The Impact of Vizhinjam International Seaport on Traditional Fishing Livelihoods

Submitted to the School of Maritime Management, Indian Maritime University in fulfilment for the requirements for the award of degree of MBA in International Transportation and Logistics Management

by

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INDIAN MARITIME UNIVERSITY

(A Central University, Government of India)

CHENNAI CAMPUS

May 2025

SCHOOL OF MARITIME MANAGEMENT INDIAN MARITIME UNIVERSITY

(A Central University under the Ministry of Ports, Shipping and Waterways)

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Certificate

This is to certify that the project report titled **" The Impact of Vizhinjam International Seaport on Traditional Fishing Livelihoods"** is a Bonafide work done by **SANDEEP S NAIR (Reg.No: - 2303305035)** in partial fulfilment of the requirement for the award of the degree of Master of Business Administration in Indian Maritime University, Chennai.

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External Viva- vocc examination conducted on: - 28/5/25

28.5.25

External Examiner:

Place: Chennai

Date: 28.5.25

DECLARATION

I, **SANDEEP S NAIR,** do hereby declare that the dissertation entitled **" The Impact of Vizhinjam International Seaport on Traditional Fishing Livelihoods"** is exclusively a Bonafide work done by me under the supervision and guidance of **Dr. Emil Mathew,** Assistant Professor, School of Maritime Management and is submitted to Indian Maritime University in partial fulfilment of the requirement for the award of the degree of Master of Business Administration.

I further declare that no part of this report has been previously submitted to any other university or academic body for the award of any degree or diploma.

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ACKNOWLEDGEMENT

I extend my sincere gratitude to **Dr. B. Swaminathan**, Head of the Department, School of Maritime Management, Indian Maritime University, for his valuable encouragement and support throughout the course of this study. I am especially thankful to **Dr. Emil Mathew**, Assistant Professor, School of Maritime Management, for her insightful guidance and dedicated supervision in the completion of this dissertation titled **"The Impact of Vizhinjam International Seaport on Traditional Fishing Livelihoods."** Her continuous motivation, constructive feedback, and academic direction have been instrumental in shaping the quality and direction of this research.

I am deeply grateful for the unwavering motivation and support extended by my family and friends throughout this journey. Their encouragement and understanding have been invaluable, and I sincerely appreciate the contributions and goodwill of all loved ones who played a role in helping me bring this project to completion.

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CHAPTER I

INTRODUCTION

1.1 ABOUT THE INDIAN PORT SECTOR

India, with its long coastline of more than 7,500 kilometers, is well placed along major international sea trade routes. This has enabled the nation to establish a strong port industry, which has become the backbone of economic development and foreign trade. The Indian port network consists of 13 major ports and more than 200 non-major ports that together receive about 95% of India's international trade by volume and about 70% by value. Being one of the rapidly growing major economies, India's port industry has a crucial role in enabling commerce, sustaining industry, and integrating the country with global supply chains.

The modernization and upgrading of port facilities have always remained a priority with the Indian government. Projects like the Sagarmala Project and Maritime India Vision 2030 look to enhance port efficiency, lower logistics costs, and foster port-led industrialization. These policies focus on creating deep-draft, all-weather ports capable of handling large cargo ships and minimizing the need for transshipment facilities abroad. Among the numerous new initiatives planned under this maritime agenda, the Vizhinjam International Deepwater Multipurpose Seaport in Thiruvananthapuram, Kerala, is notable for its strategic depth, closeness to international shipping routes, and potential to emerge as a major transshipment center in South Asia.

Adani Group's Vizhinjam Port, jointly developed with the Government of Kerala, will have the capability to accommodate megaships and offer direct shipping services to the Middle East, Europe, and the Far East. Its strategic location, merely 10 nautical miles away from the East-West shipping axis, provides a natural edge over the other ports in the area. Once commissioned, Vizhinjam will help substantially cut India's dependence on foreign ports such as Colombo, Dubai, and Singapore for transshipment, thus saving fuel and enhancing national logistics efficiency.

But the creation of such huge infrastructure projects, though good for trade and industry, tends to have far-reaching environmental and social impacts—particularly in ecologically sensitive and community-dependent areas such as Kerala's coast. Among the most impacted groups in this context are the local fishers. The Vizhinjam area has been inhabited for generations by thousands of small-scale and artisanal fishers who rely directly on ocean resources for their living. The construction of the port, dredging, and land reclamation have also created severe concerns regarding coastal erosion, loss

of habitats, and lower fish catch, all which pose dangers to the economic and cultural sustainability of these traditional communities.

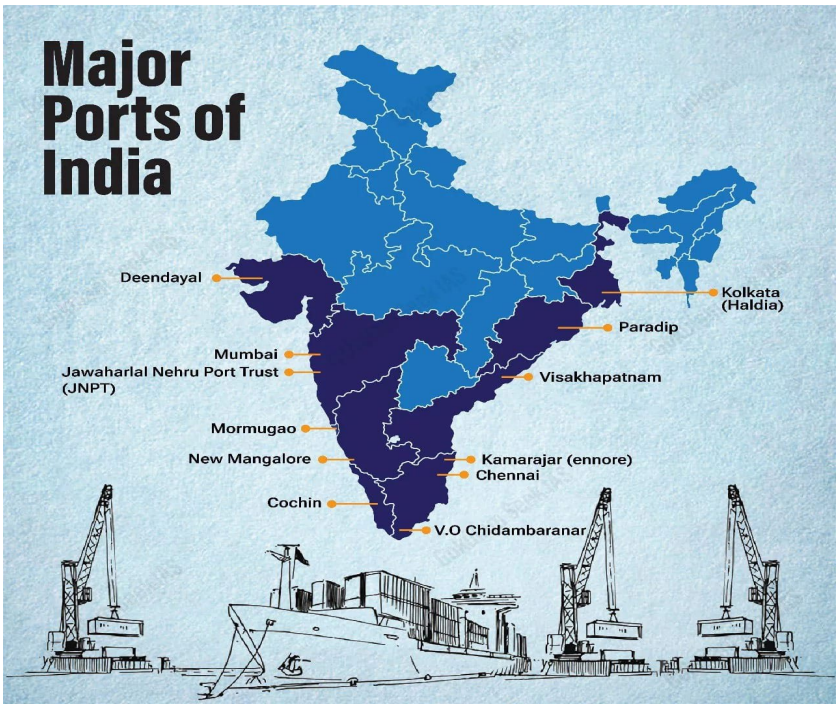

Figure 1 Indian major ports(website)

Fishing is not merely a livelihood but also a way of life for coastal dwellers. Kerala, where food security and livelihood depend heavily on fisheries, feels the impact of disturbance to marine systems or access to fishing instantly and perpetually. Displacement, loss of livelihood, and poor rehabilitation were mentioned by fisherfolk in initial reports and protests as primary concerns resulting from the Vizhinjam port project. These socio-environmental dynamics pose critical questions about the trade-offs between sustainable development and sustainability, especially when the interests of marginalized communities are in danger of being silenced.

This study proposes to examine the effect of the Vizhinjam port on fishing communities, considering the effects on marine ecology, fishery patterns, economic displacement, and community resilience. Placing this case study within the overall context of India's port-led growth agenda, the project proposes to assess if equitable and inclusive growth is being delivered or at the expense of conventional livelihoods and ecological equilibrium.

1.2 VIZHINJAM TRANSSHIPMENT PORT

The Vizhinjam International Deepwater Multipurpose Seaport, situated off the coast of Thiruvananthapuram in Kerala, is a landmark infrastructure project that has the potential to redefine India's maritime commerce profile. Built by the Adani Group in partnership with the Government of Kerala, the Vizhinjam port is being constructed as a cutting-edge transshipment facility—a facility that can accommodate the world's largest container vessels and break India's cargo redistribution dependence on foreign ports.

What distinguishes Vizhinjam is its superior geographic location. It lies only 10 nautical miles from the international east-west shipping route, one of the world's busiest—so it is a natural stopover for ships carrying cargo between Asia, Europe, and the Middle East. The port also has a natural draft of more than 18 meters, making it capable of receiving ultra-large container ships without deep dredging, something few ports in the country can claim. Such attributes put Vizhinjam well on the path to becoming India's first full-fledged transshipment center.

The growth of Vizhinjam is commensurate with national projects such as the Sagarmala Project and Maritime India Vision 2030, aimed at improving port capacity, logistics costs, and global trade competitiveness of India. After opening, Vizhinjam is likely to revolutionize the maritime logistics of the country by substantially minimizing the necessity for transshipping containers via overseas ports such as Colombo, Dubai, and Singapore. This will not only be saving foreign exchange but will also provide faster movement of cargo and improved management over logistics activities.

The port is also projected to be a driver of regional growth. It will create thousands of direct and indirect employment opportunities in port activities, shipping, warehousing, transport, and logistics. Further, Vizhinjam has been planned with state-of-the-art, automated cargo handling systems and multimodal connectivity to rail and road networks, which will link it closely with India's supply chains and hinterland markets.

From an environmental and technical perspective, the project has used contemporary precautions to reduce environmental footprint, and its development has been shaped by stringent appraisal and approvals. Success of the port will make Kerala's economy stronger, bring in international shipping companies, and position India firmly on the maritime map of the world.

In a way, the Vizhinjam Transshipment Port is a vision of the future of growth through infrastructure. It is not merely a port, but a portal to economic change, maritime independence, and green growth. With proper management and people-friendly policies, Vizhinjam can be one of Asia's most significant ports in the coming decades.

1.3 STATEMENT OF THE PROBLEM

This research seeks to evaluate the effect of the Vizhinjam International Seaport on the traditional fishing practice along the coastal strip of Thiruvananthapuram. The port, as a large infrastructural development, has generated concerns from the local fishermen about its likely influence on fish supply, sea biodiversity, and livelihood sustainability. Using both primary data from field surveys and secondary data including the CMFRI's 2021–22 impact study, this research explores changes in fish landings, species diversity, and socio-economic conditions of fishermen post port construction. The study also critically examines the effectiveness of compensation and welfare measures provided by the government. A zone-based approach—covering direct, potential, and control impact areas—has been adopted to ensure spatial accuracy in findings. By combining scientific information with the perception of fishermen, the study seeks to provide an equilibrium perspective of ecological and human effects. The research seeks to add meaningful insights to inform future policy action and practice in sustainable coastal development.

1.4 OBJECTIVE OF THE STUDY

- The primary objective of this study is to analyse the impact of the Vizhinjam International Transshipment Port on the traditional fishing community, focusing on changes in livelihood, income, and well-being.
- The secondary objective of this study is to assess economic, social impact.

1.5 SCOPE OF THE STUDY

This research deals with evaluating the effect of the Vizhinjam International Transshipment Port on traditional fishing on the coastal stretch of Thiruvananthapuram. The research analyzes fish catch volume shifts, opening of fishing areas, and the livelihood pattern of local fishermen. It also deals with the views and fears of the fishing

community against disturbances brought about by port development and shipping activities. Both primary data (gathered by interviews and questionnaires) and secondary sources have been utilized to substantiate the analysis. The geographical area of consideration is coastal villages within a radius of 10 km from the port, categorized into impact zones. The results are intended to inform sustainable port development while safeguarding the interests of marine-dependent communities.

1.6 LIMITATIONS OF THE STUDY

This study has certain limitations that may affect the comprehensiveness of its findings. Firstly, the research is based on a limited time frame, focusing mainly on the construction and immediate post-construction phases of the Vizhinjam Port, and may not capture long-term impacts on fishing activities. Secondly, the geographical scope is restricted to a 10 km radius around the port, which may exclude effects felt in more distant coastal areas. Thirdly, the study relies heavily on self-reported data from interviews and surveys, which could introduce personal biases or emotional responses. Lastly, limited access to official and up-to-date secondary data from port authorities and government agencies posed challenges in ensuring a fully data-driven analysis.

CHAPTER 2
REVIEW OF LITERATURE

2.1 LITERATURE REVIEW

This chapter reviews articles, online journals, reports, websites, and other published sources related to the study area. The sources from which this information is collected are given.

The Vizhinjam International Deepwater Seaport project in Kerala has attracted a lot of academic and journalistic interest because of its far-reaching influence on the environment and the socio-economic lives of coastal people. There have been many scholarly and journalistic studies evaluating the consequences of the port, with a central emphasis on the impacts of dredging, sedimentation, loss of habitat, depletion of fish, and displacement of communities. This research provides important insights into the implications of major coastal infrastructure development projects and their effects on sustainable development.

Mrs. Preetha Prasad's research report entitled "A Study on the Environmental and Socio-Economic Impact of Vizhinjam Port," published in the International Journal of Creative Research Thoughts (IJCSP) in 2022, presents an integrated assessment of the port's impact on the marine ecosystem as well as traditional fishery communities. Her research, based both on primary surveys as well as secondary data, illustrates how construction operations, especially dredging and coastal sedimentation, have resulted in ecological disturbances like extensive coastal erosion, devastation of habitats of fish, and disruption of marine biodiversity. Socio-economically, the research establishes that traditional fishermen have been adversely affected through diminishing fish catch because of the destruction of breeding grounds and increased maritime traffic, resulting in economic adversity and displacement. Moreover, she contends that the rehabilitation measures have been inadequate and demands development programs based on inclusiveness that put environmental surveillance, people's involvement, and policy change at the forefront.

A 2022 piece published by Mongabay India, "Fish famine, livelihood loss due to upcoming Vizhinjam port, say fishers of south Kerala," presents grassroots insights through interviews with local fishers, marine scientists, and inhabitants. The report highlights the environmental impacts, such as the degradation of the reef structures and the 'wedge bank', an important marine area with nutrient-rich waters vital for fish spawning. This has led to a reduction in fish stocks and smaller catches and increased

costs of operation among small-scale fishers. Clam collectors particularly mention that sedimentation has smothered clam beds, seriously impacting their livelihood. Compensation efforts are deemed inadequate, with fishers expressing dissatisfaction over insufficient financial aid and restricted access to traditional fishing areas. The article calls for a reevaluation of the port project with a focus on environmental sustainability and community inclusion.

Similarly, the New Indian Express brought out a report on July 28, 2021, entitled "Vizhinjam port turning into an eco-disaster," which discusses the devastating effects of dredging activities, especially on rocky reefs such as Kozhippara Paru and Madan Paru. The Friends of Marine Life (FML) and marine biologists cite a severe decline in marine biodiversity, with the extinction of more than 147 species, including mussels and corals. Ocean acidification and coral bleaching, which were exacerbated by global warming, further weakened the sea habitat. Local fishermen, particularly mussel gatherers, were hit hard in their socio-economy, experiencing diminishing fish hauls and losing species such as the Red Mullet and Torpedo Ray. The article calls for a switch to sustainable practices in development to safeguard marine diversity and ensure coastal livelihoods.

The 2024 report "Our Beaches, Our Sea: Heritage of Fishing Communities, Usufruct of All Citizens" by Janakeeya Padana Samithi, covered by the Business & Human Rights Resource Centre, provides a critical examination of the socio-environmental impacts of the Vizhinjam port. The report blames the project for speeding up coastal erosion, pushing fishing communities away, and damaging marine biodiversity. A failure to involve communities and keep things transparent when implementing the project has created suspicion. In addition, the report indicates the importance of beaches for fishing communities on cultural and social levels, inferring that development not only has economic but also cultural implications. The report advocates for environmentally sustainable paradigms of development that uphold indigenous people's rights, guarantee community engagement, and apply serious environmental research.

Contrary opinions have been reported in a January 2024 Sagar Sandesh news report under the title of "Vizhinjam Port may not affect fish landing?" that covered the findings of the Central Marine Fisheries Research Institute (CMFRI) study. The CMFRI study

assessed fish catches with a 10 km radius circle of the port location and had a 3.35% rise in landings during construction time (June 2021–May 2022) compared to data for the reference years of 2011-2012. But fishing community leaders and local stakeholders dispute these findings, contending that the increase might be caused by regional variations and not an indication of the port's actual impact. The CMFRI study recognizes the necessity of ongoing monitoring, particularly during the operational phase of the port, to determine possible long-term impacts.

Further supporting the CMFRI's viewpoint is their in-depth study titled "Estimation of Marine Fish Landings Data from the Potential Impact Zones of Vizhinjam International Seaport, Kerala, India." Conducted between June 2021 and May 2022 using a multistage stratified random sampling method, the study categorized the survey area into three zones—Direct Footprint, Potential Impact Zone, and Control Zone. With 12 landing centers under observation during monsoon, post-monsoon, and pre-monsoon periods, the study recorded the total fish landing of 23,934.03 tonnes, up by a 3.35% increase from the 2011–2012 baseline. Zone I was the largest contributor to landings, which indicated little interference to fish supply during the first years of construction. The study, nonetheless, also emphasized the significance of ongoing environmental observation to assure the sustainability of marine resources.

The Environmental Impact Assessment (EIA) of L&T Infrastructure Engineering Ltd. for the Government of Kerala provides a comprehensive analysis of the likely environmental and socio-economic implications of the Vizhinjam project. The EIA points out risks such as habitat loss, sedimentation, and water quality changes resulting from dredging and breakwater construction. It recommends mitigation strategies including controlled dredging, monitoring of water quality, and marine protected areas. On the social and economic front, the EIA has incorporated a Resettlement Action Plan (RAP) that details the compensation packages, alternative livelihood strategies, and social development programs. Stakeholder engagement and grievance redressation processes are made prominent as crucial elements of the project's Environmental Management Plan (EMP), focusing on environmental regulation and social stewardship.

A 2020 Social Impact Assessment (SIA) report by Rajagiri outREACH (RLabZ) commissioned by the Kerala Government to target the socio-economic impacts of land

acquisition in Vizhinjam and Kottukal panchayats. The report identifies displacement, loss of livelihood, and social network disruption among fishing communities. It emphasizes the cultural and occupational vulnerabilities of these communities whose lives are interlinked with fishing. Recommendations are equitable compensation, livelihood restoration schemes, and active involvement of affected individuals in planning and implementation. SIA emphasizes constant monitoring and communication between authorities and communities to promote trust and facilitate equitable development.

Lastly, the Earth Journalism Network's article "The Tragedy Looming Over Kerala's Mussel Fishers" is concerned with the effect of the Vizhinjam project on mussel gatherers in Vizhinjam, Mulloor, and Kovalam. Sedimentation and dredging have caused a drastic decline in mussel catch—from 40–50 kg to merely 4–5 kg per day—impacting severely on revenue and food security. While the government has disbursed ₹12.65 crore to more than 2,600 affected individuals as compensation, the process has been characterized by paperwork problems, exclusion of vulnerable sections such as old women, and low payouts, with some getting a mere ₹10,000. The piece urges comprehensive and participatory rehabilitation policies that grant equitable compensation, livelihood options, and effective stakeholder participation.

Finally, the literature demonstrates an intricate balance of development, environment, and welfare of communities in the scenario of the Vizhinjam International Seaport. Some research and studies point towards a low short-term effect, yet others emphasize immense ecological degradation as well as socio-economic distress. The call for continued monitoring, inclusive planning, and environmentally friendly development is the common refrain across all the evaluations. These findings are critical to informing policy advice and strategic intervention to ensure that development does not compromise environmental integrity and community welfare.

CHAPTER 3

METHODOLGY OF THE STUDY

3.1 Vizhinjam Port Project

The Vizhinjam International Deepwater Multipurpose Seaport is a flagship infrastructural development project located off the coast of Thiruvananthapuram in the state of Kerala. Strategically located at a mere 10 nautical miles off the international East-West shipping route, carrying close to 40% of the world's containerized trade, it is uniquely poised to be South Asia's leading transshipment hub. Unlike the majority of Indian ports, which require extensive dredging, Vizhinjam naturally possesses a depth of over 18 meters, so that it can support the largest container vessels in the world, up to 20,000 TEUs (twenty-foot equivalent units) with little need for modification. This plays a significant role in international sea-borne logistics, so that the transportation of goods can be undertaken more rapidly and economically.

The estimated over ₹7,000 crore project is being constructed by the Adani Group with the Kerala government's partnership to end India's reliance on foreign transshipment ports like Colombo, Dubai, and Singapore. Vizhinjam, with direct cargo transfers, is predicted to lower shipping costs by 20% and transit times by a week or more, thus making India an internationally competitive player. In addition to this, the port is expected to generate over 10,000 direct and indirect employment opportunities, boosting economic development in the region.

As a part of the country's national Sagarmala vision, the Vizhinjam Port signifies India's strategy to upgrade its maritime facilities. Its completion is expected to transform the shipping industry in India, making it an ideal destination on global shipping routes.

3.2Vizhinjam Fishing Harbour

Before the establishment of the transshipment port, Vizhinjam was well known for its traditional harbor of fishing, which served as a principal center for local fishermen. Located on Kerala's southern coast, the harbor hosted more than 600 small-scale fishing boats, comprising catamarans and motorized vessels, as a center of gravity in the daily existence of coastal people. It not only served as a fish landing place but also as a trading site, boat repair yard, anchorage, and public meeting place.

The harbor was particularly meaningful to small-scale fishermen who utilized traditional methods like catamarans and shore seines (vala). The harbor facilitated

direct auctions of fish, involving fisherfolk and traders—mostly women—in the local economy. The catch sold at this harbor accounted for an estimated yearly fish landing volume of 5,000 to 7,000 tonnes, feeding markets in Thiruvananthapuram and nearby towns and establishing a well-established supply chain.

Throughout the years, Vizhinjam fishing harbor symbolized regional livelihood security with direct and indirect employment for over 15,000 individuals. However, the construction of the Vizhinjam International Seaport disrupted the traditional functioning of the harbor. Dredging, the construction of the breakwaters, and enhanced ship traffic have decreased accessibility and safety in fishing areas. This has created uncertainty regarding the future use of the harbor and the preservation of the rights and traditions of fishing communities which have been upheld for centuries.

3.3 Historical Significance of Fishing in Vizhinjam

Fishing in Vizhinjam is not just a practice—it is a deeply rooted cultural practice that has survived generations of coastal people. Placed on the Arabian Sea, Vizhinjam was for centuries identified with its rich marine biodiversity and strategic shoreline, which makes it an ideal site for artisanal and small-scale fishing. Historical accounts and oral testimony indicate that fishing in the area is more than 500 years old, with methods, sea lore, and tradition handed down over centuries.

Some traditional forms of fishing, such as catamaran sailing, shore-seine or vala fishing, and hand-line fishing, have been at the heart of community existence and remain perceptible even now. Fishing schedules were also planned in harmony within the community—fishing parties left before dawn, hauls were pulled in batches, and auctions were held on the beach or harbour. This life cycle followed the seasonally varying abundance of the sea, affecting not just livelihood cycles but local festivals such as Kadalamma Vilakku and rituals seeking blessings for safe and bountiful fishing.

The importance of fishing goes far beyond economics—it is a signifier of culture, particularly for Christian fishing peoples who predominate in this area. The sea is perceived as both provider and divine presence. Intrusions by infrastructure schemes such as the Vizhinjam port could change not only income but also the very cultural makeup of these coastal societies.

3.4 Fishing Communities Around Vizhinjam

The coastal belt surrounding Vizhinjam is home to several long-established fishing communities whose lives revolve around the sea. Key villages include Mulloor, Pulluvila, Adimalathura, Valiyathura, Poonthura, and Muttathara, each with a predominantly fishing-dependent population. Together, these villages account for over 20,000 coastal residents, with an estimated 3,500 to 4,000 active fishing families, according to Kerala Fisheries Department data.

Most families are engaged in traditional and motorized fishing practices, using catamarans, fiber boats, or small mechanized vessels. The community structure is close-knit, with strong dependence on collective fishing, net-sharing, and village-level coordination. In addition to male fishermen, a significant portion of women are involved in post-harvest activities such as fish vending, drying, salting, and auction coordination, highlighting the family-based nature of the livelihood.

Support structures such as Matsyafed cooperatives play an important role in offering loans, fishing gear subsidies, and insurance coverage. Religious institutions like local churches also serve as hubs for community welfare, relief efforts, and protest organization when livelihoods are threatened.

While these communities have adapted to natural challenges like seasonal bans and monsoon cycles, the construction of the Vizhinjam port has introduced unprecedented social and economic uncertainty, making them among the most vulnerable stakeholders in the development discourse.

3.5 Livelihood Aspects of Fishermen

Fishing is the primary source of income and identity for most households in the Vizhinjam coastal belt. Most families rely on daily fishing trips that begin before sunrise and often last several hours, depending on sea conditions and the distance to fishing zones. The type of fishing gear used ranges from traditional catamarans and shore seines to motorized and mechanized boats. According to the Kerala Fisheries Department, over 60% of the registered boats in this region are small-scale motorized

vessels, making the communities highly sensitive to fuel prices, sea accessibility, and catch variations.

The average monthly income of a fisherman ranges from ₹8,000 to ₹18,000, depending on catch size, fuel expenses, and seasonal changes. During lean seasons or monsoon bans, earnings often drop significantly, forcing families to rely on credit or daily wage alternatives. Women contribute actively by vending fish in local markets, processing dry fish, and managing household-level distribution chains—many walking several kilometres a day to sustain their income.

However, since the onset of the port construction, fishermen have reported a 25–30% drop in nearshore fish availability, as well as increased fuel and maintenance costs due to longer distances required to find fish. These added expenses have cut into profit margins, placing already vulnerable households under further financial pressure. Port-related disturbances have not only affected income but also increased uncertainty and risk in what was once a stable livelihood.

3.6 Stakeholders Involved

The development of the Vizhinjam International Deepwater Seaport has brought together a complex network of stakeholders, each with distinct roles, priorities, and degrees of vulnerability. At the heart of the issue are the traditional fishing communities, comprising over 3,500 families across nearby coastal villages. These communities are the most directly impacted by the project, facing disruptions in sea access, loss of livelihood, and growing insecurity about their future.

The Adani Group, the private developer of the port, is tasked with construction and operations under a public-private partnership model with the Government of Kerala. The project falls under the Sagarmala Programme, India's flagship initiative for port-led development, and is being monitored by the Ministry of Ports, Shipping and Waterways. The government's vision focuses on enhancing trade connectivity, but this has also led to concerns about whether adequate safeguards are in place for the local communities.

Organizations like Matsyafed (Kerala State Co-operative Federation for Fisheries Development Ltd.) play a supportive role by providing insurance, credit schemes, and

welfare support to fishermen. At the same time, church institutions and non-governmental organizations have emerged as vocal stakeholders advocating for fair compensation, rehabilitation, and environmental responsibility.

Environmentalists and marine scientists from institutes like CMFRI (Central Marine Fisheries Research Institute) have raised alarms about the impact of dredging and breakwater construction on biodiversity and fish breeding grounds. Meanwhile, youth and marginalized groups within the fishing community seek clarity on promised job opportunities, reskilling options, and legal recognition of their traditional sea access rights.

This mix of interests has created tensions between development goals and community rights, making stakeholder engagement and transparency critical to the project's long-term sustainability.

3.7 Zone-Based Impact Description

To assess the varying levels of socio-economic and ecological impact caused by the Vizhinjam Port development, this study adopts a zone-based classification approach, aligned with the methodology used by agencies such as the Central Marine Fisheries Research Institute (CMFRI) and the Environmental Impact Assessment (EIA) reports. The study area is divided into three zones based on proximity to the port and the intensity of observed disruption.

Zone 1 – Direct Impact Zone (0–5 km radius):

This zone includes coastal villages such as Mulloor and Vizhinjam, which lie closest to the construction site. Communities in this area have experienced the highest levels of impact, including restricted access to traditional fishing zones, increased marine traffic, and direct exposure to dredging and sedimentation. According to local reports, fishermen in this zone have seen fish catch volumes decline by over 30%, and many have reported equipment damage and safety concerns due to vessel movement.

Zone 2 – Potential Impact Zone (6–10 km radius):

Villages such as Pulluvila and Adimalathura fall within this intermediate zone. While not directly adjacent to the port, fishermen here report changes in tidal behaviour,

seabed contours, and fish migration patterns. Fuel expenses have risen by approximately 20–25%, as boats travel further to avoid disturbed or unsafe waters. Though less severe than Zone 1, the socio-economic strain is still significant.

Zone 3 – Control Zone (Beyond 10 km radius):

This includes relatively unaffected villages like Poonthura and Muttathara, which serve as reference points for baseline comparison. These areas have not yet reported notable operational disturbances due to port development, making them essential for evaluating whether observed changes in other zones are directly attributable to port activities or part of broader marine trends.

3.8 Government Measures and Assistance

In response to the socio-economic challenges faced by fishing communities due to the Vizhinjam Port development, the Government of Kerala, in collaboration with the Adani Group and related agencies, has initiated several measures aimed at relief, rehabilitation, and livelihood restoration. As part of the Rehabilitation and Resettlement Package, approximately ₹12.65 crore was disbursed among 2,667 affected individuals, according to official records from 2022. Compensation was provided to fishermen, clam collectors, mussel gatherers, and others whose livelihoods were disrupted by dredging, loss of fishing grounds, and port activity.

The Kerala Fisheries Department and Matsyafed have also launched support schemes, such as subsidized fishing gear, microfinance, and fishermen welfare pensions. However, field-level feedback indicates that many beneficiaries were dissatisfied, citing delays, low compensation amounts, and lack of transparency in the selection process. Several elderly women and unregistered workers were reportedly excluded from compensation lists, raising concerns about inclusivity.

While initial consultations were held during the Environmental Impact Assessment (EIA) phase, community participation in ongoing decisions has been limited. Promises of port-related employment, training programs, and housing assistance remain largely unfulfilled or inconsistently applied. As a result, the effectiveness of government interventions remains uneven and urgently requires improved coordination, monitoring,

and stakeholder engagement to ensure that development does not come at the cost of community well-being.

3.9 Coping Strategies Adopted by Fishermen

Fishermen in and around Vizhinjam have adopted a range of coping strategies to address the mounting challenges brought on by the port expansion. One of the most common responses has been to extend the duration and distance of fishing trips, with many venturing over 20–30 nautical miles into the sea in search of better catches. This, however, comes with higher fuel costs, longer working hours, and increased safety risks, particularly for those using smaller or older boats.

To offset declining incomes, some fishermen and their family members have diversified their livelihoods by taking up seasonal or daily-wage jobs in nearby construction sites, transport services, and markets. This shift is especially common among youth, many of whom are forced to temporarily abandon fishing due to reduced catch and uncertainty.

Community-based cooperation has become a key survival strategy. Fishermen often share boats, fuel, nets, and gear, creating informal collectives to reduce individual expenses. Additionally, local groups, supported by church institutions and NGOs, have begun mobilizing protests and petitioning for government intervention and fair compensation.

Despite these efforts, the economic pressure continues to mount, and the community's resilience is being tested by both environmental degradation and social upheaval. Many families now live in a state of economic precarity, relying on short-term coping methods in the absence of long-term institutional support.

3.10 Awareness of Port-Linked Job Opportunities

Increasingly, the younger generation in fishing villages around Vizhinjam is becoming aware of potential employment opportunities arising from the port project, particularly in areas such as cargo handling, logistics, security services, and port maintenance. For many youths, these jobs are seen as more stable and economically attractive than traditional fishing, which has become increasingly unpredictable due to reduced fish availability and rising operational costs.

3.11 Aim of the study

The aim of this research is to analyze the effect of the development of the Vizhinjam International Seaport on the fishing community, specifically the decreasing catch of fish and its socio-economic implications. This chapter describes the methods used for data collection, analysis, and interpretation to make the findings credible, pertinent, and based on field realities.

3.12 Research Approach and Design

The study was done in the coastal villages near Vizhinjam, a town in the Thiruvananthapuram district of Kerala. Vizhinjam has a big fishing community that relies on the sea for their jobs. Since the new Vizhinjam International Seaport was built, this area has seen many changes to the environment and people's ways of making a living. The research focused on the areas most affected by the port, like the fishing communities of Pulluvila, Adimalathura, and Mulloor, where fishermen have been saying that they are catching fewer fish and that their traditional fishing methods are being disrupted.

3.13 Area of the Study

The research was carried out in the coastal villages of Vizhinjam, a coastal town in the Thiruvananthapuram district of the state of Kerala. Vizhinjam is inhabited by a huge fishing population whose livelihood is directly associated with the sea. With the construction of the Vizhinjam International Seaport going on, the area has experienced various kinds of environment and livelihood changes. The research concentrated on the regions impacted directly by the port operation, such as fishing villages of Pulluvila, Adimalathura, and Mulloor, where the fishermen complained about decreased catch of fish and interference in their traditional fishing activities.

3.14 Sources of Data

Primary Data:

Primary data was gathered directly from the local fishing communities in and around Vizhinjam through field visits, interviews, and questionnaires. Fishermen, fish vendors, and community leaders were approached to obtain first-hand information regarding the influence of the port on fishing activities, fish catch, and their livelihood.

Secondary Data:

Secondary data were collected from different published reports, government documents, news articles, research studies, and Environmental and Social Impact Assessment studies. The Central Marine Fisheries Research Institute (CMFRI), Environmental Impact Assessment (EIA) studies, and studies conducted by NGOs and media were reviewed for background and corroborative data.

3.15 Sampling Design

- Type of Population: The focus group consists of local marine fishermen working in the coastal regions near the Vizhinjam International Seaport in Thiruvananthapuram, Kerala.
- Sampling unit: Fishermen and their families who were actively involved in marine fishing both prior to and following the port development served as the subjects for this study.
- Sampling Size: A total of 67 respondents were surveyed using a structured questionnaire to collect primary data.
- Sampling frame: The sampling frame included registered fishermen from coastal villages within a 10 km radius of Vizhinjam Port, especially those from impacted areas like Valiyathura, Poonthura, and Muttathara.
- Sampling Procedure: A purposive sampling was method was used to select participants who had relevant fishing experience and were from areas directly affected by the port development.

3.16 Research Instrument

A structured questionnaire was employed to collect primary data for this study. It was designed to obtain detailed insights into the socio-economic impact of the Vizhinjam International Seaport on traditional fishing communities. The tool was divided into five thematic sections:

- **Section A: General Experience** – Focused on the immediate effects of the port on daily fishing activities, fish availability, and overall livelihood impact.
- **Section B: Economic Impact** – Captured trends in income, fish catch (2015 vs 2025), fuel costs, and awareness of port-related economic opportunities.
- **Section C: Environmental Concerns** – Assessed perceptions related to coastal erosion, biodiversity loss, fishing restrictions, and ecological safety.
- **Section D: Government and Policy** – Addressed awareness of compensation, relocation programs, and support from authorities.
- **Section E: Future Outlook** – Explored community expectations, youth employment trends, and suggestions for balancing development with sustainable livelihoods.

The questionnaire combined closed-ended and open-ended questions, allowing for both quantitative and qualitative analysis aligned with the study's objectives.

3.17 Data Analysis Tools

Python-based tools like **pandas**, **matplotlib**, and **scipy** were used via **Google Colab** to:

- Clean data
- Generate bar and pie charts
- Perform paired sample **t-tests** to test for significance in variables such as fish catch and income.

3.18 Conclusion

The research methodology employed in this study was carefully planned to extensively examine the socio-economic impacts of the Vizhinjam International Seaport project on the local fishing community. This study utilized both primary and secondary data sources for a balanced view. Primary data were gathered through a structured questionnaire to collect significant general experience data, community perceptions, and changes in livelihood patterns. A systematic sampling procedure was used to select participants to ensure that the most affected people by port development were covered. This selected research approach not only enabled the gathering of reliable and relevant data but also provided a good foundation to comprehend the actual circumstances of the impacted community, thereby assisting in achieving the objectives of the study.

CHAPTER 4

DATA ANALYSIS

4.1 Data Collection and Preparation

Data for this research was gathered using structured questionnaires distributed to 67 fishermen from coastal villages near Vizhinjam. The survey focused on essential factors such as the impact of daily fishing activities, monthly fish catch (measured in kilograms) before and after the port's development in 2015 and 2025, household income during the same timeframe, livelihood status, environmental perceptions, and access limitations. The information was collected digitally via Excel, encompassing both categorical variables (like environmental impact level and government support) and numerical data (such as income and fish catch). The main emphasis for quantitative analysis was on comparing monthly fish catch and income over time to evaluate changes in livelihoods.

For the analysis, Google Colab was utilized alongside the Python programming language. Various libraries, including pandas, matplotlib, and scipy were used to clean, visualize, and conduct statistical analyses on the dataset, providing a comprehensive understanding of the socio-economic impacts of the Vizhinjam Port on local fishing communities.

4.2 Data Analysis

This chapter provides an in-depth analysis of the socio-economic and environmental effects of the Vizhinjam Port project, based on primary data gathered from 67 fishermen in the impacted coastal villages. The analysis is organized around five main themes: Impact on Fishing Activities, Economic Consequences, Environmental Issues, Government Assistance, and Future Perspectives. Each section delves into specific aspects such as fish catch, income levels, stability of livelihoods, environmental changes, and the effectiveness of government support. Quantitative data, particularly fish catch and income statistics from 2015 and 2025, were examined using Python tools like pandas, matplotlib, and scipy. The results are illustrated with bar and pie charts, offering a comprehensive view of the disruptions, adaptations, and concerns faced by the fishing community amid large-scale infrastructure development.

4.3 Fishing Activities Impact

The construction of the Vizhinjam International Deepwater Seaport has significantly impacted the traditional fishing practices of local communities. Based on feedback from fishermen, three primary concerns emerged: changes in fishing operations, fish availability, and fishing restrictions. Many fishermen reported that their regular fishing activities have been moderately to severely disrupted, attributing this to increased boat traffic offshore, changes in tidal patterns, and fewer safe areas for launching or operating boats. These changes have led some to reduce the frequency of their fishing trips, affecting their daily routines and financial stability.

4.3.1 Daily Fishing Activity Impact

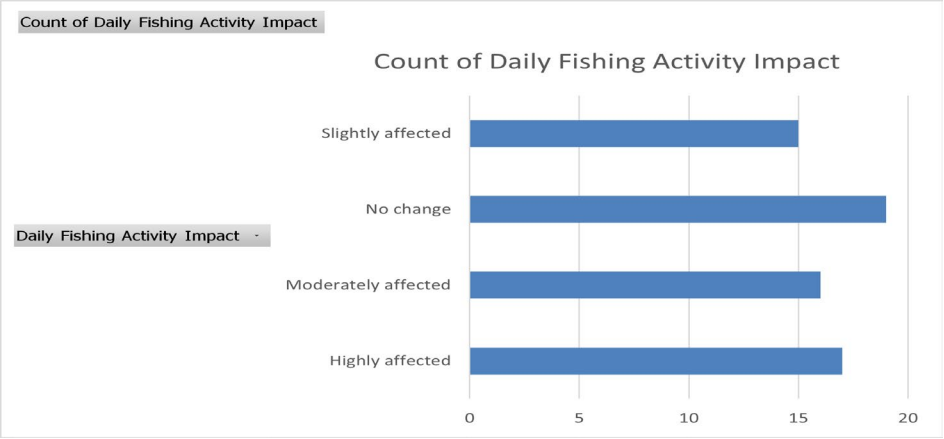

Figure 2 Daily fishing activity

Interpretation

The graph depicts fishermen's views on how the development of the Vizhinjam port has influenced their daily fishing activities. A large number of respondents indicated they were either significantly or moderately impacted, pointing to interruptions in their routines caused by limited access, safety issues, or changes in marine conditions. Conversely, a considerable segment reported no changes, likely to represent those from less impacted areas or those fishing in deeper waters.

4.3.2 Change in Fish Availability

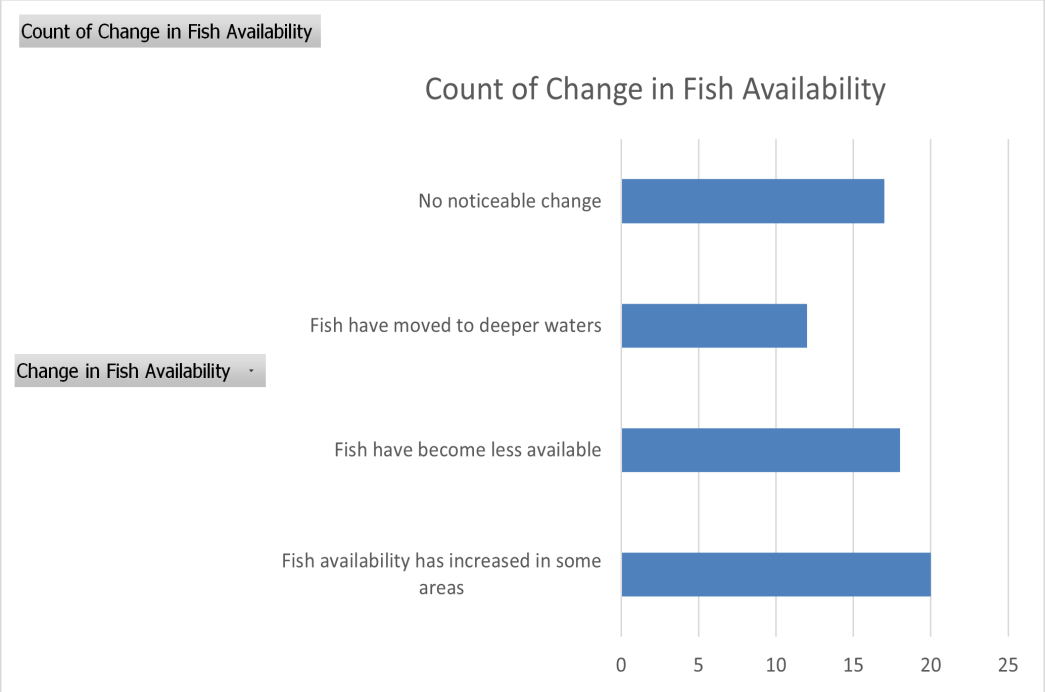

Figure 3 Fish availability

Interpretation

The chart shows varying perceptions among fishermen regarding changes in fish availability after the port's construction. A notable number observed that fish availability increased in some areas, possibly due to migratory shifts. However, a slightly lower number reported that fish have become less available, suggesting localized depletion near the coast—likely due to dredging, sedimentation, or disruption of breeding zones. Some respondents also noted that fish have moved to deeper waters, indicating a geographical shift in fishing zones. A portion reported no noticeable change, which could be attributed to those fishing farther from the port. Overall, the responses suggest that port development has had uneven ecological effects, altering traditional fishing patterns.

4.3.3 Fishing Access Restrictions

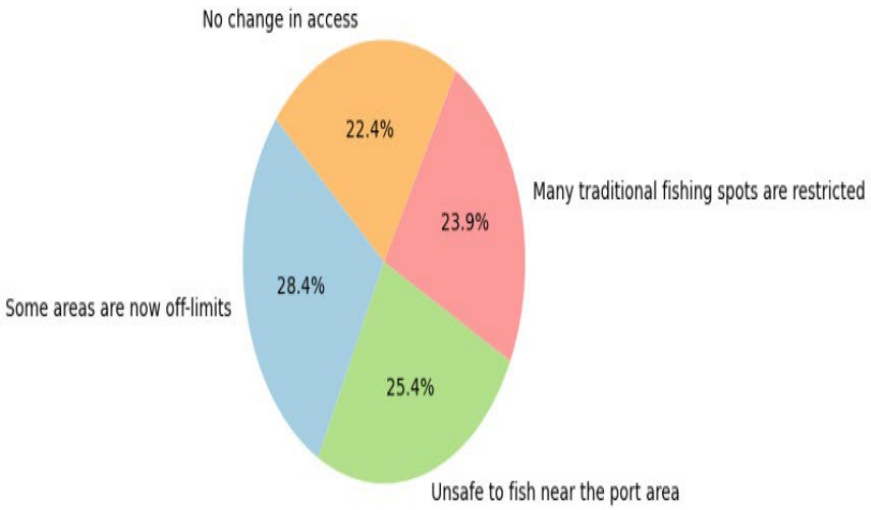

Figure 4 Fishing access

Interpretation

This pie chart demonstrates the impact of the Vizhinjam port's construction and operation on fishermen's access to their traditional fishing areas. The largest segment, comprising 28.4%, indicated that certain regions are now inaccessible, likely due to construction barriers or safety issues. Additionally, 25.4% reported that they felt fishing near the port was unsafe, probably because of heightened marine traffic or underwater dangers. Furthermore, 23.9% mentioned that many of their traditional fishing locations are now restricted, highlighting a direct displacement from previously available waters. Only 22.4% noted no change in access, suggesting that the majority of fishermen have experienced disruptions in their fishing routes. This extensive limitation not only affects their daily catch but also leads to increased travel times and fuel expenses, which directly impacts their income and sustainability.

4.4 Economic Impact

The economic effects of the Vizhinjam Port project are clearly reflected in quantifiable shifts in fish catch, income, and the stability of livelihoods. A comparison of data from 2015 to 2025 reveals a marked decrease in monthly fish catch for numerous respondents. This decline has had a direct impact on income, with many fishermen reporting lower earnings over the years. Statistical evaluations using paired t-tests have proved that both fish catch and income have seen a significant drop. Furthermore, responses regarding livelihood impacts showed that a large majority felt their way of life had been affected to a moderate or severe degree. These results indicate that the development of the port has disrupted the traditional marine economy, putting considerable financial pressure on established fishing communities.

4.4.1 Average Fish Catch Comparison (2015 vs 2025)

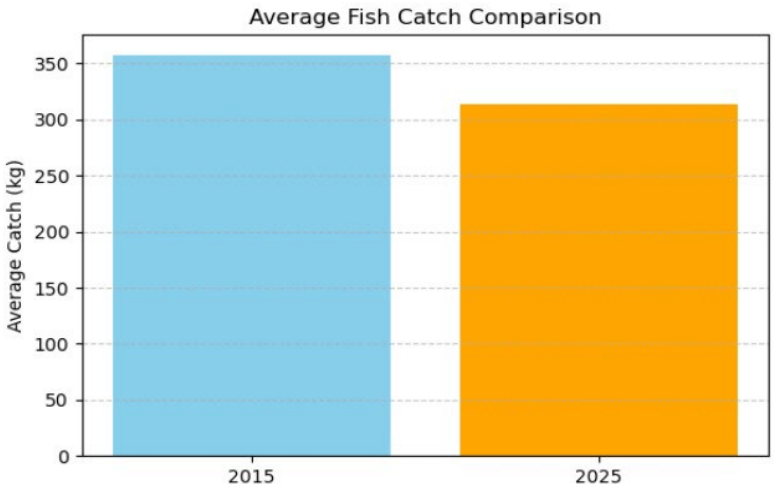

Figure 5 Fish catch comparison

Interpretation

The bar chart illustrates a comparison of the average monthly fish catch from 2015 to 2025, revealing a noticeable decrease. Fishermen reported an average catch of about 360 kg in 2015, which fell to roughly 315 kg by 2025. This decline indicates a reduction in the availability of nearshore fish, likely due to construction, dredging, and increased marine traffic associated with the port.

4.4.2 Average Income Comparison (2015 vs 2025)

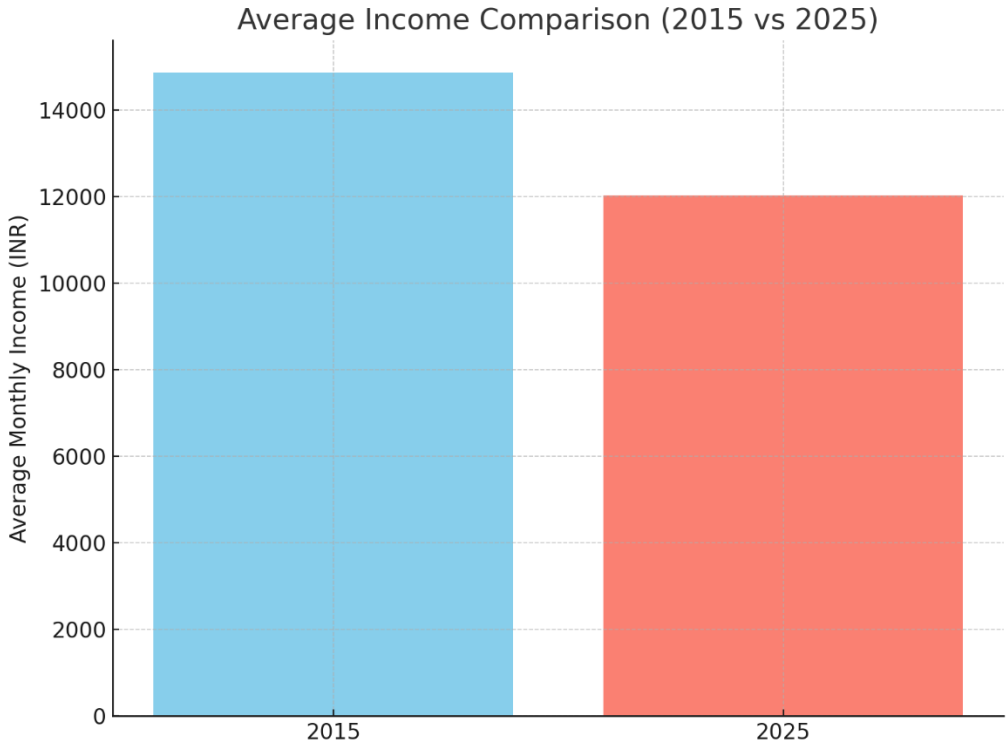

Figure 6 Income comparison

Interpretation

The bar chart illustrates a significant reduction in the average monthly earnings of fishermen over the span of ten years. In 2015, the average income was approximately ₹14,870, which fell to about ₹12,020 by 2025. This decline indicates the financial challenges faced by fishing families following the development of the port. The decrease in earnings is likely associated with diminished fish catches, rising operational expenses, and limited access to fishing areas, as noted in other sections. This further supports the overarching conclusion that, although the project provides regional development advantages, it has negatively impacted the traditional income streams of the fishing community.

4.4.3 Distribution of Livelihood Impact

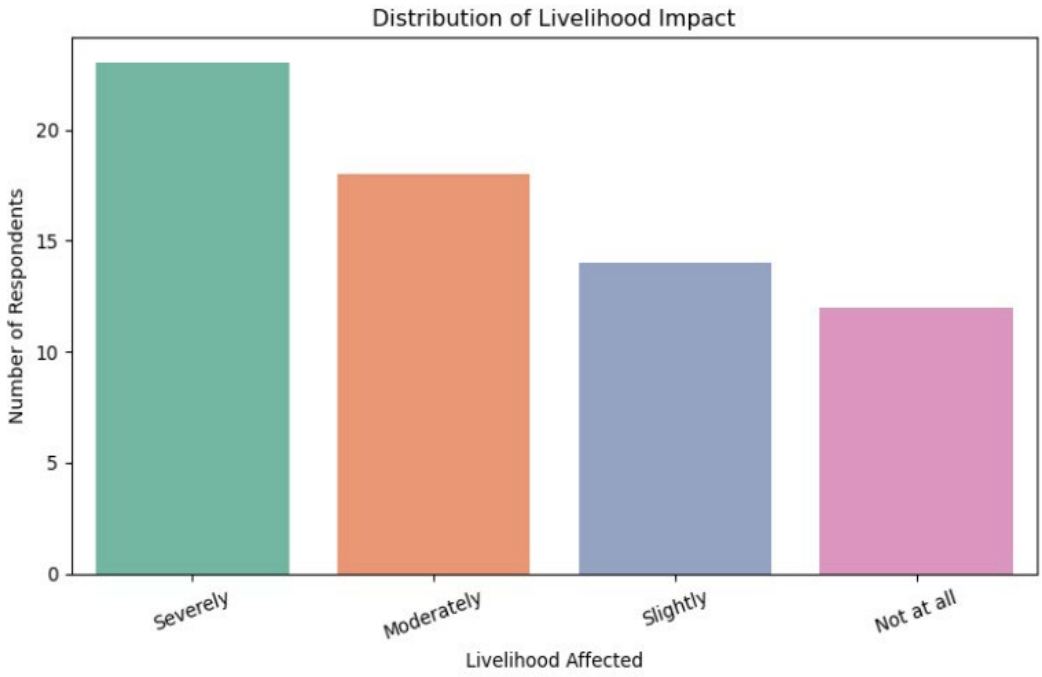

Figure 7 Livelihood impact

Interpretation

The bar chart depicts fishermen's perceptions regarding the effects of the Vizhinjam Port development on their livelihoods. A considerable number—over 20 respondents—indicated they were significantly impacted, while many others reported a moderate effect. A smaller group felt only a slight impact, and the least number claimed they were unaffected. These findings imply that most fishermen have faced a noticeable decline in their economic and job security. The consequences are likely linked to diminished fish catches, reduced income, and limited access to fishing areas. This data reinforces previous conclusions and emphasizes the critical nature of livelihood disruption within coastal communities, highlighting the urgent need for focused support and sustainable solutions.

4.5 Environmental Concerns by Respondents

Fishermen have reported significant environmental changes since the start of port development. Many have noticed unusual tidal patterns, stronger currents, and increased coastal erosion, all of which have disrupted their traditional fishing practices. A considerable number have also observed a decline in fish and marine species near the shore, indicating possible ecological disturbances due to dredging and sedimentation from construction activities. Regarding environmental damage, responses varied in concern levels. Some fishermen acknowledged substantial degradation of the marine environment, while others were either unaware or uncertain about the changes. This disparity highlights both visible ecological stress and a lack of environmental awareness or communication. Overall, these findings indicate that the port's development has had a tangible impact on local marine ecosystems, affecting biodiversity, shoreline stability, and safe fishing conditions. It is essential to address these issues through improved marine conservation efforts and clear communication with fishing communities to ensure long-term sustainability.

4.5.1 Environmental Changes

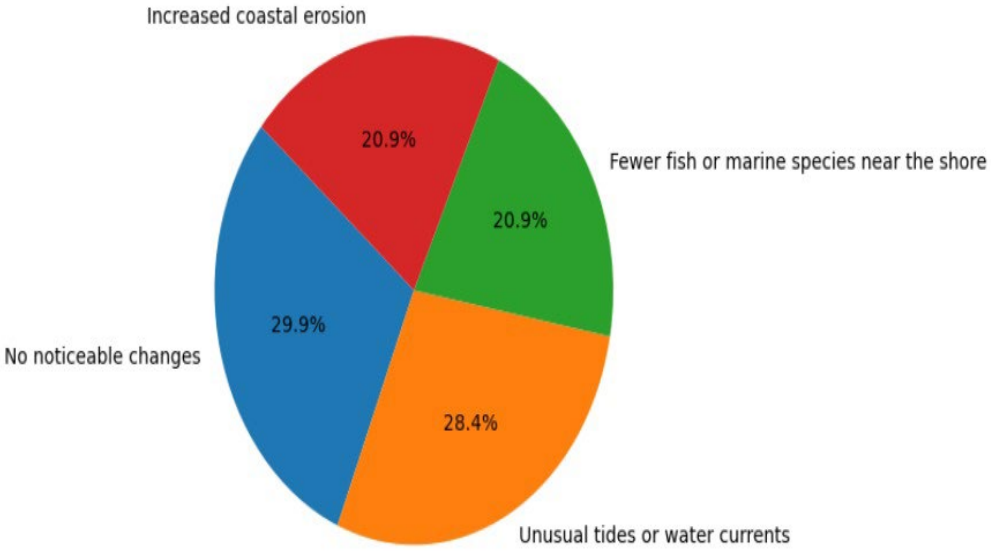

Figure 8 Environmental changes

Interpretation

The pie chart illustrates fishermen's insights into environmental changes in their coastal areas since the initiation of port development. While almost 30% noted no significant changes, the majority reported disturbances in the marine ecosystem. Specifically, 28.4% observed irregular tides or altered water currents, which can impact navigation, safety, and fish behavior. Approximately 20.9% each indicated increased coastal erosion and a marked decrease in fish or marine species near the shore, both of which point to physical and ecological degradation associated with dredging and construction activities. These alterations correspond with reported reductions in fish catch and accessibility, highlighting that environmental disruptions are a major concern for the fishing community.

4.5.2 Environmental Damage

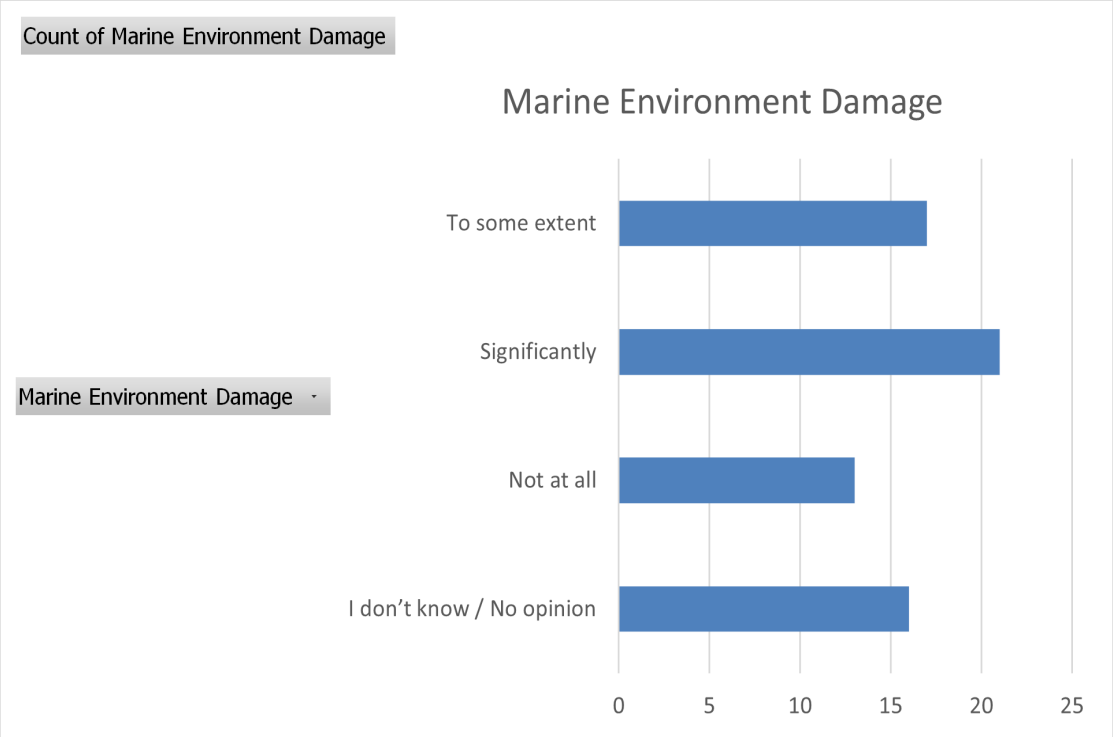

Figure 9 Environmental damage

Interpretation

The chart illustrates fishermen's views on the environmental harm caused by the development of Vizhinjam Port. A significant number of respondents—over 20 individuals—believe that the environment has suffered considerable damage, while another notable group acknowledged some level of harm. These insights indicate a heightened awareness of ecological decline, likely associated with activities such as dredging, sediment displacement, and increased maritime traffic. Interestingly, a minority of respondents felt that no damage had occurred, and others were uncertain or had no opinion, which may suggest limited access to scientific data or differing impacts across fishing areas. Overall, the chart emphasizes that environmental damage is both apparent and troubling for most of the fishing community, strongly supporting claims that the project has disrupted marine ecosystems.

4.6 Government support

This section assesses the degree and effectiveness of government actions aimed at assisting fishermen impacted by the Vizhinjam Port project. It highlights key areas such as consultation and compensation, support from local authorities, and efforts for relocation or rehabilitation. The analysis draws on fishermen's feedback regarding their awareness, experiences, and satisfaction with these initiatives. The findings indicate mixed feelings—while some participants reported being consulted or receiving support, a significant number indicated they had not received compensation or meaningful involvement. Additionally, concerns were expressed about the unfulfilled promises concerning relocation and the restoration of livelihoods. These outcomes point to discrepancies between policy intentions and actual implementation, emphasizing the necessity for more inclusive, transparent, and sustained government initiatives to protect traditional fishing communities.

4.6.1 Government Consultation

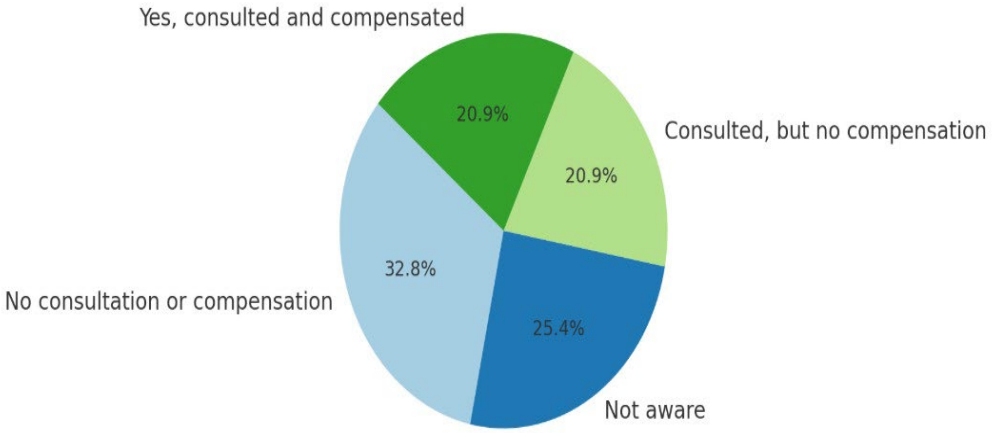

Figure 10 Government consultation

Interpretation

The graph depicts the responses of fishermen concerning government consultations and compensation efforts related to the Vizhinjam Port project. A notable 32.8% indicated they received neither consultation nor compensation, revealing a significant gap in communication and engagement. Furthermore, 25.4% of participants were unaware of any initiatives, suggesting potential shortcomings in outreach and transparency. Only 20.9% reported being both consulted and compensated, while the same percentage indicated they were consulted but did not receive compensation. These results highlight inconsistent government practices and a lack of inclusion for fishing communities in the planning and development phases. The data implies that although some efforts were made, they were either not consistently implemented or inadequately communicated, underscoring the necessity for more organized, inclusive, and accountable public engagement strategies.

4.6.2 Support from Authorities

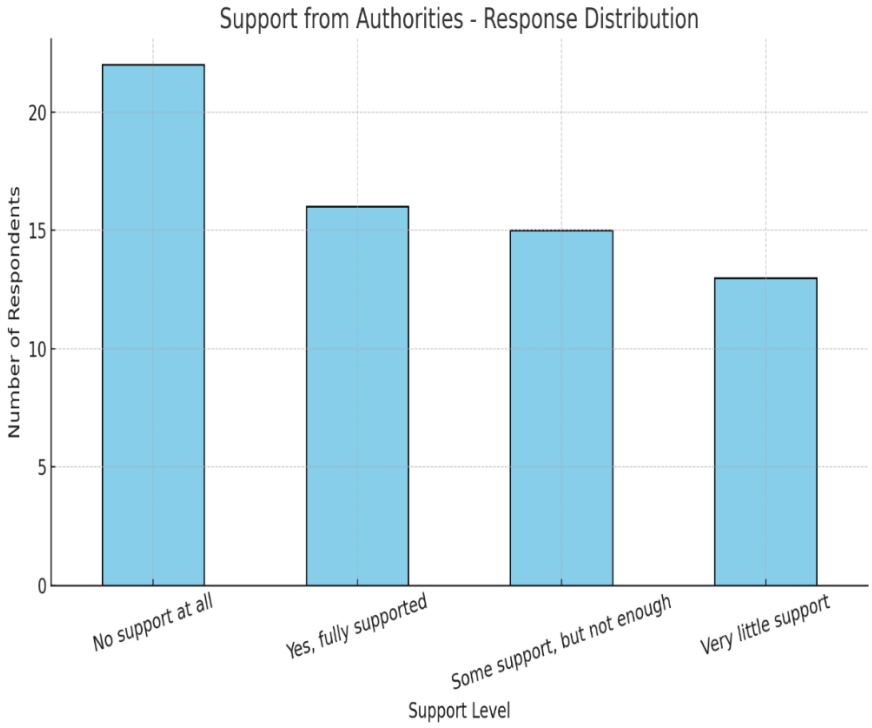

Figure 11 Authorities support

Interpretation

The bar chart illustrates the differing levels of institutional support perceived by fishermen after the establishment of Vizhinjam Port. The majority of respondents indicated they received no support whatsoever, while others felt they only received partial or inadequate assistance. A smaller segment reported being fully supported, and some mentioned receiving minimal help. These findings reveal a significant inconsistency in the provision of aid from essential institutions like the Fisheries Department, local panchayats, Matsyafed, and coastal regulatory agencies. Despite the presence of relief and rehabilitation frameworks, many fishermen affected by the situation seem to have been neglected or insufficiently supported, highlighting the urgent need for improved coordination and accountability among the relevant authorities.

4.6.3 Relocation Programs

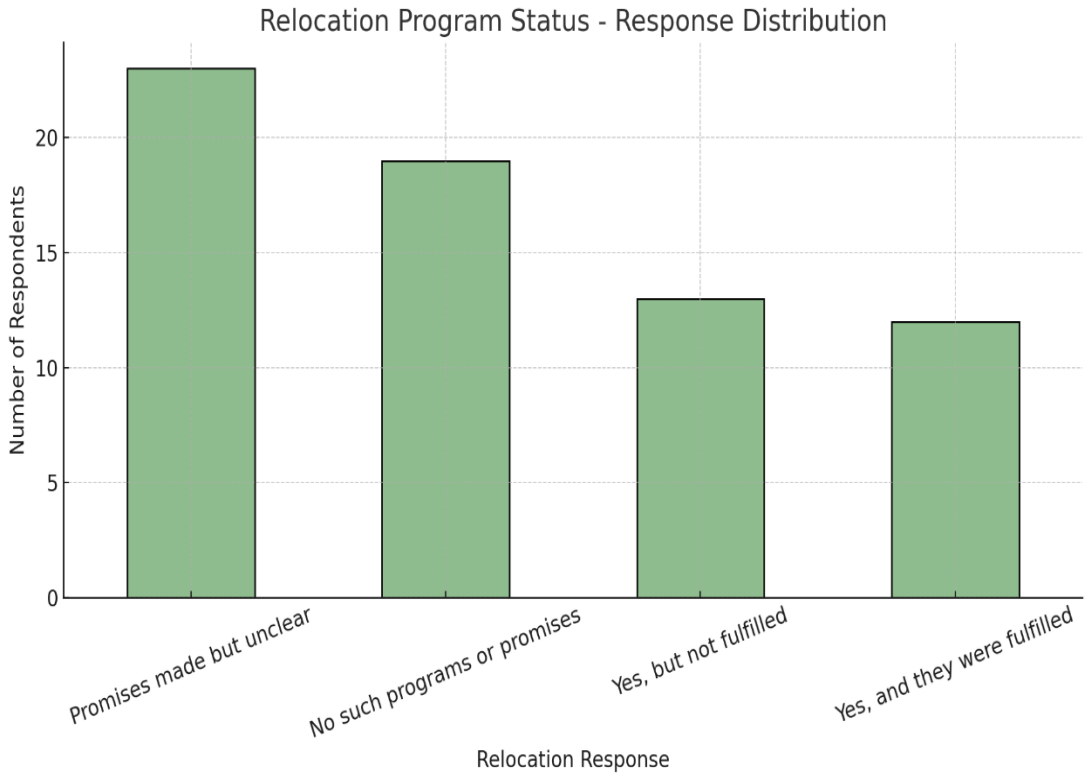

Figure 12 Relocation program

Interpretation

The data illustrates significant disparities in the experiences of fishermen regarding relocation initiatives. Many respondents noted that commitments were made but lacked clarity, indicating poor communication. The next largest group reported the absence of such programs or promises, implying either neglect or insufficient outreach. A considerable number mentioned that while programs were announced, they were not carried out, underscoring failures in implementation. Only a smaller segment confirmed the successful execution of relocation programs. These results highlight the perception that resettlement efforts have been inconsistent, inadequately communicated, or poorly executed. In light of the extensive displacement, this underscores a critical policy deficiency that requires immediate attention through more transparent and accountable processes.

4.7 Future Outlook

The future of the traditional fishing community near Vizhinjam is marked by uncertainty and differing opinions. A significant worry among those surveyed is the waning interest of younger individuals in pursuing fishing as a career. Many noted that the youth are increasingly opting for jobs related to the port, migrating to urban areas, or choosing other non-fishing occupations, citing the instability and low profits associated with fishing. This trend indicates a shift in aspirations across generations, influenced by the challenges posed by port development. Regarding the overall future perspective, opinions varied. Some fishermen expressed optimism for improved infrastructure and new job prospects, while others feared a continued decline in marine resources and the erosion of traditional fishing methods. These insights imply that without focused policies and alternative livelihood options the fishing community may experience long-term economic and cultural decline.

4.7.1 Youth Trend

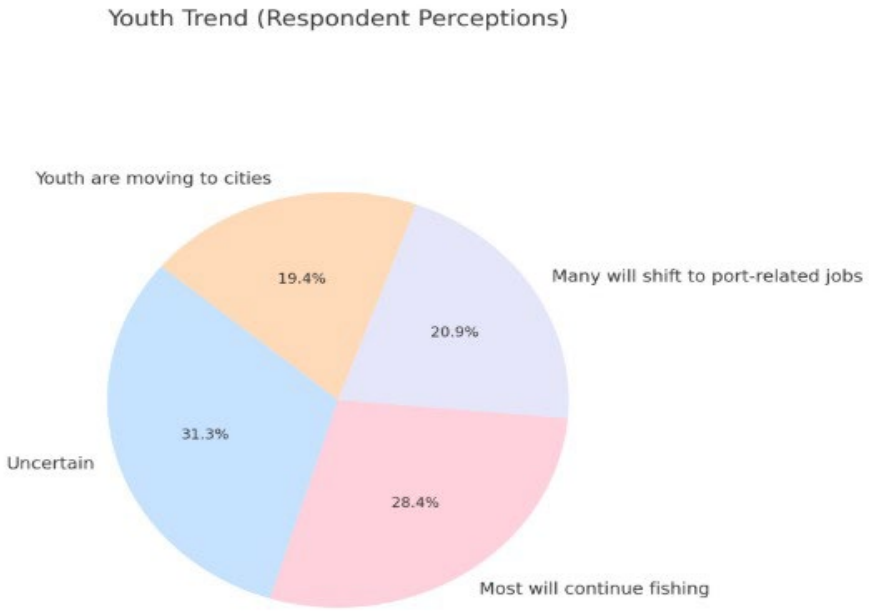

Figure 13 Youth Trend

Interpretation

This pie chart highlights community perceptions regarding the future of youth in fishing villages near Vizhinjam. A notable 31.3% of respondents expressed uncertainty about what direction the next generation would take, indicating a lack of clarity or confidence in the current livelihood landscape. 28.4% believed that most youth will continue fishing, suggesting that traditional occupations still hold value, at least culturally. Meanwhile, 20.9% expect youth to shift to port-related jobs, reflecting emerging interest in alternative employment created by the port. Finally, 19.4% observed that youth are moving to cities, possibly in search of more stable or lucrative careers. The results indicate a community in transition, with younger generations weighing economic survival against cultural continuity. This reinforces the importance of training, education, and inclusion of local youth in port-linked employment plans

4.7.2 New Opportunities – Respondent Perceptions

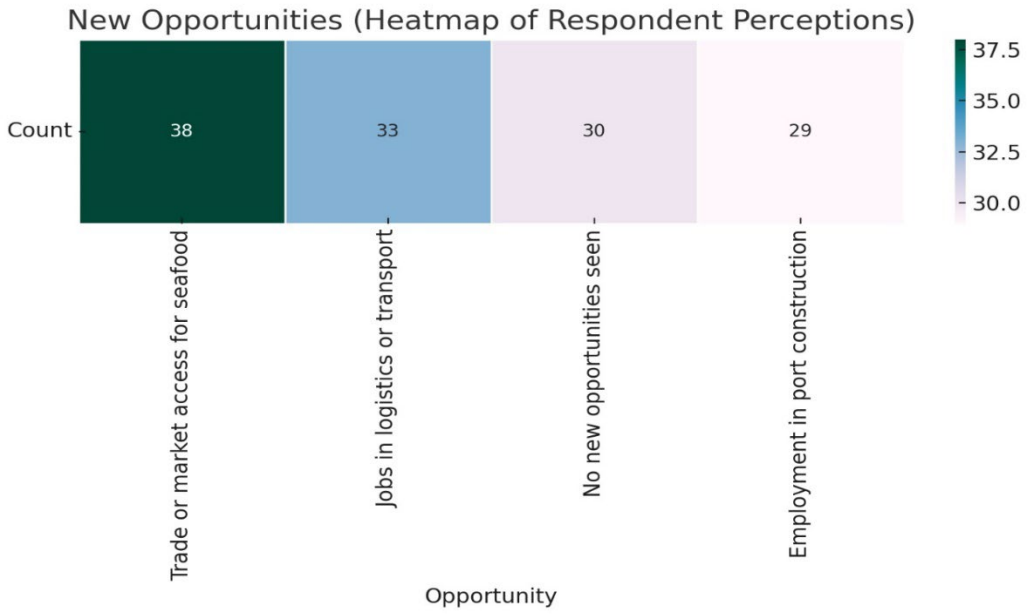

Figure 14 New opportunities

Interpretation

This heatmap illustrates fishermen's perceptions of new opportunities related to the Vizhinjam Port project. The primary opportunity identified was improved trade or market access for seafood, as noted by 38 respondents. This indicates that although the port has altered fishing patterns, some individuals recognize potential advantages in better distribution and sales. Additionally, 33 respondents pointed to job prospects in logistics or transport, reflecting consideration for alternative employment within the growing port ecosystem. Notably, 30 respondents reported a lack of new opportunities, highlighting feelings of exclusion or disconnection from the economic advantages of the port. Furthermore, 29 respondents mentioned job opportunities in port construction, suggesting a focus on temporary labour rather than sustainable career options. These findings imply that while some community members see economic promise linked to the port, many others feel marginalized or unaware of how to benefit from these opportunities. This underscores the necessity for targeted skill development, outreach initiatives, and equitable hiring practices to promote inclusive growth.

CHAPTER V

INTERPRETATION

5.1 Introduction to T-Test Analysis

This chapter provides a statistical analysis of significant findings through the paired sample t-test, a technique employed to compare the means of two related groups. In this research, the t-test was utilized to assess the differences in monthly fish catch and income prior to and following the establishment of the Vizhinjam Port (2015 vs 2025). The aim is to ascertain whether the observed changes are statistically significant and not merely the result of random fluctuations. The analysis was performed using Python libraries, including scipy. Subsequent sections will detail the code outputs and the relevant interpretations for each variable examined.

5.2 INTERPRETATION OF PAIRED SAMPLE T-TEST FOR FISH CATCH

In [2]:
```
from scipy.stats import ttest_rel
import pandas as pd

# Specify the path to your Excel file
file_path = 'Vizhinjam Port Fisheries Questionnaire Responses 1.xlsx'

# Load the Excel file
df = pd.read_excel(file_path, sheet_name='Sheet1')



# Drop rows with missing data
paired_data = df[['Fish Catch 2015 (kg)', 'Fish Catch 2025 (kg)']].dropna()

# Paired t-test
t_stat, p_value = ttest_rel(paired_data['Fish Catch 2015 (kg)'], paired_data['Fish Catch 2025 (kg)'])
t_stat, p_value

```

Out[2]: (2.9628103631073177, 0.004235427200955235)

Figure 15 Input and Output of Paired Sample T-Test on Fish Catch Data

```
In [7]:
mean_2015 = paired_data['Fish Catch 2015 (kg)'].mean()
mean_2025 = paired_data['Fish Catch 2025 (kg)'].mean()
print("Mean 2015:", mean_2015)
print("Mean 2025:", mean_2025)

Mean 2015: 357.46268656716416
Mean 2025: 313.5820895522388
```

Figure 16 Mean Values of Fish Catch in 2015 and 2025

To determine the impact of the Vizhinjam Port development on fishing yields, a paired sample t-test was conducted to compare the monthly fish catch data from 2015 and 2025. This statistical method was selected as it assesses the mean difference between two related samples, specifically the same group of fishermen over two different time frames.

The results of the test are as follows:

- Mean fish catch (2015): 357.46 kg
- Mean fish catch (2025): 313.58 kg
- t-statistic: 2.9628
- p-value: 0.0042

The p-value of 0.0042 is significantly lower than the 0.05 threshold, leading us to reject the null hypothesis. This indicates a statistically significant decrease in fish catch over the past decade. The results support the conclusion that the establishment and functioning of Vizhinjam Port have led to observable changes in fishing conditions, likely caused by limited access, marine disturbances, and ecological changes. This statistical data corroborates previous survey feedback from fishermen who have noted a significant drop in their daily catch.

5.3 Paired Sample t-Test – Monthly Income Comparison (2015 vs 2025)

In [1]:

```python
import pandas as pd
from scipy.stats import ttest_rel

# Load the Excel file
file_path = "Vizhinjam Port Fisheries Questionnaire Responses 1.xlsx"
df = pd.read_excel(file_path)

# Drop rows with missing income data
income_data = df[['Income 2015 (INR)', 'Income 2025 (INR)']].dropna()

# Run paired t-test
t_stat, p_value = ttest_rel(income_data['Income 2015 (INR)'], income_data['Income 2025 (INR)'])

# Output results
print("Paired t-test result:")
print(f"t-statistic: {t_stat:.4f}")
print(f"p-value: {p_value:.4f}")

```

```
Paired t-test result:
t-statistic: 5.7780
p-value: 0.0000
```

Figure 17 Code and Output for Paired Sample T-Test on Income Data

A paired sample t-test was performed to statistically evaluate how Vizhinjam Port affects fishermen's income levels, utilizing monthly income data from 2015 and 2025. This analysis compares the income of the same respondents over time to assess if the difference in means is statistically significant.

The test yielded the following results:

- **t-statistic**: 5.7780
- **p-value**: 0.0000

The findings reveal a markedly significant decrease in income from 2015 to 2025. Given that the p-value is substantially lower than the conventional threshold of 0.05, we can confidently reject the null hypothesis, which posits that there is no change in income over time. This indicates that the noted decline in income is not merely coincidental but represents a genuine and quantifiable downturn likely associated with

the construction of the port and its wider economic impacts on traditional fishing practices. This conclusion aligns with qualitative insights and survey feedback, where numerous fishermen have indicated diminished catch areas, limited access, and altered employment trends as factors contributing to their financial challenges.

5.4 Comparative Analysis of Average Fish Catch and Income (2015 vs 2025)

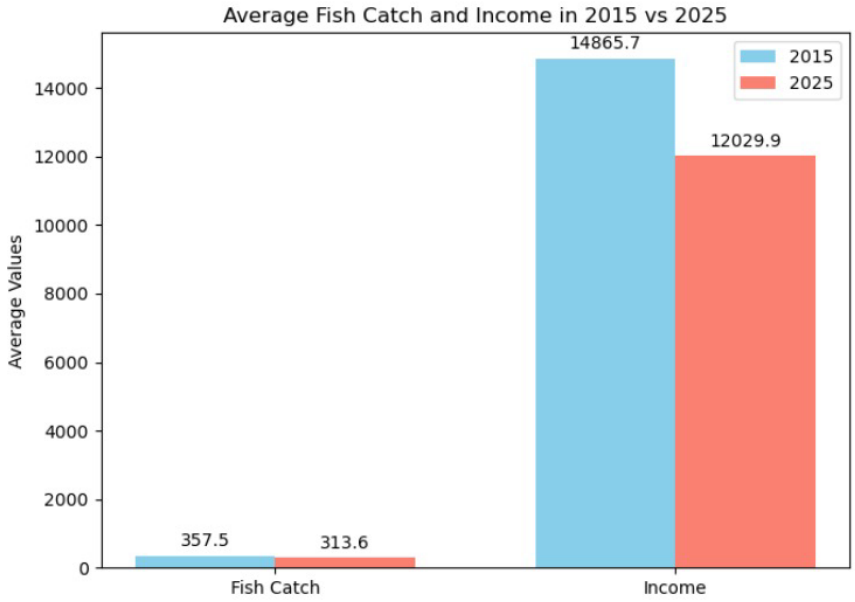

Figure 18 Average fish catch and income comparison: 2015 vs 2025.

The graph depicts the average fish catch (measured in kilograms) and household income (expressed in INR) for the years 2015 and 2025. A noticeable decrease is observed in both metrics over the decade. The average fish catch diminished from 357.5 kg in 2015 to 313.6 kg in 2025, signifying a considerable decline in marine yield. Similarly, the average monthly income decreased from ₹14,865.7 to ₹12,029.9, highlighting a significant economic downturn for the fishing community. These findings support the results of the paired t-test, which confirmed that the reductions in both fish catch, and income are statistically significant. This dual decline illustrates the cumulative impact of diminished fish availability, heightened operational difficulties, and environmental changes linked to the port development.

CHAPTER VI

CONCLUSION

6.1 Major Findings

The study found clear evidence that the development of the Vizhinjam International Seaport has had a noticeable impact on the fishing community's livelihood and surrounding environment. Statistical analysis confirmed a decline in both fish catch and income over the past decade. The average monthly fish catch fell from 357.5 kg in 2015 to 313.6 kg in 2025, while income decreased from ₹14,865.7 to ₹12,029.9, both changes being statistically significant.

Over 60% of respondents reported reduced access to traditional fishing areas due to construction-related restrictions. Most fishermen indicated that they had received little to no support from authorities, and only a few were aware of or had benefitted from relocation or compensation programmes. Although some younger members of the community have shown interest in alternative employment linked to the port, many still face challenges such as lack of training and information. Environmental concerns, including erosion and biodiversity loss, were frequently raised by participants

6.2 Conclusion

The research reveals strong evidence that the Vizhinjam Port, while a step forward in infrastructure and maritime commerce, has caused significant socio-economic challenges for the local fishing community. The reduction in income and fish catches, along with a lack of adequate support and insufficient consultation with stakeholders, highlights a developmental disparity. This study shows that the negative impacts of such projects are widespread, affecting individuals regardless of their perceived level of influence. Traditional fishing, which is essential to the culture and economy of these communities, is now under increasing threat from ecological changes and displacement. The lack of ongoing communication between authorities and local stakeholders has further diminished trust in public institutions. Consequently, the research emphasizes the necessity for a development approach that focuses on inclusion, transparency, and the long-term protection of livelihoods for vulnerable groups impacted by large-scale infrastructure projects like the Vizhinjam Port.

6.3 Recommendations

- Revise and Strengthen Compensation and Relocation Frameworks

Current compensation programs need to be reassessed to guarantee they are prompt, clear, and easy to access. Relocation initiatives should be crafted with input from the community and address the genuine economic, cultural, and spatial requirements of displaced families. Compensation must extend beyond mere financial payments to encompass livelihood restoration, housing solutions, and sustainable support systems.

- Develop Tailored Skill-Building and Employment Transition Programs

Training initiatives should be designed for younger individuals in fishing families to help them transition into port-related or other industries. These initiatives need to match local employment needs and include job placement assistance. Additionally, it is essential to safeguard traditional knowledge and provide opportunities for dual income sources whenever possible.

- Implement Marine and Environmental Safeguards

To protect the ecological base of traditional fishing, authorities should create marine conservation zones, regulate port-based pollution, and invest in habitat restoration such as artificial reefs. Continuous environmental impact assessments should guide port expansion and ensure ecological sustainability alongside economic growth.

6.4 Practical Implications

This research offers practical recommendations for policymakers, port developers, and civil society groups engaged in the nexus of infrastructure growth and community welfare. The results reveal a significant gap between the execution of large-scale projects and the real-life challenges encountered by traditional fishing communities. Without the active participation of stakeholders during the planning and implementation stages, even well-meaning development initiatives risk alienating these communities. This necessitates a transformation in governance models—from hierarchical systems to inclusive and participatory approaches. Institutions need to enhance their accountability frameworks and create comprehensive compensation strategies that extend beyond one-time payments to encompass capacity building and pathways for economic transition. Additionally, the social license to operate such

initiatives must be consistently reaffirmed through open communication and fair distribution of benefits. Ultimately, this research advocates for a more compassionate and comprehensive perspective on development—one that prioritizes people alongside infrastructure.

6.5 Theoretical Significance

This study significantly enhances the existing literature on displacement caused by development, disruption of livelihoods, and coastal socio-economics. Utilizing quantitative techniques like paired and independent sample t-tests on field data, it presents a model that can be replicated for assessing livelihood effects in similar infrastructural scenarios. Additionally, the results deepen our comprehension of the interplay between large infrastructure initiatives and traditional occupational practices, especially in culturally rooted sectors like artisanal fishing. The findings reinforce theoretical viewpoints that warn against a purely economic or technical interpretation of development, promoting instead a comprehensive approach that encompasses social, environmental, and psychological factors. Consequently, this research connects applied development studies with the tangible realities faced by communities, serving as a crucial reference for future academic inquiries and policy strategies aimed at aligning growth with social equity.

REFERENCES

• Prasad, P. (2022). *A study on the environmental and socio-economic impact of Vizhinjam Port*. International Journal of Creative Research Thoughts (IJCSP), 10(2), 35–42.

• Mongabay India. (2022). *Fish famine, livelihood loss due to upcoming Vizhinjam port, say fishers of south Kerala*. Retrieved from https://india.mongabay.com

• The New Indian Express. (2021, July 28). *Vizhinjam port turning into an eco-disaster*. Retrieved from https://www.newindianexpress.com

• Jana Keeya Padana Samithi. (2024). *Our Beaches, Our Sea: Heritage of Fishing Communities, Usufruct of All Citizens*. Business & Human Rights Resource Centre.

• Sagar Sandesh. (2024, January). *Vizhinjam Port may not affect fish landing?* Retrieved from https://www.sagarsandesh.in

• CMFRI. (2022). *Estimation of Marine Fish Landings Data from the Potential Impact Zones of Vizhinjam International Seaport, Kerala, India*. Kochi: Central Marine Fisheries Research Institute.

• L&T Infrastructure Engineering Ltd. (2021). *Environmental Impact Assessment (EIA) Report for Vizhinjam Port*. Submitted to the Government of Kerala.

• Rajagiri outREACH. (2020). *Social Impact Assessment of Land Acquisition in Vizhinjam and Kottukal Panchayats*. Kochi: RLabZ.

• Earth Journalism Network. (2023). *The tragedy looming over Kerala's mussel fishers*. Retrieved from https://earthjournalism.net

• Ministry of Ports, Shipping and Waterways. (2020). *Maritime India Vision 2030*. Government of India.

• Adani Group. (2023). *Vizhinjam Port: Project Overview*. Retrieved from https://www.adaniports.com/vizhinjam

• Kerala State Coastal Area Development Corporation (KSCADC). (2022). *Skill Development & Livelihood Programs Report*. Government of Kerala.

• Matsya fed. (2021). *Annual Report: Welfare Programs for Fishermen*. Thiruvananthapuram: Kerala Fisheries Department.

• Central Marine Fisheries Research Institute. (2021). *Marine Biodiversity Loss in Coastal Kerala*. CMFRI Bulletin No. 89.

• Friends of Marine Life (FML). (2021). *Community Statement on Coastal Erosion and Habitat Loss in Vizhinjam*.

• CMFRI. (2012). *Fish Landing Trends in the Kerala Coast: 2011–2012 Baseline Study*. Kochi: CMFRI.

• Kerala Fisheries Department. (2020). *Fishing Fleet and Income Statistics of Thiruvananthapuram District*. Government of Kerala.

• Government of Kerala. (2018). *Rehabilitation and Resettlement Plan for Vizhinjam Project Affected Families*. Department of Ports.

• Indian Ports Association. (2020). *Sagarmala Project Overview*. Ministry of Ports, Shipping & Waterways.

• The Hindu. (2021, December 5). *Concerns rise over ecological loss near Vizhinjam coast*. Retrieved from https://www.thehindu.com

• CMFRI. (2021). *Annual Fish Catch Analysis and Ecosystem Changes*. Kochi: CMFRI.

• The Times of India. (2023, February 15). *Fishermen protest over port compensation delay*. Retrieved from https://timesofindia.indiatimes.com

• Business Line. (2021, August 14). *Vizhinjam port development and the disappearing beaches*. Retrieved from https://www.thehindubusinessline.com

• K.V. Thomas, & Mathew, G. (2019). *Marine Infrastructure and Coastal Community Livelihoods*. Journal of Coastal Studies, 16(3), 221–236.

• Sharma, R. (2022). *Environmental Governance in Indian Ports: A Case of Vizhinjam*. Indian Journal of Maritime Policy, 7(1), 55–68.