Shoreline Changes and its Impact on Fishing Communities

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Abstract

The fishery system plays a major role as the engine of the coastal economy providing local economic benefits, foreign exchange and employment. Conservation of shoreline area is essential for the existence and well-being of the fishing community. This paper identifies the reasons for shoreline changes and its impact on fishing community. This paper focused on opportunities for the improvement of life of fishing communities. This study will explore the practical concerns among the fishing community and suggest viable measures for making it more effective. The study will also examine the present scope of existing sustainable and resilience measures. The study is based on primary and secondary data. Primary data is available from the fishing communities in Chellanam. Primary data on socio-economic conditions of fishing community will be undertaken by using techniques including semi structured questionnaire, personal interviews and observation methods. The secondary data were collected from the published and unpublished sources of various coastal management Department, Government offices, School of Marine Industrial Fisheries and from various websites of Department of Fisheries, Ministry of Commerce, Ministry of Food Processing Industries and from books, Journals, International and National working papers.

***Key words**: Sustainable Shoreline, Fishing Communities, Coastal Economy, Conservation of Shoreline, Resilience measures.*

1. INTRODUCTION

Fisheries sector plays an important role in the socio-economic development of Indian economy. It contributes significantly to the national income, exports, food security and nutritional value and productive employment generation. Fish production in India reached 14.16 million metric tons in 2019-20. The Gross Value Added (GVA) by the fisheries sector to the national economy is 1.24 per cent of the total national GVA and 7.28 per cent of the agricultural GVA. The fisheries sector provides the principal source of livelihood for marginalised groups of people, especially in the coastal areas. This sector is the fastest-growing agriculture and allied sector in the economy. The COVID pandemic and sluggish overseas markets cast their shadow over India's seafood export sector exported US$ 5.96 billion during 2020-21. USA, China and the European Union (EU) were the leading importers, while frozen shrimp retained its position as the major export item followed by frozen fish.

According to the 'The State of World Fisheries and Aquaculture 2018-Meeting the sustainable development goals' published by Food and Agriculture Organisation (FAO), among the countries in the world, India ranks second in inland waters captured fish production and sixth in marine captured fish production. India is also a major producer of fish through aquaculture and ranks second in the world after China. Kerala has 593 km of coastline and more than 50 percent of the coast is occupied with artificial structures like groins, seawall, ports and fishing harbours. Shoreline changes are at a momentum due coastal protection structures and economic development activities. It is better to monitor and analyse shoreline changes for effective planning and sustainable shoreline management. Kerala situated on the southwest coast of India Large scale displacement are need of the era due to rapid coastal erosion and increasing trend of economic growth and development. Kerala has nine coastal districts and about 600 km shoreline is densely populated.

NCCR (2018) analysed that more than 40 per cent of erosion is noticed in four states i.e. West Bengal (63 per cent), Pondicherry (57 per cent) Kerala (45 per cent) and Tamil Nadu (41 Percent). Chenthamil Selvan S et.al.(2019) revealed that the accretion/erosion pattern of shoreline change on either side of breakwaters was varying from place to place. The effectiveness of the coastal protective seawall was very minimal which highlighted that proper planning of any artificial structures is the basic requirement for effective management of the coast. The Shoreline change status of the Kerala coast showed that 45 per cent of the coast is eroding and 34 per cent of the coast is in stable condition. Only 21 per cent of the coast is of accreting nature. Noujas V et.al (2020) envisaged that Vengurla embayed beach is not only affected by various anthropogenic modifications including the destruction of sand dunes but also by future climate-change projections and proposed the implementation of a dune-based shoreline management plan with strict regulations and awareness program. S Chenthamil Selvan et.al (2014) emphasised that remote sensing satellite images have been used effectively for coastal shoreline change monitoring along the coast. The study revealed change rate was classified into three categories indicating the accretion, low erosion and high erosion locations due to variation in coastal processes, land runoff and geomorphologic units influencing the coast. Shyam et al, (2014) commented in their paper that minimal awareness of climate change evidently indicates the fishers' inability to find a correlation between environmental changes due to climate change to their livelihoods. Allison et al.(2005) opinioned that changes in climate change often lead to loss of fishing days due to bad weather, increasing loss of nets, traps and longlines, damages to craft, gear and shore facilities, increased mortality among fishermen, and catastrophic collateral damage to coastal communities. The study identified the reasons for shoreline changes and the constraints faced by the Chellanam fishing community.

2. STUDY AREA

The study area is located in Kerala, the south western state of the country. Chellanam is situated 25 km away from Kochi, in Ernakulam district of the state. Chellanam is a coastal panchayath with total coastline of 17.5 km. The geographical area of Chellanam panchayat is 812 hectares. Chellanam has a total population of 14,928 people. There are about 3,446 houses in Chellanam village. Figure 1 illustrates the location of the study area.

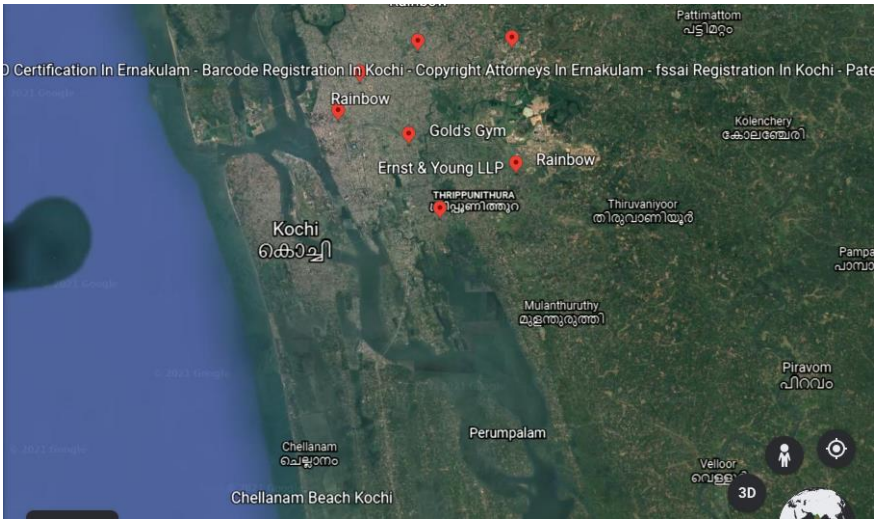


Figure1. Shoreline of Study Area

Source: https://earth.google.com/web/search/CHELLANAM+SHORELINE+CHANGES

As per 2019 stats, Chellanam villages comes under Kochi assembly and Ernakulam parliamentary constituency. Total literacy rate of Chellanam is 94.02 percent for male literacy is 94.92 percent and for female literacy rate is 93.14 percent.

3. Review of Literature

Pontee et.al (2008) examined the approaches that have been developed in the UK to achieve sustainable shoreline management. The main facilitator of this is adopting a strategic framework at a national scale by which coastal flood and risk management in the UK has vastly improved. They highlighted the best methods to assist the coastal communities in adapting to climate change. They also examined that it is necessary to start planning for these changes as early as possible to enable communities to prepare for change. They envisaged several tools and approaches that have assisted the delivery of sustainable coastal policies in the UK which can also be used to promote sustainable shoreline management at each country level.

Varangalil Noujas et.al (2017) tested the performance of transitional groynes for the southwest coast of India with two pilot groynes and found that two separate transitional groyne fields with a maximum length comparable with surf zone width is best for managing erosion of the Panathura coast. And they observed that beach forms uniformly in all the groyne cells and these groynes help the coast to have a beach during the non-monsoon season which reduces the monsoonal wave attack on the coast.

Mascarenhas, A., and Jayakumar, S. (2008) investigated Tamil Nadu seaside about the changes after the tsunami which happened in December 2004. They described the importance of sand dunes bel and forests to the rescue of habituation and humankind. The event damaged sand dunes, ripped dune vegetation, created new water bodies and shattered high-value assets.

Rajesh Das Gupta and Rajib Shaw (2013) examined the legislative framework formed for conserving mangrove forests along the coastline during the time period of development of Indian forest management. According to them, during the period 1952-1999, there were many gaps and incomplete implementation of many policies that led to the degradation of

Mangroves. As suggested by them there were many issues with the Joint Mangrove Management such as lack of management and lack of motivation. An effective management focus should be on the implementation or execution side.

Divya Karnad et.al (2013), examined fishermen's perceptions about the state of fish stocks and document current fishing practices in India. In their studies, they predicted that fish stocks are on the decline there is little evidence that these declines are being countered by changes in their fishing regulations or fishing practices.. They identified non-compliance with regulations and government incentives as an important livelihood opportunity. They recommended strengthening local fishing communities by enabling them to enforce fishing regulations locally and scaling back existing government incentives to protect the sustainability of fisheries.

Nadesan Usha et al (2015) was conducted a study which focuses on monitoring long-term shoreline changes along Tamil Nadu. They conducted this study with the help of geospatial techniques. They concluded that most of the coastal areas showing accretion. Pattern of waves are the one of the reasons for configuration of shore line position.

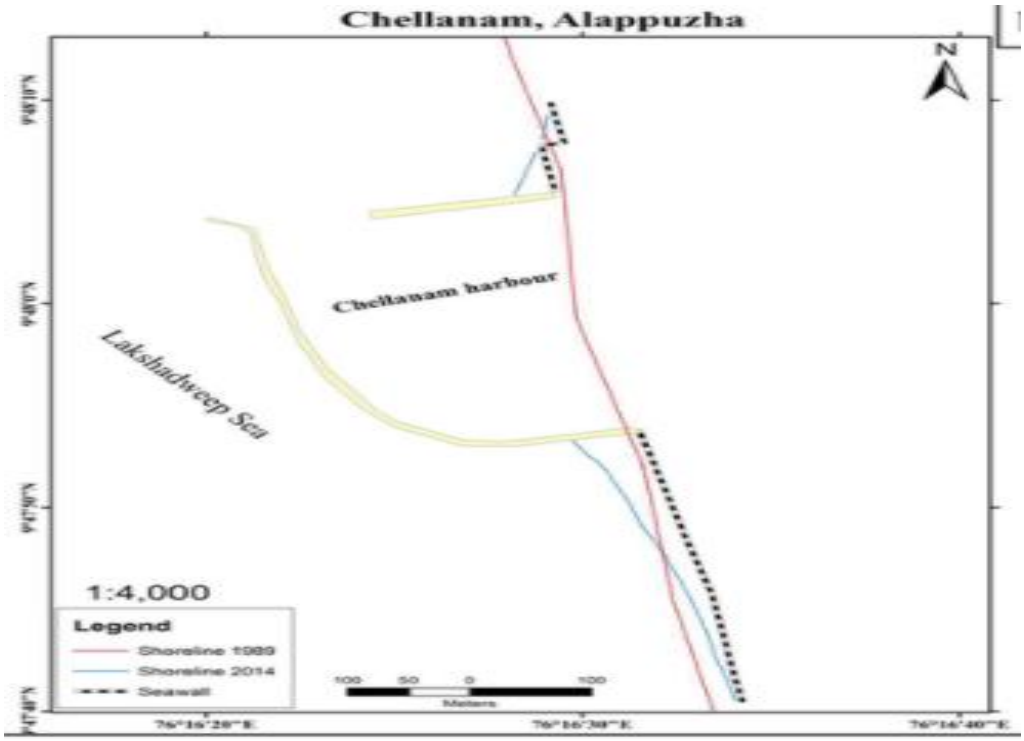
4. Materials and Methods

The study is based on primary and secondary data. Primary data is collected from the fishing communities in Chellanam. Primary data on socio-economic conditions of fishing community will be undertaken by using techniques including semi structured questionnaire, personal interviews and observation methods. The secondary data were collected from the published and unpublished sources of various coastal management Department, Government offices, School of Marine Industrial Fisheries and various websites of the Department of Fisheries, Ministry of Commerce, the Ministry of Food Processing Industries and from books, Journals, International and National working papers. This paper identifies the reasons for shoreline changes and its impact on the fishing community. This study will explore the practical concerns of the fishing community and suggest viable measures for making it more effective. The study will also examine the present scope of existing sustainable and resilience measures.

5. RESULTS AND DISCUSSION

Natural causes of shoreline changes are action of waves, winds, tides, nearshore currents, storms and sea-level rise. Anthropogenic causes are the construction of coastal structures, mining of beach sand, dredging of tidal entrances and navigational channels and destruction of mangroves and other natural buffers. Figure 2 shows the long-term shoreline change at Chellanam Coastal area from 1989 to 2014. The red colour line shows the shoreline of 1989, the blue colour line shows the shoreline of 2014 and the black colour dotted line are seawalls. Figure 3 shows the shoreline mapping between 2015 to 2021. Eroded and Accreted areas are clearly shown with different colours. Red colour shows Erosion, Green colour line, Accretion, Yellow shows Moderate Accretion, Magenta colour indicates Moderate Erosion.

Figure 2 Long Term Shoreline Change at Chellanam from 1989 to 2014.



Source: https://www.researchgate.net/figure/Long-term-shoreline-change-at-a-Chethi-b-Chellanam_fig7_327844147

Figure 3: Shoreline mapping of Chellanam from 2015-2021

Source: The LANDSAT 8 (OLI/TIRS)]

The major challenges faced by Chellanam are conservation of shoreline and renovation of eroded beach line. The scientific and sustainable measures have to be concerned with the foremost accomplishment of Chellanam. The main reasons for Shoreline erosion due to the construction of the fishing harbour, regular dredging for the deepening of the Shipping Channel by Cochin Port Trust and other coastal developmental activities. Natural and manmade coastal transformations have a large-scale displacement of fishing communities are inevitable.

Primary data collected from 30 respondents for the assessment of shoreline changes using the Henry Garrett Ranking method. Garrett Method is used to assess the ranking of respondents that converted into certain ranks. The Garrett method is done by calculating the respondents' data as a factor of the per cent position value using this equation.

Percent Position= 100(Rij -0,5)/Nj.

Where Rij is the value of the i variable given by the respondents to j, while Nj is the total number of factor variables assessed. The result of the percentage position is converted into Garrett value using the Garrett ranking conversion table. The value of R ij is multiplied by the Garrett Value to determine the Garrett score. The average Garrett score is then calculated by dividing the total Garrett score by the total respondents. The ranking is done on the basis of the highest a rage value. The calculation of the percentage of positions as well as conversion into Garret score are shown in Table 1 and the average Garrett score and raking are shown in Table 2.

Table 1 The Percent Position AND GARRET Score.

Factor Variables	Percent Position	Garrett Score
F1-Sea Level Rise	10	75
F2- Increased in surface temperatures	30	60
F3- Incidence of Natural calamities	50	50
F4- Reducing Sea Depth	70	40
F5- Change in Rainfall	90	25

Source:Primary Survey2021

Table 2 THE AVERAGE GARRET SCORE AND FINAL RANK OF FACTOR VARIABLES

FACTORS	TOTAL SCORE	GARRETT MEAN SCORE	RANKING
F1-Sea Level Rise	1630	54.33	2nd
F2- Increased in surface temperatures	1490	49.67	3rd
F3- Incidence of Natural calamities	1995	66.5	1st
F4- Reducing Sea Depth	1185	39.5	5th
F5- Change in Rainfall	1425	47.5	4th

Source: Primary Survey, 2021.

On the basis of the ranks assigned by the sample respondents the challenges of shoreline changes are analysed through Garrett Ranking Technique. Incidence of natural calamities rank first as threat faced by Chellanam Grama Panchayat, followed by Sea level rise, increased surface temperature, change in rainfall and finally reducing sea depth.

The survey observed that the Chellanam area does not have a proper drainage system and roads. Coastal people are mainly dependent on private transportation and private hospitals due to the absence of enough public transportation and sufficient facilities in government primary health centers in Chellanam and Kandakadavu. People are facing a lot of issues related to sewage tanks after this coastal erosion. 77 percent of the people are facing drinking water issues, mainly the people from Chalakkadavu ward are facing this problem intensively. 79percent of the coastal people depend on fishing for their livelihood and the remaining percentage includes self-employees and government employees. About 89 percent of people in Chellanam are daily breadwinners for their livelihood. 59 percent of people in Chellanam are having secondary education, 32 percent have higher education and the remaining 9 percent are having primary education.

5.1 Shoreline Conservation Strategies

Chellanam Panachayath adopted measures like seawalls, groynes and geotubes. The Government of Kerala has constructed seawalls for protecting shorelines, but the seawalls have an adverse impact on the equilibrium of shorelines. When water waves from the sea attack on sea walls, the waves are reflected due to the hard surface of the wall. These reflected incoming gravity wind waves of water superimpose on each other leading to generating more wave height than the incident wave height. The larger wave heights lead to circulation. This circulation is

responsible for the suspension of deposited sediments and their lateral movement causes again erosion in that part. The uprooting of these sediments in the surrounding region further causes scouring of the toe of the seawall, leading to damage to the foundation of the wall. This adds to the maintenance cost. So instead of mitigating the problem, the seawalls simply divert the wave attack and that cause adverse effects in surrounding nearby locations. The construction of groynes is a permanent solution and protected with tetra pods 3 to 4 tons more durable in nature. Tetrapod blocks are used for preventing seawater invasion at Marine drive, Mumbai. Another method is dumping the geo-tubes in the near-shore seawater. It is well known that wave breaking corresponds to the dissipation of wave energy and it depends on the depth of water. This dumping of geo-tubes, enhances the wave breaking by providing dummy shallow depth and hence wave dissipates the energy before reaching the shore. Thus the wave attack is reduced and sand or sediments at the coast are preserved. This geo-tube method is used in Dahanu, Maharashtra. As the tube basically contains sand, this only requires initial capital but requires continuous maintenance for monitoring sea bed levels and have to avoid tube punctures. Other methods like bio-shielding is a soft method of beach nourishment that is suitable for lessening the damage in coastal areas. For disaster reduction risk management community participation is an essential part, Chellanam Grama panchayath organised a Community participation planning programme initiated for reducing the risk and disaster in the Chellanam Panchayath.

6. CONCLUSION

The shoreline area of Chellanam is one of the most densely populated area. The need of the hour is for a resilience plan and ensure the safety to the lives and properties of the fishing communities of Chellanam and for sustainable shoreline measures that are essential throughout the shoreline. Conservation of shoreline area is essential for the existence and well-being of the fishing community. This paper emphasises on opportunities for the improvement of life in fishing communities. The real beneficiary is the fishing community and other coast inhabitants will be benefited indirectly. Economics of Information on shoreline changes is important for the planning of disaster reduction risk management measures and the development of socio-economic overheads in the coastal belt. Efficient and efficacy protection measures will reduce the socio-economic and environmental impact and which would be taken for the success of a sustainable shoreline. An integrated coastal zone management program is essential for the protection of coastal resources.

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