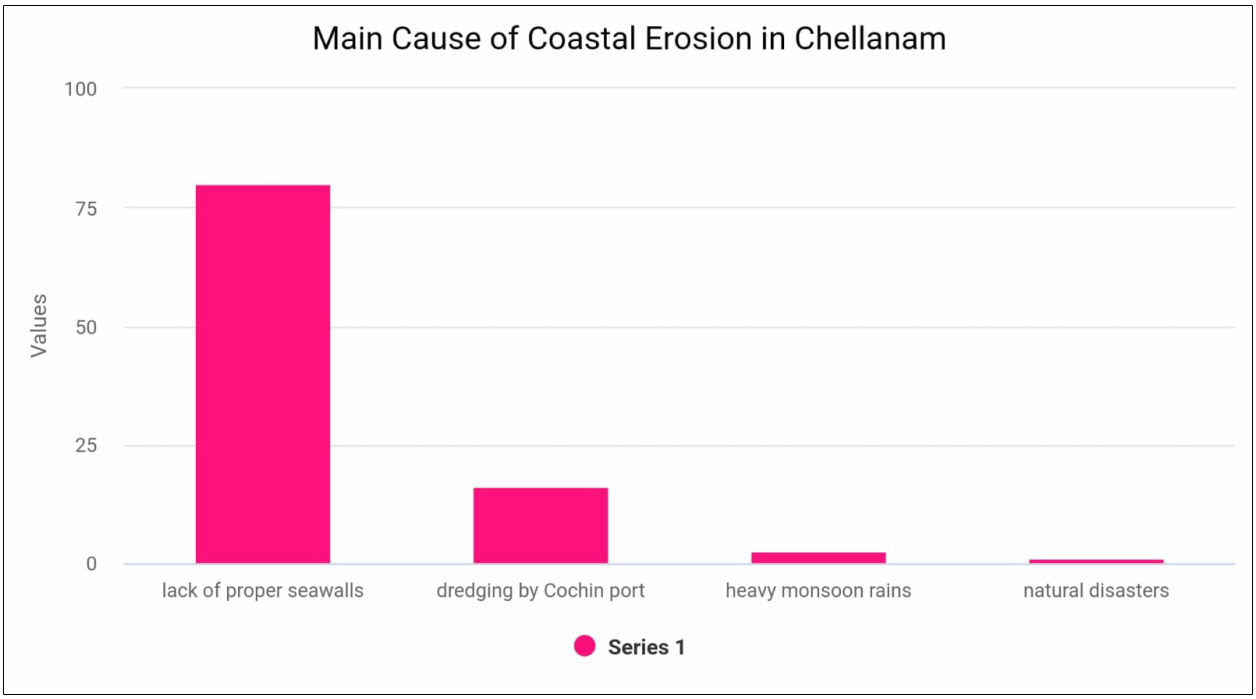
Source: primary data

Fig 3.6

Fishing has traditionally been the primary source of livelihood for the people of Chellanam, but in recent years, there has been a growing interest in alternative sources

of income that can help diversify and strengthen the local economy and provide other opportunities for the community. This data reveals that the respondents' alternate sources of income include MGNREGA which constitutes around 30 percent of the population, housewives and other females in the family goes for domestic works constituting 31.9 percent of the population and 40 percent of the population does not have any other alternative sources of incomes and that they only depend on their sole earnings to meet their daily needs. A major share of women are employed under MNREGA. Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) is a government scheme in India that provides a legal guarantee of 100 days of wage employment in a financial year to every rural household whose adult members volunteer to do unskilled manual work. Domestic workers in Chellanam, who are mostly women, benefit from this scheme. They register under MGNREGA and get employment opportunities in various works, such as road construction, water conservation, afforestation, and other manual labor works. By doing so, they earn a wage that is guaranteed by the government and enhance their livelihoods. The next prevailing share is held by the domestic maid workers who are an essential part of the local economy, as they provide valuable services to households in the urban area. However, they often face several challenges, such as low wages, lack of job security, long working hours, and a lack of legal protection.

3.7 Main Cause of Coastal Erosion in Chellanam

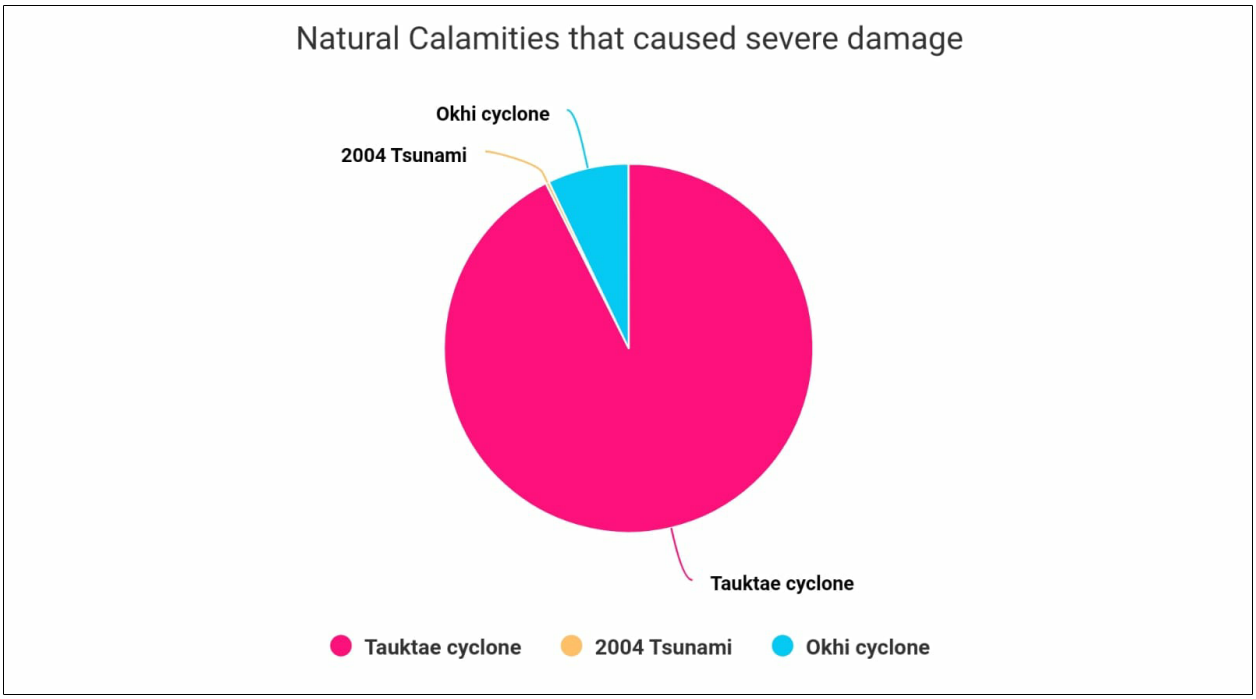


Source: primary data

Fig 3.7

In Chellanam, anthropogenic activities have contributed significantly to coastal erosion. Some of the major causes of coastal erosion in Chellanam were improper construction and maintenance of sea walls, sand mining (involves removing sand from the beach, which disrupts the natural balance of the beach, leading to erosion), climate change (the rising sea level and ocean temperatures has led to an increase in the intensity of waves, which cause more erosion). From the sample collected, 80 percent of the population claims the lack of proper sea walls being the ultimate reason for the cause of frequent coastal erosion in Chellanam being experienced. Yet, 16.4 percent of the population strictly believes the dredging by the Cochin Port being the Reason for the consequent coastal erosion in Chellanam. And a very few people state it's the heavy monsoon rains and the natural disasters being the reason for the coastal erosion.

3.8 Natural Calamities that caused Severe Damage

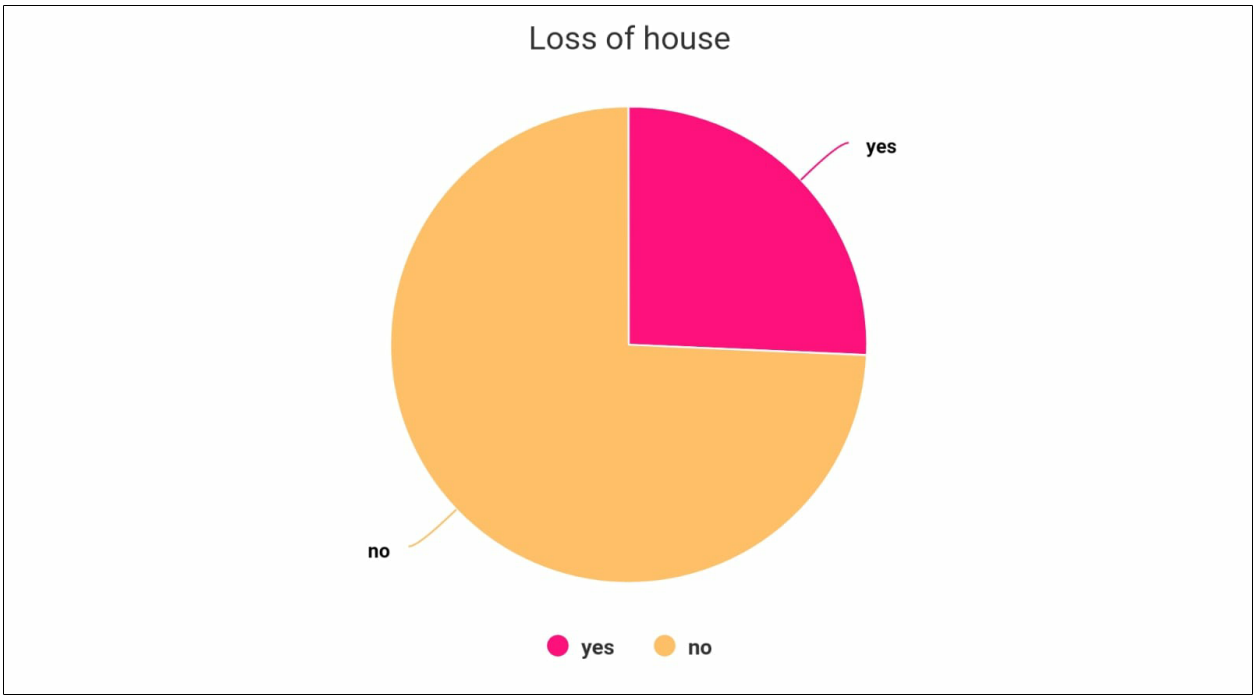


Source : primary data

Fig 3.8

Chellanam, being a coastal area, has been impacted by several natural calamities in the past, including Tauktae cyclone, Okhi cyclone, and the 2004 tsunami. The impacts of these events have been significant, and their effects can still be felt in the area. Out of the respondents, 92.6 percent of the population asserts it's the 2020 Tauktae cyclone which caused severe damage to their property and lives. Yet 7.1 percent of the population believes it's the Okhi cyclone which causes severe damage to their livelihood and the remaining share are of the opinion that coastal erosion has its roots in chellanam since 2004 Tsunami. The aftermaths of these natural calamities have been severe, and they have had long-lasting effects on the lives and livelihoods of the people in Chellanam. The seawalls that were earlier laid on the sealine to protect the households close to the sea underwent its first destruction during the 2004 Tsunami followed by Okhi cyclone in 2017. Later in 2020, After Tauktae cyclone the sea walls were completely demolished and that intensified the salt water intrusion.

3.9 Loss of house

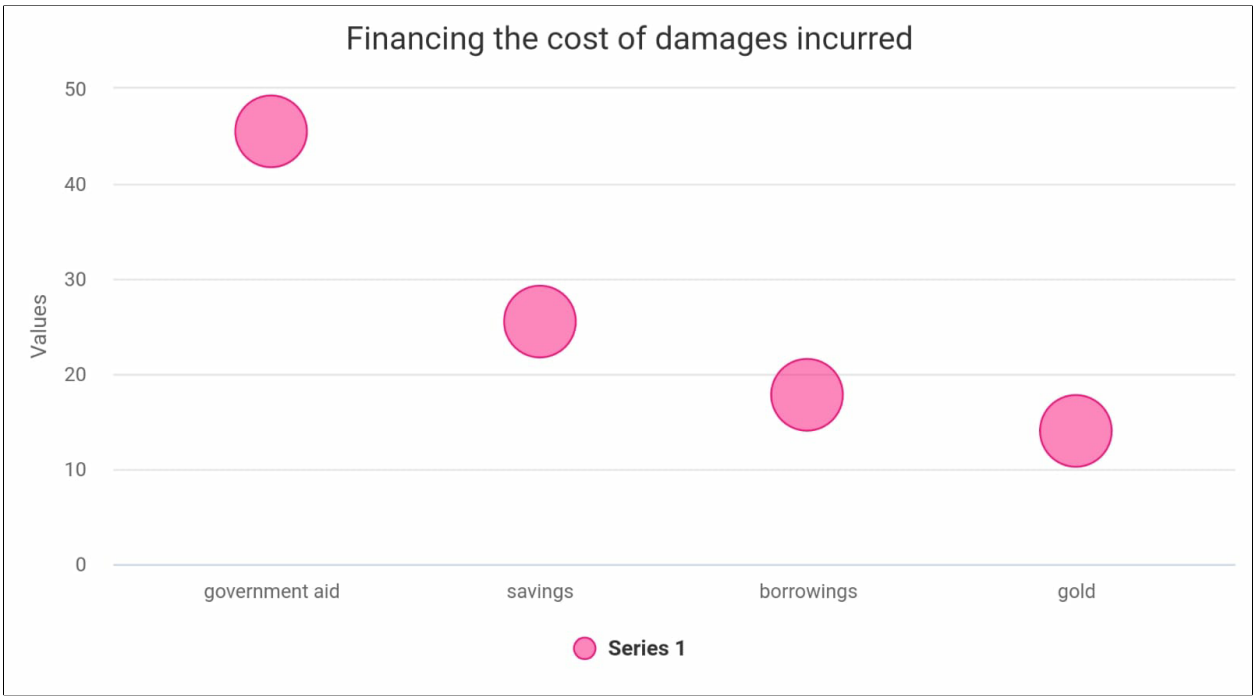


Source: primary data

Fig 3.9

74.3 percent of the population have responded that their house wasn't completely lost during the coastal erosion happening in Chellanam. Although major damages and other losses have been mentioned. 25.7 percent of the population completely lost their houses and properties during the coastal erosion. According to a news article from The Hindu published in June 2020, several families in Chellanam were forced to evacuate their homes due to severe coastal erosion. The article stated that around 150 families were affected, and many of them had lost their homes or were in danger of losing them. However, it is important to note that not all homes in Chellanam have been affected by coastal erosion to the same extent, and the degree of damage can vary depending on a variety of factors such as the location of the home, the severity of the erosion, and the condition of the infrastructure.

3.10 Financing the Cost of Damages incurred

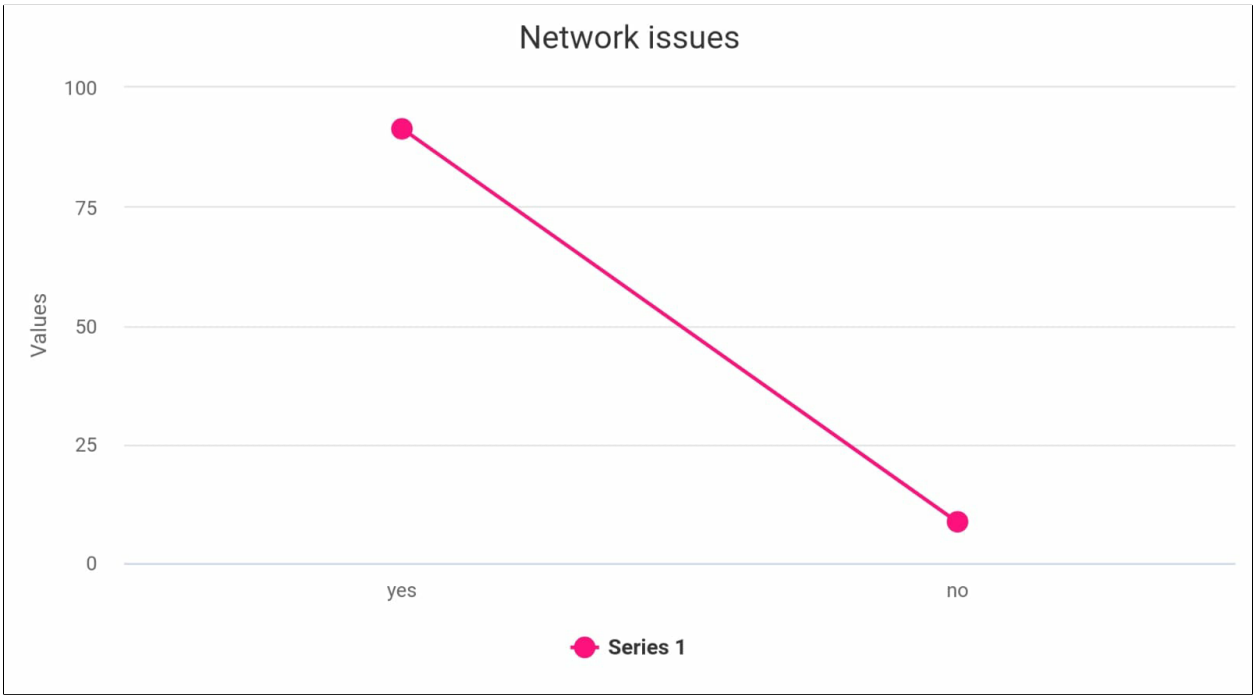


Source: primary data

Fig 3.10

Out of the total respondents, 45.5 percent of the population stated that they relied on government aid to manage finance the cost incurred for rebuilding their houses after coastal erosion though it wasn't enough to cover up the losses incurred. 25.5 percent of the population used up all their savings to cover up the costs for rebuilding. 17.8 percent of the population borrowed money from neighbors, relatives, other corporations or moneylenders to cover up the costs and the remaining 14 percent sold their gold and other assets.

3.11 Network Issues

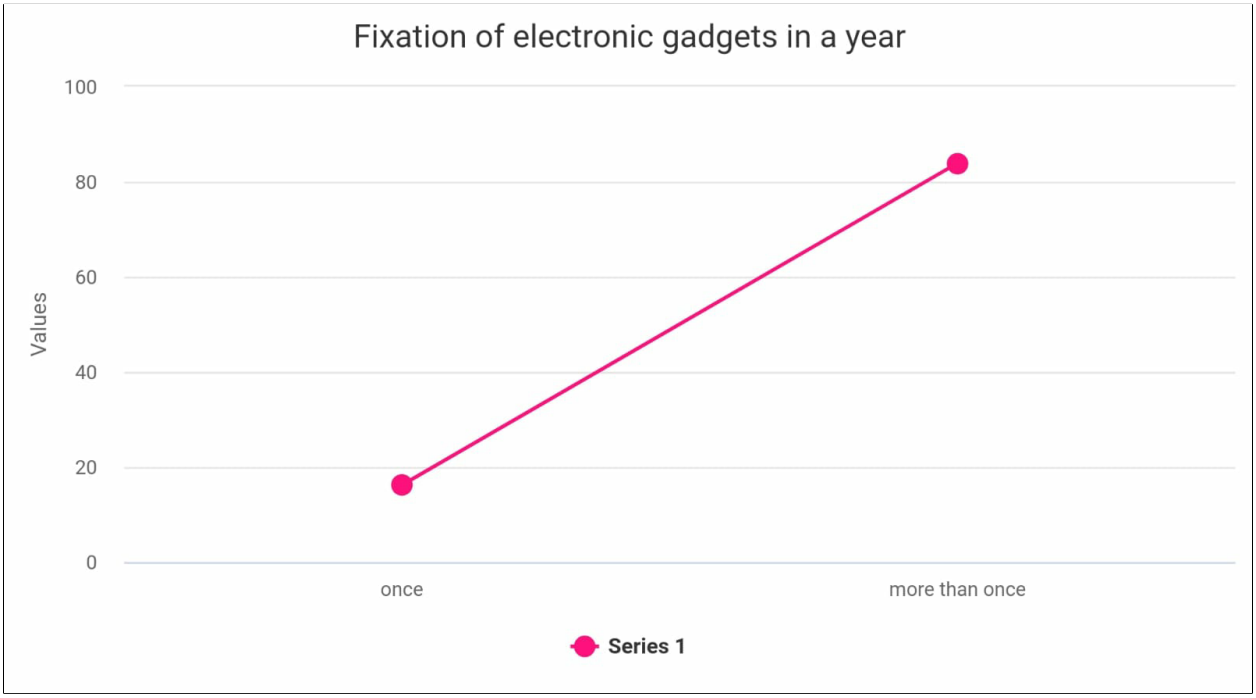


Source : primary data

Fig 3.11

From the following, it is evident that almost 91.4% of the households faced network and connectivity issues during the period of coastal erosion. They were not able to contact others through their mobile phones as their connectivity lines got affected due to water. The respondents stated that the lines that carried network connections to their home were all damaged due to erosion. Only 8.6 % of the total respondents had access to proper connectivity.

3.12 Fixation of Electronic Gadgets



Source : primary data

Fig 3.12

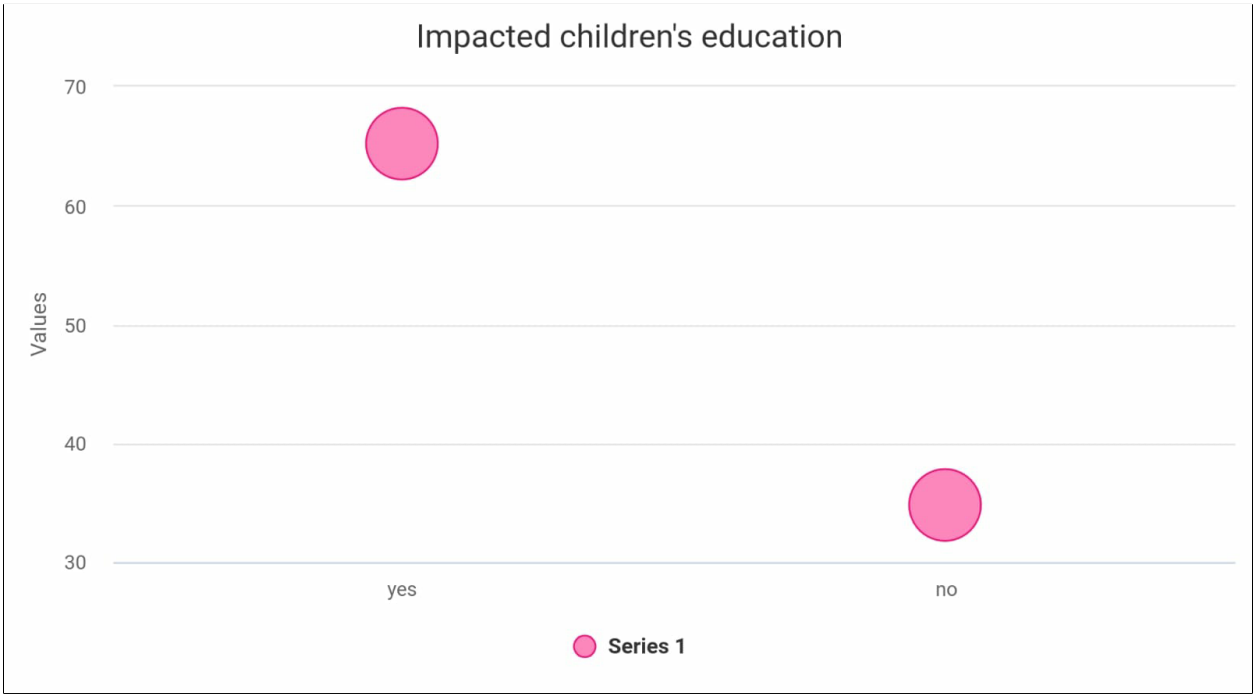
83.9% of their electronic gadgets are affected by salt winds, they are required to repair it more than once in a year. 16.2% repair their appliances once in a year. Since the winds are salty in nature, the durability of electronic gadgets gradually deteriorates. Salt winds and coastal erosion can have a negative impact on electronic gadgets in Chellanam, especially if they are exposed to these elements for extended periods. Salt is a corrosive substance that can damage the internal components of electronic devices, and when combined with the abrasive action of sand and saltwater, it can accelerate the erosion process.

The salty air can also cause the accumulation of salt crystals on the surface of

electronic gadgets, which can cause electrical conductivity issues and lead to circuit failure. This is particularly problematic in humid environments, such as those found in coastal areas like Chellanam.

Coastal erosion can also lead to physical damage to electronic gadgets, as high winds and waves can cause them to be knocked over or washed away. Additionally, erosion can cause power outages and infrastructure damage that can affect the functioning of electronic devices.

3.13 Education of Students

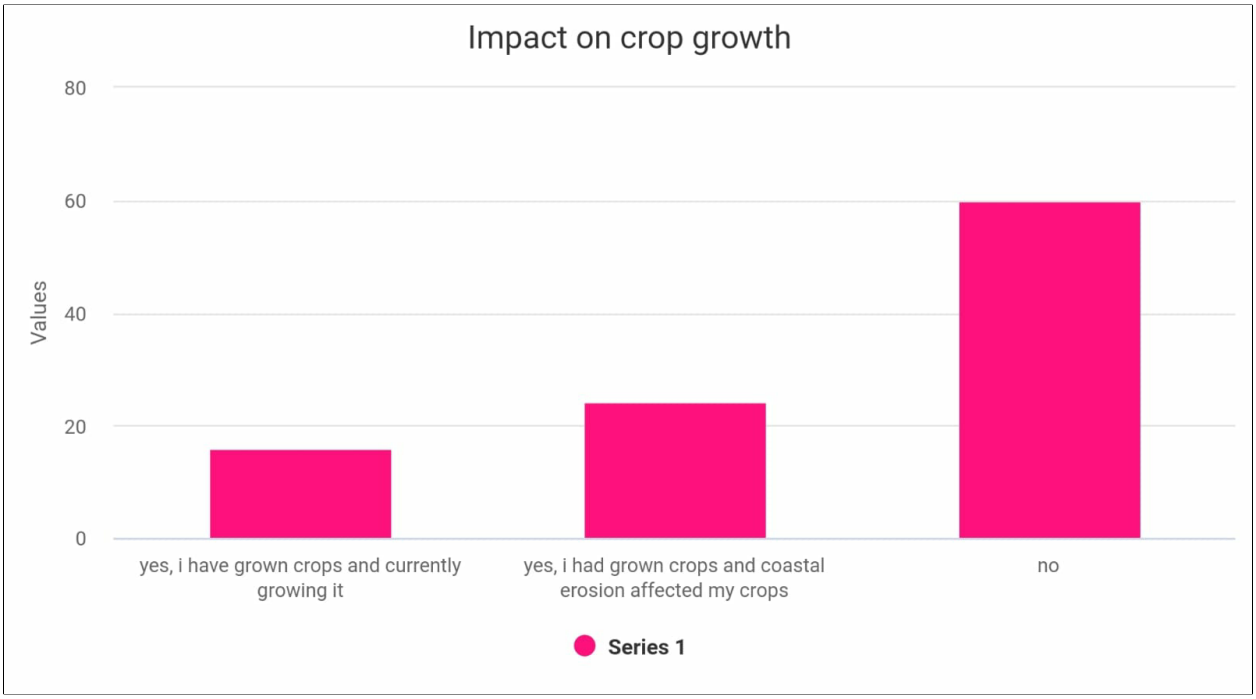


Source : primary data

Fig 3.13

65.2 percent of the respondents stated that the education of their children was adversely affected during the time of coastal erosion and that they were unable to attend classes due to classrooms being made as rehabilitation camps. The roads were also blocked. A few of the children even lost their books and other study materials when seawater entered their houses. 34.8 percent of the rest of the population whose house is situated distant from the sea said the education of their kids were not affected with the coastal erosion and were able to attend classes on a regular basis.

3.14 Impact on Crops



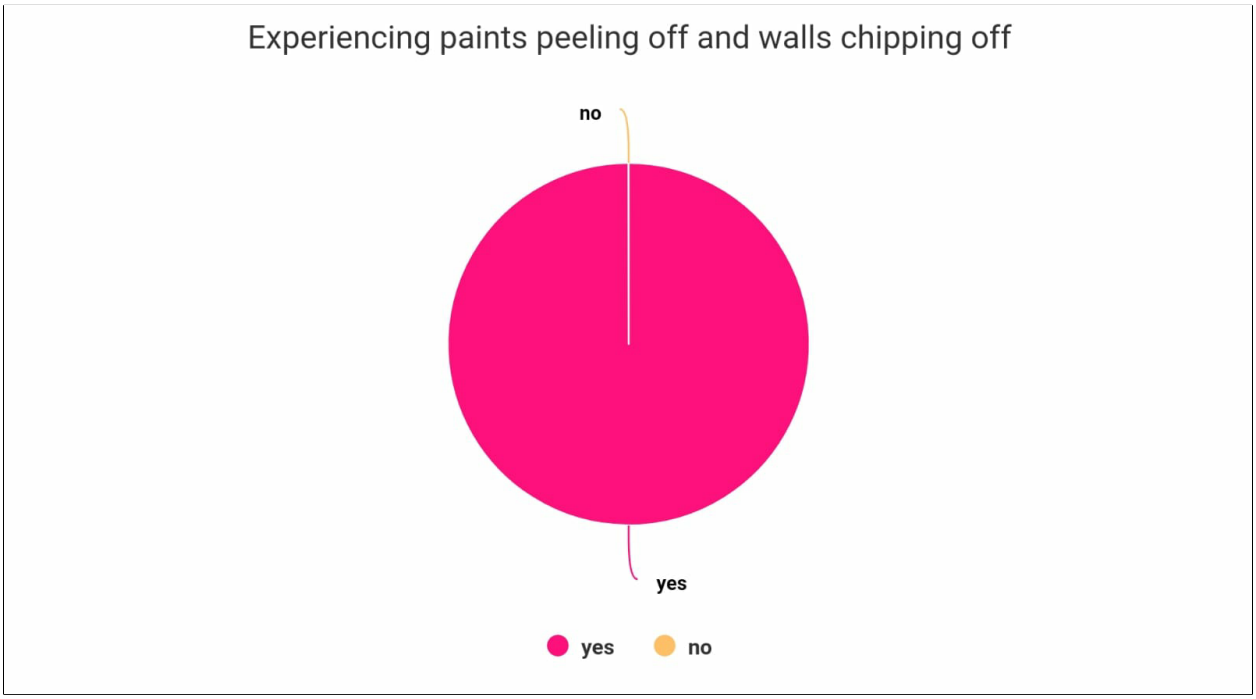
Source : primary data

Fig 3.14

Localities in Chellanam mostly depend on fishing for their livelihood and only a fair few households practice small scale farming. Around 60 percent of the population does not

grow crops or engage in other farming activities as their alternate sources of income. The reasons they claimed are either they lack enough land to grow crops or the soil is not suitable for growing crops, they also assert the frequent coastal erosion being a contributing factor for not growing crops. 15.9 percent of the population growing crops said that they used to grow crops before coastal erosion and still do, although maintenance charges seem high after erosion. 24.1 percent of the rest of the population says that they used to grow crops before the occurrence of coastal erosion but stopped in 2020 after the Tauktae cyclone due to the destruction and losses faced. They also added the land became unfavorable after the coastal erosion to continue growing crops.

3.15 Damaging Effects on Paints and Walls

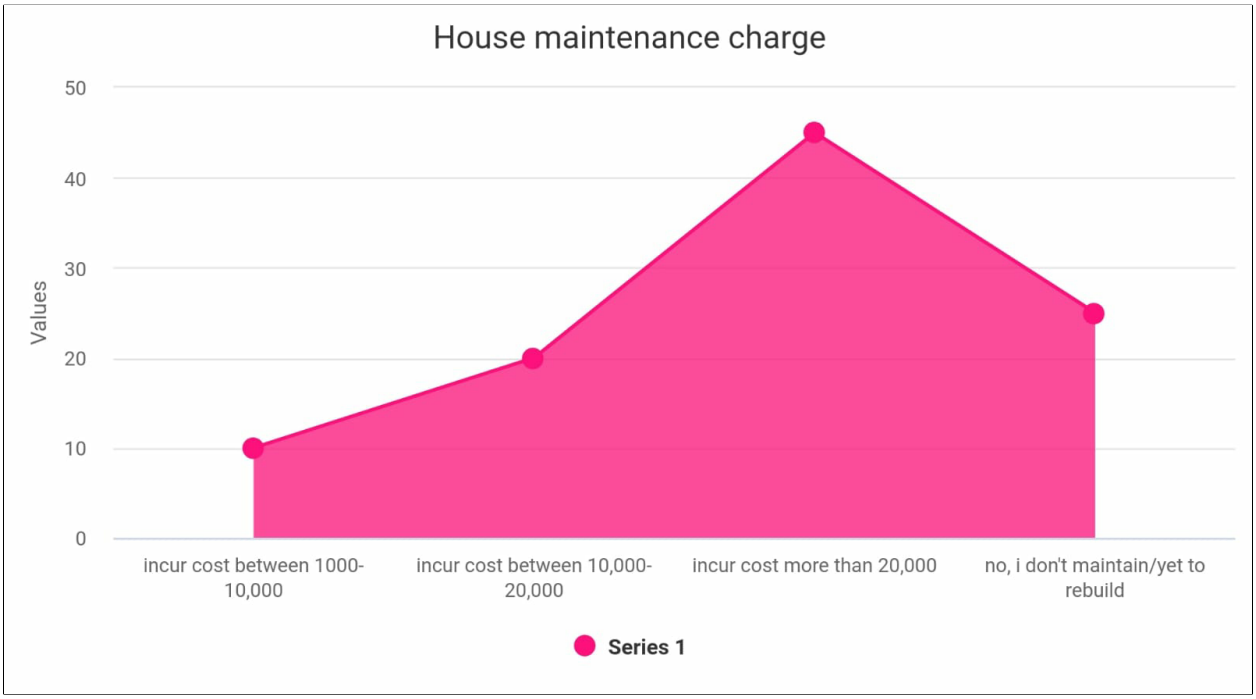


Source: primary data

Fig 3.15

100 Percentage of the people living in the study area experience the problems of walls chipping off and peeling of paints. The main reason that they believe for this to happen is the saline environment that is common in the coastal regions. In the conversation with them, they clarified many other reasons. They pointed out that another reason is that the waves from the sea hit the walls of the houses during the high tide and after that the salt did not leave the walls completely. They were of the opinion that only if the repair work of the house is carried out at short intervals, the walls can be saved from falling off to some extent. They told us that the walls of a stone-built house with painted walls will last for some period, but the walls of a stone-built house without painting will soon crumble.

3.16 House Maintenance

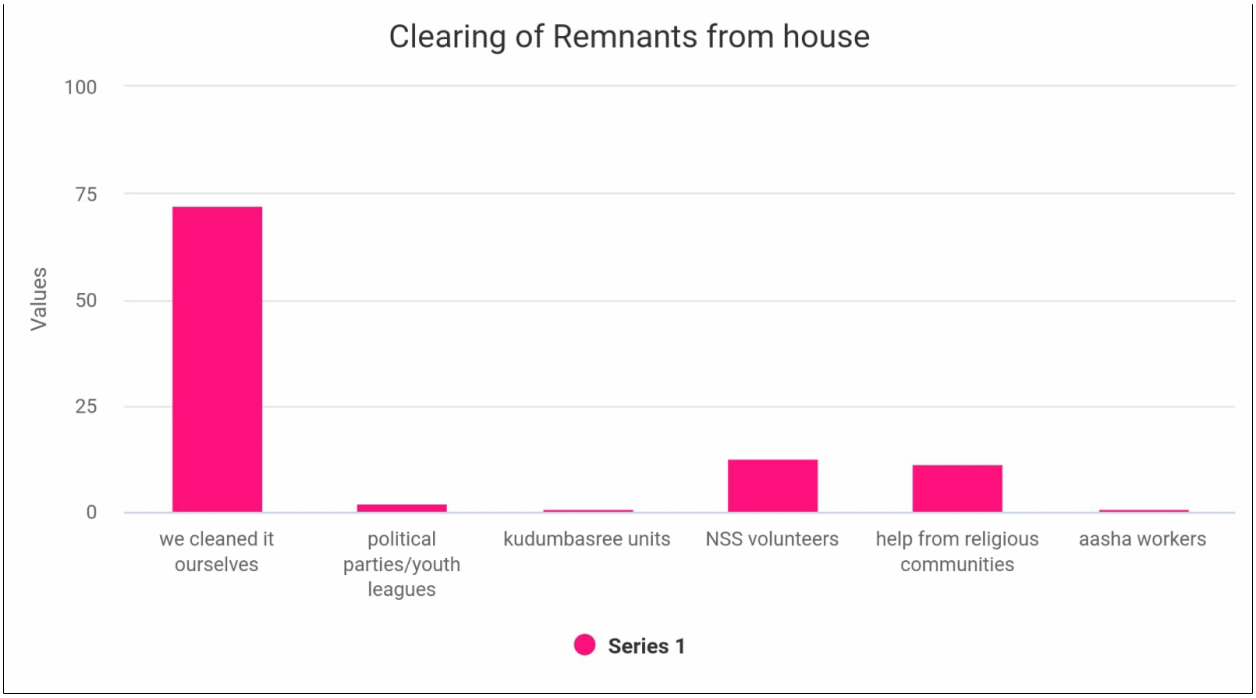


Source : primary data

Fig 3.16

The respondents stated that coastal erosion during monsoon is a thing of no doubt ever since the sea walls were destroyed. They do expect sea water to flood their homes, roads and locality. The erosion will also cause severe to silly damages to their properties as well. After the monsoon erosion, few parts of their houses like walls, will require maintenance as it would have suffered damage. Some of them maintain their houses regularly after each erosion whereas some others find it difficult to afford continuous maintenance and repair works. From the data collected, it is evident that around 45% of the respondents incur more than 20,000 rupees for maintaining their houses after erosion, 20% of the people incur a cost between 10,000 and 20,000 and below 10% of the respondents incur a cost between 1000 and 10,000 rupees. More than 25% of the people find house maintenance to be very expensive and they do not engage in such activities. As a result, their houses have only limited life.

3.17 Clearing of Remnants from House

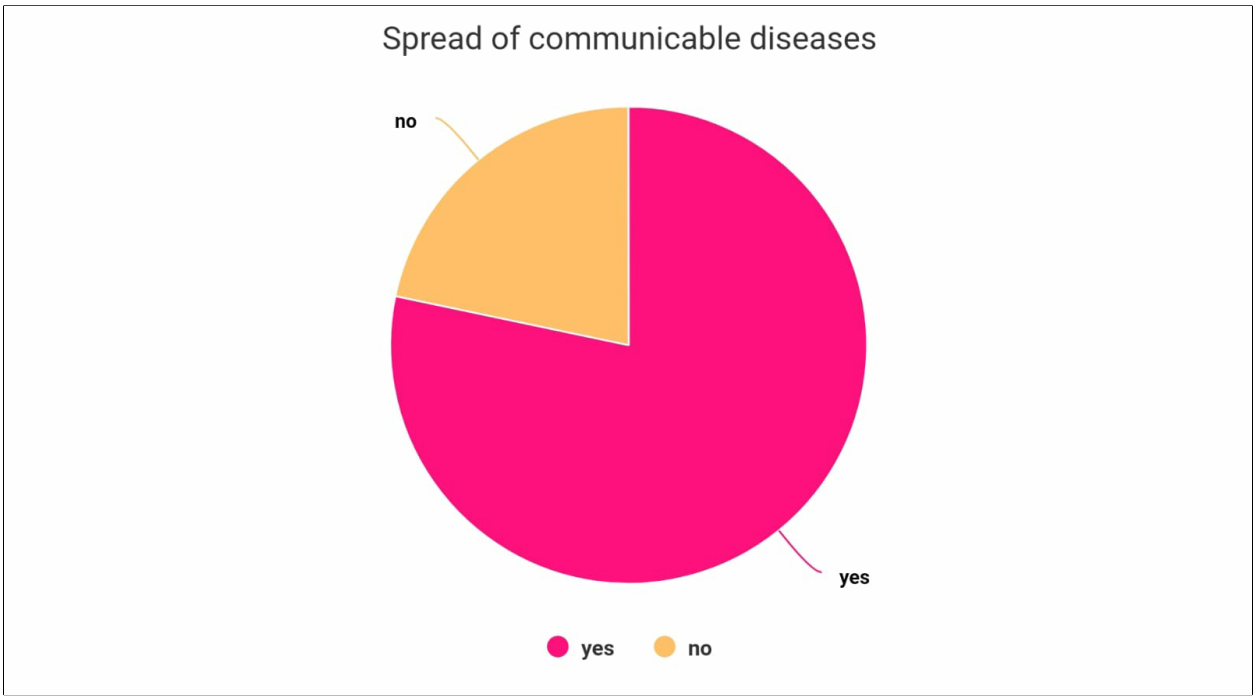


Source : primary data

Fig 3.17

Salt water, mud and soil will enter each house after coastal erosion. Cleaning up all this is a matter of great difficulty but they cannot continue to stay in these houses without cleaning them. Around 72 percent of the households managed to clean the houses themselves. 12.7 responded that NSS volunteers from various colleges helped the households. The other people who helped the respondents to clean their houses include political parties/ youth leagues constituting 2 percent, kudumbashree units constituting 1 percent, religious communities which constitute 11.6 percent and Aasha workers.

3.18 Communicable Diseases

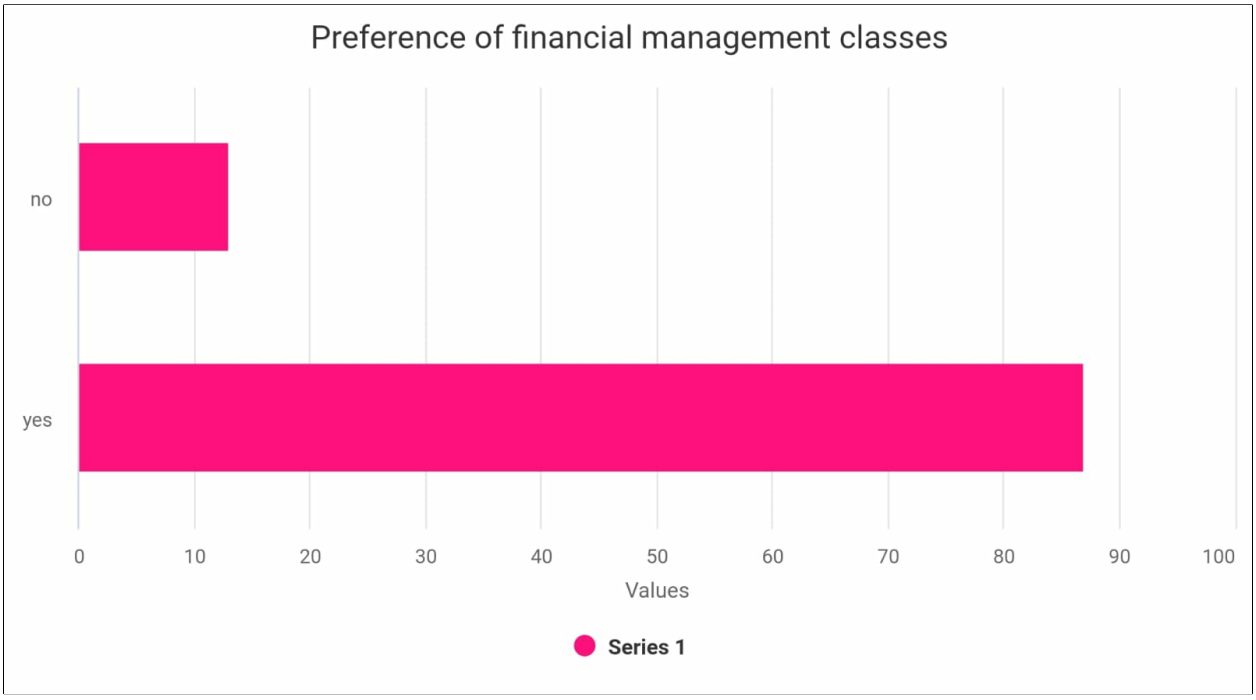


Source : primary data

Fig 3.18

78.3 Percentage of the people of the coastal erosion affected area in the Chellanam Panchayat, were also affected with widespread communicable diseases as per the analysis of the data collected. At the same instant, 21.7 percent of the people living in the affected area were found not being infected with any kinds of widespread communicable diseases. One major disease that transmitted extensively during that period was Leptospirosis, also known as rat fever. Some of the households even shared the hardships that they faced when they were ordered to isolate the patient in a single room, for them it was quite difficult to do so because most of the family members survived in a single room at the time of the calamity. Few of them rented a house, though they could not afford to isolate themselves when they were affected with Leptospirosis.

3.19 Financial Management Classes

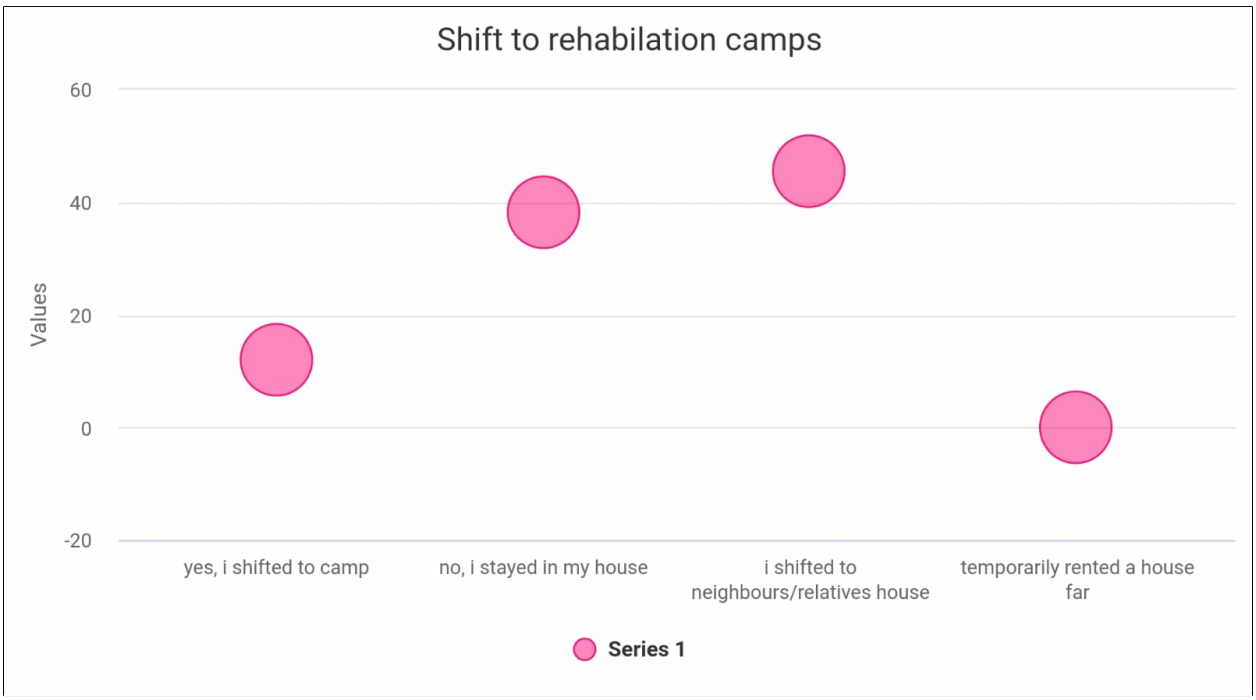


Source : primary data

Fig 3.19

Preference of the households for any kind of financial management orientation and classes were queried. 87 Percentage of them were of the opinion that they do not require any such classes because they don't have any balanced income with them to decide and learn how to manage those funds. They strive hard to meet two ends and have 3 meals per day, spending for basic amenities is their first priority. Many of them claimed that they have only sufficient funds to finance their lives and are not interested in any expert advice, because only if they have money, they have to learn how to manage them. In contradiction to this, 13 Percentage of the people shared their interests in attending financial management classes so as to learn how to mobilize their funds in an efficient and effective manner.

3.20 Rehabilitation Camps

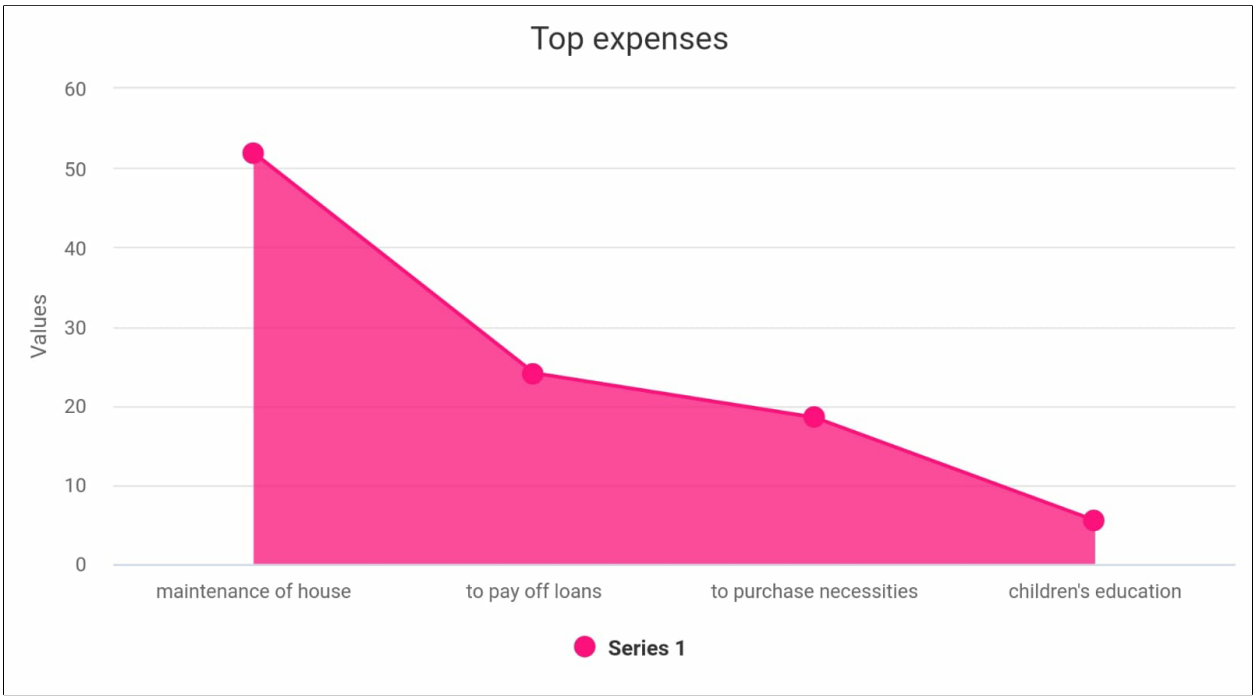


Source : primary data

Fig 3.20

45.5% of the respondents found shelter in their neighbor's homes. People who had two storied homes and trees working on their rooftop, provided shelter for their neighbor's whose houses were flooded in salt water. Despite sea water intrusion, around 38.2% stayed at their own home. Only 12% went to the camps and probably none of the respondents went to rent or shifted to hotels. The camps had limited facilities to accommodate many and the residents were unsatisfied. Many preferred to stay at home, reluctant to leave their belongings. In case the water level rose beyond control, the residents shifted to their relatives or friends' homes.

3.21 Top Expenses

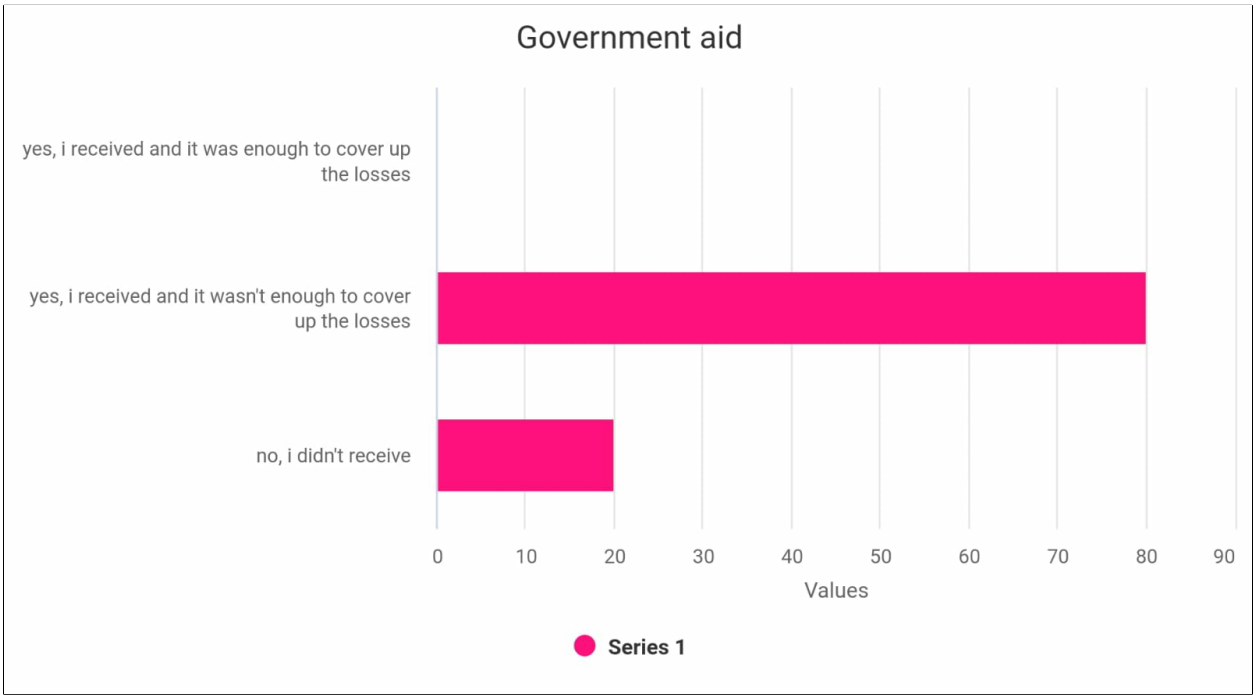


Source : primary data

Fig 3.21

Around 51.9% of the respondents spent their salary or earnings mostly for the maintenance of their houses. 24.1% of them spent their income primly for repayment of their loans, that are taken from Sahakarana banks or kudumbashree. 18.5% of the people spent their income for fulfilling their basic needs. The damages caused by coastal erosion has destroyed and eroded the state of many houses in the locality, people were left to back to square one, rebuilding their lives and standard of living.Many are at the verge of immense financial debt and bankruptcy,leaving them no option but to use majority of their earnings reimbursing the loans taken. People also have limited funds in buying their basic necessities and funding their children's education.

3.22 Government Aid

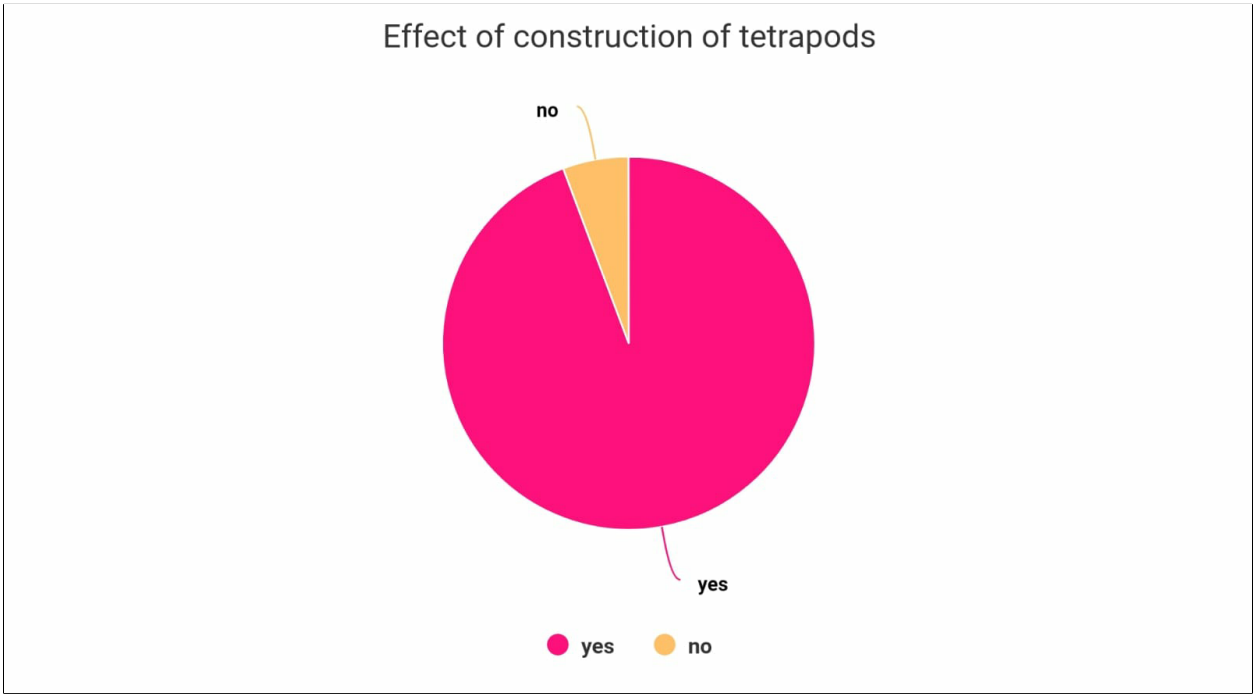


Source : primary data

Fig 3.22

Around 80% of the respondents received aid from the government after coastal erosion. But they are of the opinion that the aid provided by the government was very limited and it was never enough or adequate to cover the losses that they have incurred. The remaining people were not granted any compensation. The panchayat was allowed only a limited sum of money to cover up the entire expenses in the area. They could only allot a certain amount to each of the affected households based on the intensity of the damage caused from within the attained compensation received from the government.

3.23 Construction of Tetrapod's



Source : primary data

Fig 3.23

Tetrapods are concrete structures that are commonly used in coastal engineering to help reduce the impact of waves and prevent coastal erosion. In Chellanam, tetrapods have been used as a coastal protection measure and to protect the shoreline from erosion. They presume that tetrapods provide a natural habitat for marine life, which can help to restore and protect the coastal ecosystem. Majority of the respondent's state that the construction of tetrapods has reduced/stopped the occurrence of coastal erosion. However, so far, the disaster of coastal erosion hasn't occurred since its construction. Now the sea is not even visible from their houses and they seem to be much relieved. On the other hand, some others argue that the tetrapods are laid only in some wards and the remaining area still faces coastal erosion.

CHAPTER 4

FINDINGS RECOMMENDATIONS AND CONCLUSION

This chapter will give ideas about major findings and conclusions of the study and give suitable suggestions and recommendations based on the study of economic impact of coastal erosion in Chellanam.

FINDINGS

- Most of the respondents were between 30 and 70 years of age.
- Highest share of the respondents lives in joint families and the number of members go up till 9 in some families.
- Out of the total respondents, 43.4 percent of the population living in Chellanam earn income below 10,000 per year and they depend mostly on government subsidies for their daily ends meet. This suggests that a major portion of the people residing in Chellanam comes Below Poverty Level.
- Almost all of the inhabitants of Chellanam have been residing there for more than 30 years. Moreover, no new residents have moved into Chellanam in the past year. This is one reason why they hesitate to shift to another location.
- Major source of livelihood of the residents is fishing and it consists of around 43.5 percent of the male population. Others mainly depend on pensions to meet the expenses. The women in the households do odd jobs such as shopkeeping and other domestic works to support living, which makes up 11.6 percent of the

surveyed population. Alternative sources of adding to the income include government schemes such as MGNREGA (Mahatma Gandhi National Rural Employment Generation Act).

- 80 percent of the population admitted lack of proper seawalls being the ultimate reason for the cause of constant coastal erosion in Chellanam. Although 16.4 percent believe it's the dredging of Cochin Port which reduced their distance from the sea and in turn leading to coastal erosion.
- Almost all households surveyed admitted that the Tauktae cyclone which happened in 2020 caused the most destruction to their lives and livelihoods. This was also the time of the widespread of COVID 19. Therefore, people found it even difficult to shift to camps due to fear of spread of the disease.
- Around 25.7 percent of the households living proximate to the sea had lost their house completely and the rest of the households sustained severe damage to their house.
- 45.5 percent depended on government aid to finance the cost incurred on rebuilding houses after coastal erosion and others either borrowed or used up their savings to meet the expense that couldn't be done with the government aid.
- Around half of the affected population were deprived of proper drinking water and sanitation at the time of the disaster and had to depend on other organizations and the panchayat to provide them with bottled water to meet the basic needs for days. 31.4 percent of the residents also faced food shortages for days. Yet they have said they received emergency kits consisting of basic needs including food and bottled water from volunteers and panchayat.
- Network unavailability was the major issue faced at the time of coastal erosion. Almost all households faced disconnections and were not able to communicate with the rest of the world. There was no supply of electricity for 4 days and cell phones were down.

- Residents have also confirmed that their electronic gadgets often get damaged and rusted more than often and in a span of 5 months, they have to either repair it spending a major part of their income or buy new ones to replace it. This is due to the constant salt winds.
- 98.6 percent of the residents have faced transportation issues and that at the time of coastal erosion, they couldn't move out of their house to get basic necessities or even medications for the ill. These include service roads, footpaths, main roads etc.
- Classes of students got hindered for months since the schools were kept as relief camps. A lot of their houses were flooded with water and some students even lost their books for study.
- All inhabitants claimed that they experience frequent paint peeling and walls chipping off due to the constant exposure to the salt winds and that every year, they have to spend a major proportion of their income on house maintenance. And the maintenance cost incurred is more than 20,000 per household a year.
- Residents said that they cleaned the remnants from and around their house after coastal erosion. There were other NGOs, NSS, NCC volunteers who helped with the panchayat in clearing the main roads and other public spaces.
- 31.4 percent got affected with COVID 19 at the time of coastal erosion 2020 and they couldn't go to camps and had to stay at home quarantined.
- Only 12.5 percent of the affected households shifted to rehabilitation camps. 39.3 percent stayed at their houses and 44.6 percent of the residents shifted to their relatives house for the time period.
- 50.9 percent of the residents spend their entire income for house maintenance every year. 25.5 percent have to spend their income paying on loans and the rest for buying basic necessities.

- Chellanam, being a coastal area, has been impacted by several natural calamities in the past, including Tauktae cyclone, Okhi cyclone, and the 2004 tsunami. The impacts of these events have been significant, and their effects can still be felt in the area.
- Tauktae Cyclone: Tauktae cyclone hit the coast of Kerala in May 2021. The cyclone caused significant damage to the coastline of Chellanam, with high waves and strong winds leading to coastal erosion and flooding. Several houses and fishing boats were damaged, and many people were displaced from their homes.

- Okhi Cyclone: Okhi cyclone hit the coast of Kerala in November 2017. The cyclone caused significant damage to the fishing communities in Chellanam, with many fishing boats destroyed, and several fishermen reported missing.

- 2004 Tsunami: The 2004 Indian Ocean tsunami had a devastating impact on the coast of Chellanam. The tsunami caused significant damage to the fishing communities in the area, with many fishing boats destroyed, and several fishermen lost their lives. The tsunami also caused coastal erosion and flooding, leading to the displacement of many people from their homes.

- The impacts of these natural calamities have been severe, and they have had long-lasting effects on the lives and livelihoods of the people in Chellanam. To address the impacts of these events, it is essential to invest in disaster preparedness and management, including early warning systems, evacuation plans, and resilient infrastructure. Additionally, measures such as the restoration of natural barriers, such as mangroves, and the regulation of sand mining can help to mitigate the effects of coastal erosion and flooding.

- When asked if residents prefer relocating with government aid to another city, only 6.1 percent have agreed and the rest of the community denied. The residents also said that they were unsatisfied with the government aid received and were not able to compensate for their loss. They had to find other sources for money such as borrowing, loans, using savings or gold to meet the expenses caused by coastal erosion.
- Punargeham scheme which offers Rs 10 lakh to every family willing to relocate from the sea coast who lives within 500 meters from the sea shore to a safer place. Rs 6 lakh are given for the purchase of land and the rest Rs 4 lakh for the construction of a house. Almost all residents declined the offer. They claim their sole income is through fishing and that they do not know any other skilled work other than fishing and are aware that 10 Lakh is insufficient for constructing a new house in a new city.

4.2 RECOMMENDATIONS

- Residents should be provided with information about new grants and schemes provided by the government. Awareness about various benefits that they can redeem must be provided without fail.
- Coastal erosion in Kerala remains a significant environmental and socio-economic challenge, and addressing it will require a comprehensive and sustainable approach that balances the needs of human development and environmental protection.
- The impacts of coastal erosion in Kerala are significant and far-reaching, affecting both the natural environment and the human population. It is important for local governments and communities to take steps to mitigate these impacts, such as implementing coastal protection measures, promoting sustainable land use practices, and investing in alternative livelihoods for affected communities.
- A combination of structural measures, natural solutions, and regulatory frameworks can help prevent coastal erosion in Kerala.
- To address the impacts of coastal erosion, it is essential to take measures to mitigate the effects of climate change, such as reducing greenhouse gas emissions, and investing in disaster preparedness and management. Additionally, measures such as the restoration of natural barriers and the regulation of sand mining can help to mitigate the effects of coastal erosion in Chellanam.
- Improving the working conditions and legal protections of domestic maid workers in Chellanam is essential to promote decent work and reduce poverty in the area.

- The fishermen community should receive more income to meet their daily needs. The government should take measures to ensure minimum wage for the fishermen.

- Fishermen should be provided with alternative employment opportunities when they face a no income period due to unfavorable weather conditions (they are unable to go to sea for fishing in extreme weather).

- Easy loans and financial assistance should be granted for annual house maintenance and other basic needs.

- Free medical camps must be organized for the regular health checkup of the residents.

- Government should implement policy interventions such as a comprehensive coastal management plan and a property buyout program. These interventions would help mitigate the impact of coastal erosion on the community and protect the town’s economic interests.

4.3 CONCLUSION

Coastal Erosion had a significant impact on the town. It had severely affected property values, fishing industry and tourism. The residents in Chellanam are one among the most economically disadvantaged communities in India. Fishermen communities who constitute the sole earner of each household work hard and take much effort to meet their standard of living. They face a lot of barriers such as not having a regular secure income base. All families have a poor financial background because their meals consist of ayala fry and rice every day. The community should be provided with more subsidies and grants from the government. They lack skills for other job opportunities which should be arranged by the government, along with treatment for health hazards. Salt winds are also a current issue being faced by the localities which damages their electronics and leads to high house maintenance which should be dealt with. It is imperative that policymakers and stakeholders take proactive measures to mitigate the impacts of coastal erosion, to ensure the long-term viability of the communities and coastal ecosystem.

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