Voices From The Atolls: A Participatory Assessment Of Climate Change Awareness Among Small-Scale Fishermen In Lakshadweep Islands.

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Abstract
Amid the fragile beauty of the Lakshadweep atolls, where livelihoods are deeply intertwined with the sea, the research amplifies the voices of small-scale fishermen to uncover how they perceive and respond to the mounting challenges of climate change. Climate change poses significant challenges to coastal and island communities, and this research focuses on understanding the awareness and perceptions of small-scale fishermen in the Lakshadweep Islands through a participatory assessment. Sixty fishermen from six inhabited islands were interviewed using semi-structured interviews, focus group discussions, and participatory tools such as seasonal calendars and risk mapping. The findings reveal that while 56.7% of the participants were partially aware of climate change based on their lived experiences, only 15% demonstrated comprehensive awareness of its causes and consequences. The majority of the fishermen reported a decline in fish availability (86.7%) and instances of coral bleaching (71.7%), which they perceived as threats to their traditional fishing grounds and livelihoods. The participants relied on traditional ecological knowledge and informal adaptive strategies, such as shifting to deeper fishing areas (58.3%) and using seasonal fishing calendars (68.3%). The participatory tools were found to be effective in engaging the participants and capturing their local knowledge. The study highlights the need for targeted awareness campaigns, capacity-building initiatives, and the integration of local ecological knowledge with scientific understanding to enhance community resilience to climate change in the Lakshadweep Islands.

Key words - Small-scale fishermen- Lakshadweep Islands- Participatory assessment- Traditional ecological knowledge- Community resilience

Introduction

The Lakshadweep Islands, India's only coral atoll archipelago, are at the frontline of the global climate crisis. Characterized by low-lying terrain, fragile ecosystems, and deep-rooted cultural ties to the sea, these islands are particularly vulnerable to rising sea levels, shifting weather patterns, and the degradation of marine resources. Among the most affected are small-scale fishermen, whose lives and livelihoods are intricately connected to the rhythms of the ocean. Despite their vulnerability, the voices of these coastal communities often remain underrepresented in formal climate discourse. Through participatory research tools and community engagement, the study explores the level of climate change awareness among fishermen, documents their observations of environmental transformations, and highlights the traditional knowledge systems and coping strategies that sustain them. In doing so, it contributes to a more inclusive and grounded understanding of climate resilience in small island contexts—where local knowledge, when meaningfully integrated with policy and scientific insight, can inform more adaptive and community-driven responses to environmental change.

The coral atoll islands of Lakshadweep are among the world's lowest-lying island groups, making them exceptionally vulnerable to the impacts of sea level rise. This geographic fragility places Lakshadweep at the frontline of climate change threats. According to the IPCC (2007), global sea levels could rise by at least 40 cm by 2100, potentially submerging extensive coastal areas and resulting in the loss of up to 88 percent of coral reefs—often described as the "rainforests of the ocean." In India, researchers have identified the Lakshadweep archipelago as one of the regions most susceptible to such inundation. The Lakshadweep Action Plan on Climate Change (2012) highlights several unique characteristics of the islands that intensify their climate vulnerability: limited land area, high population density, insufficient infrastructure, dependence on a narrow range of fragile natural resources, and a declining freshwater supply. Combined with ongoing economic and developmental constraints, these factors increase the islands' exposure to both current and future climate-related risks. As such, the recommended climate strategy for Lakshadweep emphasizes a precautionary adaptation approach, integrated within the broader framework of sustainable development. Even in the absence of climate change, this approach supports "no-regret" investments—measures that not only enhance the islands'

resilience and reduce vulnerability but also promote the long-term sustainability of both natural resources and human communities.

Additionally, climate change exacerbates issues related to urbanization, pollution, and sanitation, thereby stressing freshwater resources, as observed in countries like Kiribati (Storey & Hunter, 2010).The vulnerability of small island communities is further heightened by their limited resources and geographical isolation. Small island developing states (SIDS) have been proactive in international climate change negotiations, such as during the Paris Agreement talks, advocating for strong climate action and highlighting their unique vulnerabilities. However, these states face challenges in advancing their leadership and securing immediate actions to protect their communities (Ourbak & Magnan, 2017). Islands such as those in the Lakshadweep archipelago, characterized by limited land area, high dependency on natural resources, and constrained adaptive capacity, encounter significant environmental and socioeconomic challenges. Phenomena associated with climate change, including sea-level rise, ocean acidification, coral reef degradation, and altered weather patterns, have already begun to impact the ecological balance and livelihoods of coastal populations globally. Particularly affected are small-scale fishermen, whose daily interactions with marine ecosystems position them as both frontline witnesses and victims of environmental transformation. The Lakshadweep Islands, comprising 36 low-lying coral atolls and reefs in the Arabian Sea, host vibrant small-scale fishing communities whose livelihoods are intricately linked to marine biodiversity. Over generations, these communities have developed an intimate ecological knowledge of their surrounding seas, employing traditional practices that have sustained both marine life and human well-being. However, recent years have seen unprecedented environmental stress in the region, including increased sea surface temperatures, coral bleaching events, shifts in fish migration patterns, and more erratic monsoons. Despite these observable changes, there remains a paucity of empirical research on how local fishing communities perceive, understand, and respond to climate change.

While numerous global studies have investigated climate awareness, the majority have focused on urban populations or formal sectors, with limited attention given to Indigenous and small-scale resource users in remote areas. Understanding local perceptions is crucial not only for documenting ground realities but also for designing inclusive, context-specific climate adaptation strategies. Furthermore, participatory research approaches—where communities are engaged as active contributors rather than passive subjects—can enhance the relevance and effectiveness of environmental policy interventions. This study aims to address these gaps by conducting a participatory assessment of climate change awareness among small-scale fishermen across six inhabited islands of Lakshadweep. Specifically, it examines fishermen's understanding of climate change, documents their observations of environmental changes, identifies their coping strategies, and evaluates the effectiveness of participatory tools in surfacing local environmental narratives. Through this lens, the study seeks to amplify the voices of those living at the climate frontline and contribute to more grounded and equitable climate discourse and policymaking in India's coastal and island regions. The objectives of this study are centred on understanding the intersection of local knowledge and climate change among small-scale fishermen in the Lakshadweep Islands. Specifically, the study focus to assess the level of climate change awareness within these fishing communities and to document their observations of changes in the environment and marine ecosystems. It also seeks to identify traditional ecological knowledge and locally practiced coping mechanisms used in response to climate variability. Additionally, the study utilizes participatory methods to document community-driven environmental narratives, placing local voices and lived experiences at the core of the research process.

Study Area

Lakshadweep, the smallest Union Territory of India by land area, is a coral archipelago situated in the Arabian Sea between latitudes 8°N to 12°30'N and longitudes 71°E to 74°E. It is the only coral atoll reef system in the Indian subcontinent and forms part of the northern section of the Chagos–Maldive–Laccadive Ridge—a 2,500 km-long underwater mountain range in the Indian Ocean. The territory encompasses 36 islands, including 12 atolls, three coral reefs, and six submerged sandbanks, with only 10 islands currently inhabited. Despite covering a mere 32.20 square kilometres of land, Lakshadweep features a lagoon area of 4,200 square kilometres, territorial waters extending over 20,000 square kilometres, and an Exclusive Economic Zone (EEZ) of approximately 400,000 square kilometres, underscoring its ecological and geopolitical significance. The islands are organized into three primary clusters: the Aminidivi Group (Amini, Kadmat, Kiltan, Chetlat, Bitra), the Laccadive Group (Androth, Kavaratti, Agatti, Kalpeni, Bangaram), and the Minicoy Group, with Minicoy being the sole inhabited island in its cluster. The topography is characterized by low elevation, ranging from -0.4 to 6 meters above mean sea level, making the islands particularly vulnerable to the impacts of climate change, including sea-level rise, storm surges, coastal erosion, and coral bleaching. The total coastline of Lakshadweep extends approximately 132 kilometers, encircling flat islands primarily composed of coral debris and sand. This research was conducted on six inhabited islands of the Lakshadweep archipelago: Kavaratti, Agatti, Minicoy, Kalpeni, Andrott, and Amini. (Fig 1) These islands were selected based on their active small-scale fishing communities and varying degrees of exposure to coastal and climate-related environmental changes. Each island represents distinct socio-ecological settings pertinent to assessing localized climate change awareness.

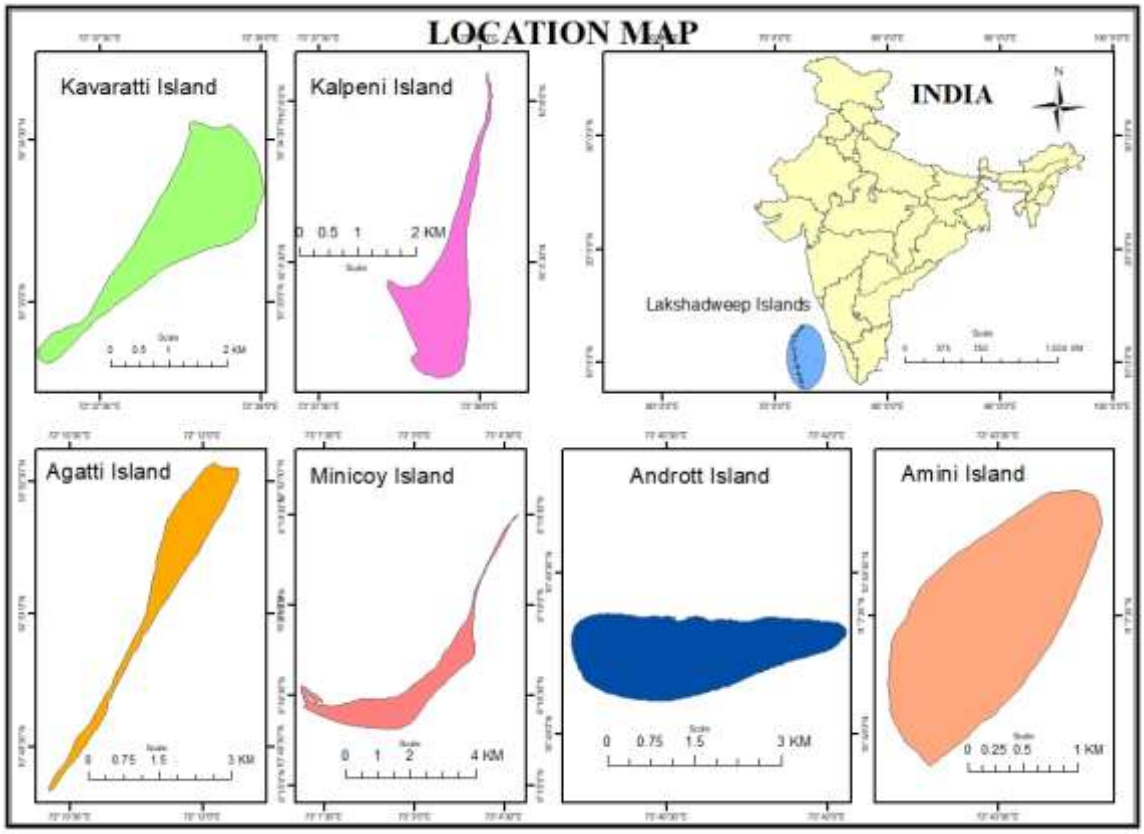

Fig 1 Study area Kavaratti, Agatti, Minicoy, Kalpeni, Andrott, and Amini island.

Methods

The research was carried out across six inhabited islands of the Lakshadweep archipelago—Kavaratti, Agatti, Minicoy, Kalpeni, Andrott, and Amini—each representing distinctive socio-ecological settings and fishing traditions within the island ecosystem. These islands were chosen due to their active small-scale fishing communities and their varying degrees of vulnerability to climate-induced environmental changes. (Fig 2)A total of 60 small-scale fishermen participated in the study, with 10 individuals selected from each island through purposive sampling. The selection criteria aimed to achieve diversity in age, years of fishing experience, and fishing techniques, including reef, lagoon, and pole-and-line fishing. This sampling strategy ensured a broad range of perspectives on climate change awareness and local ecological knowledge. The study employed a participatory qualitative research design to capture the lived experiences and perceptions of climate change among local fishing communities. Data were collected using semi-structured interviews, focus group discussions (FGDs), and participatory tools. Each participant was interviewed individually using an interview guide that included questions on observed environmental changes, climate change awareness, and adaptive practices. Interviews were conducted in the local language (Malayalam and Jasari) with the assistance of trained community facilitators and lasted between 30 to 45 minutes. Additionally, one focus group discussion was conducted on each island, involving the same group of 10 fishermen. These discussions provided a platform for shared reflection on climate-related experiences and community coping mechanisms. To further engage participants and visualize local knowledge, participatory tools such as seasonal calendars and risk mapping exercises were conducted on each island. These tools enabled the fishermen to illustrate changes in fishing seasons, marine biodiversity, and local climate patterns. All qualitative data—including interview transcripts, FGD recordings, and participatory materials—were translated into English and analyzed thematically through manual coding. Key themes were identified related to climate awareness, perceived environmental shifts, and adaptation strategies. Descriptive statistics were also used to summarize participants' demographic profiles and basic levels of climate awareness across the six islands. Ethical approval for the study was obtained from the relevant institutional ethics committee. Informed verbal consent was obtained from all participants after clearly explaining the purpose of the research and ensuring their right to withdraw at any stage. Confidentiality and anonymity were maintained throughout the study, and findings will be shared with local communities through island-level feedback sessions to support localized climate adaptation planning.

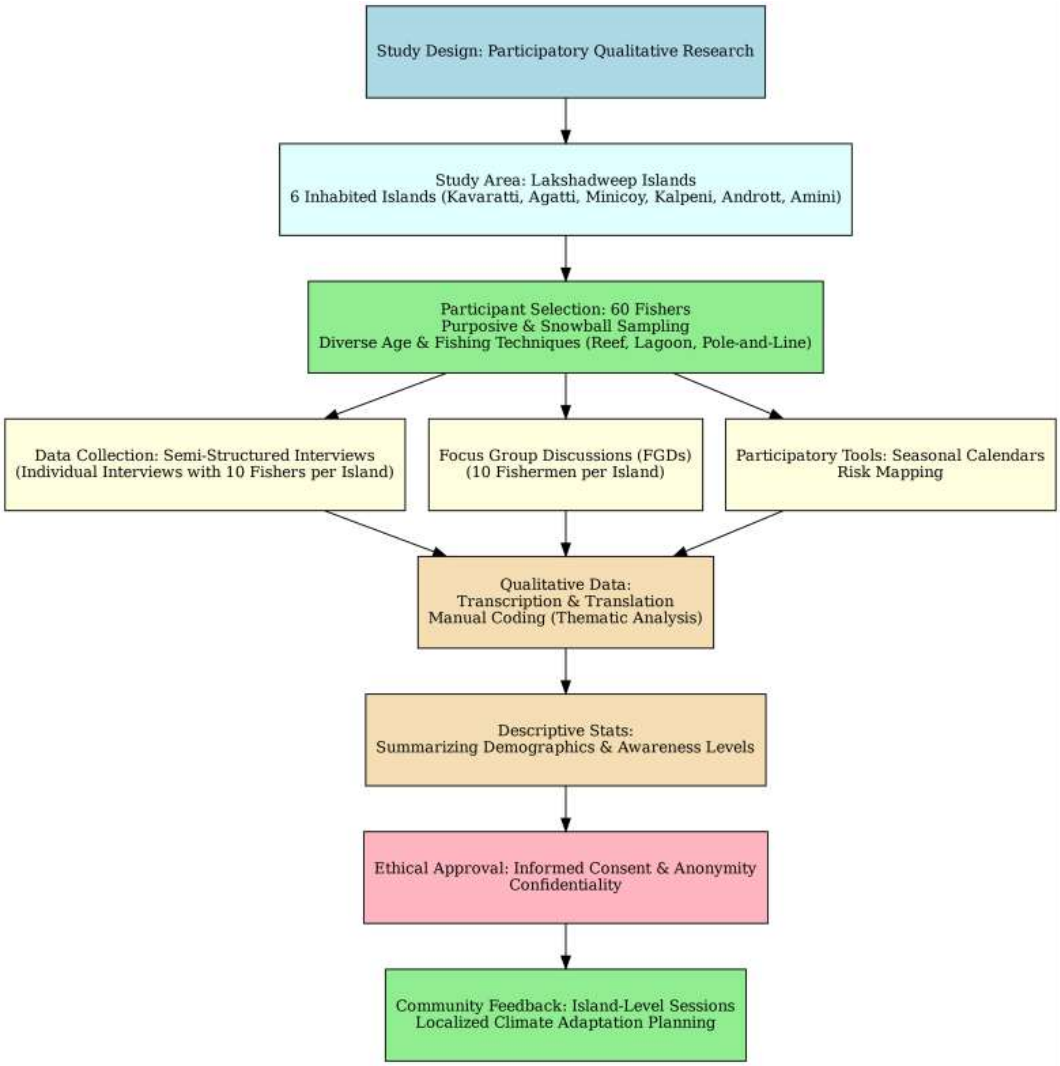

Figure 1 **Participatory Assessment of Climate Change Awareness among Small-Scale Fishermen in Lakshadweep Islands**

Results

The data obtained from 60 small-scale fishermen across six inhabited islands of Lakshadweep have been subjected to basic descriptive statistical analysis. The results are presented below in the form of tables, accompanied by detailed explanations.

Table 1: Level of Climate Change Awareness among Respondents

Awareness Level	Frequency (n = 60)	Percentage (%)
Fully Aware (understands causes and effects)	9	15.0%
Partially Aware (aware of changes but not causes)	34	56.7%
Unaware (no understanding of climate change)	17	28.3%

Table 1 elucidates that a substantial proportion of respondents (56.7%) exhibited partial awareness of climate change, primarily informed by personal experiences (e.g., observing warmer seas, reduced fish populations) rather than scientific comprehension. Only 15% demonstrated comprehensive awareness of the causes and consequences of climate change, whereas 28.3% were entirely unaware of the concept.

Table 2: Observed Environmental Changes Reported by Fishermen

Environmental Change	Frequency (n = 60)	Percentage (%)
Decline in nearshore fish availability	52	86.7%
Coral bleaching and reef damage	43	71.7%
Shifts in migratory fish species	38	63.3%

Increased storm frequency or severity	36	60.0%
Coastal erosion and land loss	31	51.7%
Saltwater intrusion into freshwater sources	23	38.3%

Table 2 illustrates that a significant majority of fishermen (87%) reported a decline in fish availability, corroborating the widespread perception of changes in marine biodiversity. Additionally, over 70% of respondents noted instances of coral bleaching, particularly in the regions surrounding Kalpeni and Agatti. These environmental changes are perceived as threats to traditional fishing grounds and the livelihoods of local communities.

Table 3: Coping Mechanisms and Adaptive Strategies

Coping Strategy	Frequency (n = 60)	Percentage (%)
Shift to deeper/offshore fishing areas	35	58.3%
Night fishing to avoid reef heat stress	28	46.7%
Use of traditional seasonal/lunar fishing calendars	41	68.3%
Informal local weather observation and alerts	33	55.0%
Rotating or resting fishing zones periodically	22	36.7%

Table 3 indicates that 68.3% of fishermen continue to rely on traditional ecological calendars, which have been transmitted through generations, thereby demonstrating the persistence of Indigenous knowledge systems. The support from modern scientific methods is largely absent; adaptation strategies are predominantly reactive and informal. Approximately 58% of fishermen have relocated to deeper fishing grounds as a direct response to reef degradation and the resulting scarcity of fish.

Table 4: Perceived Usefulness of Participatory Tools

Tool Used	% Found Useful	Common Feedback Themes
Seasonal Calendars	91.7%	Helped identify changes in fish migration and peak seasons
Risk Maps	83.3%	Made coastal erosion and hazardous zones visible
Focus Group Discussions	86.7%	Promoted community dialogue and knowledge-sharing

Table 4 illustrates the efficacy of participatory tools in enabling fishermen to visually reflect on their experiences. Seasonal calendars facilitated the tracking of changes in marine cycles, while risk maps empowered communities to identify coastal threats and delineate safe zones. These tools were commended for their practicality and inclusivity.

Table 5: Island-Wise Comparison of Awareness Levels

Island	Fully Aware (%)	Partially Aware (%)	Unaware (%)
Kavaratti	20.0%	60.0%	20.0%
Agatti	10.0%	70.0%	20.0%
Minicoy	30.0%	50.0%	20.0%
Kalpeni	10.0%	60.0%	30.0%
Andrott	10.0%	50.0%	40.0%
Amini	10.0%	60.0%	30.0%

Table 5 indicates that Minicoy demonstrated the highest level of full awareness (30%), which is likely attributable to increased exposure to tuna fisheries and climate programs led by non-governmental organizations. Conversely, Andrott exhibited the lowest level of awareness, with 40% of respondents entirely unaware of climate change. This discrepancy underscores the uneven distribution of environmental education and outreach initiatives across the islands.

Table 6: Respondents' Demographic Profile

Variable	Mean	Std. Deviation	Min	Max
Age (in years)	42.3	10.7	25	66
Years of Fishing Experience	22.1	9.3	5	45
Education (years of schooling)	6.4	2.8	0	12

Table 6 indicates that the respondents were predominantly middle-aged individuals with substantial fishing experience.

Nevertheless, the relatively low average educational attainment (mean = 6.4 years) may partially account for the limited scientific comprehension of climate change. Traditional ecological knowledge remains the primary framework through which local communities interpret climatic phenomena. Despite experiencing direct and tangible environmental changes, scientific concepts related to climate change have not been fully integrated into local discourse. The implementation of participatory tools has proven effective in enhancing community engagement and improving the quality of data collection. However, there remains an urgent need for targeted awareness campaigns and capacity-building initiatives, particularly in islands with lower levels of climate awareness, such as Andrott and Amini.

Fishermen's Voices from Lakshadweep

1. "Earlier we knew when the tuna would come close to shore. Now the sea is warmer, and they come late or not at all. We spend more fuel going farther, and sometimes we come back empty." – Male fisherman, Minicoy
2. "In the past, we used to fix our nets before the monsoon knowing exactly when it would start. Now the seasons are confused. Sometimes we lose our nets because the storm comes without warning." – Elder fisherman, Kalpeni
3. "Our fathers taught us that when the sea birds fly low, the fish will be plenty. But now, even the birds seem lost. The fish move differently, and we can't predict them anymore." – Youth fisherman, Kavaratti
4. "There's more heat in the afternoons. We used to fish till late, but now it's too hot and risky. I get headaches just standing on the boat for long." – Crew member, Agatti
5. "The coral reefs near our island have become white. We can see it with our eyes. That was where we caught parrotfish and reef cod. Now those places are empty." – Male diver-fisherman, Amini
6. "We still use the old lunar calendar for fishing. But even the tides are not behaving like they used to. Something is not right with the sea." – Boat captain, Androtт
7. "Before, the lagoon water stayed clean. Now we see more algal blooms and jellyfish near the shore. This affects the lagoon fish and the younger ones we depend on." – Net fisherman, Kalpeni
8. "When we were children, we used to walk across the reef at low tide to collect shellfish. Now, with the sea rising, we can't walk safely, and many spots are submerged all year." – Female family fisher, Minicoy
9. "Last year, a sudden storm took two boats by surprise. No one expected it. The sea used to give signs, now the signs are gone. It's like the ocean doesn't talk to us anymore." – Male elder, Agatti
10. "Fuel prices are going up, and we have to go farther to catch fish. It's getting harder to make ends meet. Climate change is making us spend more but earn less." – Line fisherman, Kavaratti

Fishermen's voice on Adaptation Measures in Lakshadweep

1. "Now we go fishing at night instead of during the day. The heat is too much, and the fish come closer to the surface when it's cooler." – Male fisherman, Kavaratti
2. "We've started using GPS and mobile apps for weather updates. Before, we only watched the sky, but now the sea changes too quickly." – Boat owner, Agatti
3. "Earlier we fished only near the reef. Now we go to deeper water because the reef fish are fewer. But it costs more fuel." – Crew member, Kalpeni
4. "We plan our trips according to the moon and tides, like always, but now we also check government advisories. We cannot rely on old ways alone." – Senior fisherman, Minicoy
5. "We have started pooling fuel and going out in groups. That way, even if one boat has a poor catch, we share what we get." – Group leader, Androtт
6. "Some of us have fixed shaded covers on our boats. It protects us from the sun during long hours. Earlier, it was never this hot on the sea." – Young fisherman, Amini
7. "We are drying more fish now, especially when there's a good catch. That way we can store and sell when the weather turns bad or the boats can't go out." – Male fisher, Kalpeni
8. "My son is learning about eco-tourism. If fishing becomes worse, we may shift to taking visitors to see the reef. It's a backup plan." – Fisherman-turned-guide, Minicoy
9. "We rotate our fishing spots now. If one area has fewer fish, we leave it for a while and try somewhere else. We never did that earlier." – Reef fisherman, Agatti
10. "After the last storm, we reinforced our boat shelters and store extra rope and gear. We've learned not to take the sea lightly anymore." – Boat repair worker, Kavaratti

Discussion

The dynamic relationship between small-scale fishers and their surrounding marine ecosystems in the Lakshadweep Islands offers a compelling lens through which to understand community-level responses to climate variability. The discussion interprets the insights gathered from participatory engagements, highlighting how local perceptions of changing weather patterns, declining fish stocks, and coral reef degradation reflect both experiential knowledge and lived realities. By examining these narratives, this section connects indigenous observations with broader scientific understandings of climate change, emphasizing how cultural values, livelihood strategies, and ecological awareness intersect to shape adaptive behaviour. Ultimately, the discussion seeks to contextualize these voices from the atolls within the wider discourse on climate resilience, sustainability, and policy inclusion in small island environments.

The analysis presents a complex and multifaceted understanding of climate change awareness among small-scale fishers in the Lakshadweep Islands. While most participants had limited formal education, a majority demonstrated an intuitive understanding of environmental changes based on lived experience. This aligns with previous studies in small island

developing states (SIDS), which highlight how Indigenous knowledge systems often substitute for scientific literacy in climate-vulnerable regions (Tompkins et al., 2005).

A key insight is that 56.7% of fishermen were partially aware of climate change. They noticed shifting marine patterns—such as declining fish availability, coral bleaching, and irregular monsoons—but could not always attribute these changes to broader climatic drivers. Only 15% exhibited full awareness of climate change causes and long-term consequences. This gap suggests that while experiential knowledge is strong, scientific understanding is limited, likely due to low levels of formal education (mean 6.4 years) and lack of targeted outreach by government or NGOs.

In Uganda, fishers are aware of climate changes, evidenced by irregular seasons and environmental changes affecting their livelihoods. However, despite this awareness, adaptation is hindered by limited access to credit and land, as well as low awareness about climate change impacts (Musinguzi et al., 2015). Several strategies have been identified to improve awareness and resilience among fishing communities. Educational outreach, particularly in local languages, through media and community engagement, is crucial for enhancing fishermen's understanding of climate change and promoting adaptation strategies. Such initiatives could involve practical demonstrations and use of technology, like in the Tanzanian context, where communities employ methods like deep water fishing and alternative economic activities to adapt sustainably (Kihila, 2017).

The environmental observations reported by participants—particularly fish stock depletion (86.7%) and coral reef degradation (71.7%)—are consistent across all islands. These findings corroborate ecological studies in the region that warn of rising sea surface temperatures and coral bleaching events threatening reef-based fisheries (Raghuraman & Singh, 2020). The fishermen's detailed recollections of seasonal shifts and species migration patterns also reflect the sensitivity of their livelihoods to even minor ecological changes.The rise in sea surface temperatures has significant implications for coral reefs and fisheries, as highlighted by recent studies. This is further exacerbated by ocean acidification and changes in ocean circulation patterns, which threaten the structural integrity and functionality of coral reefs (Cinner et al., 2015).The increased sea surface temperatures facilitate the poleward expansion of tropical reef corals, which can transform temperate ecosystems as they extend their range. This shift can lead to significant ecological changes, as these corals demand specific conditions to thrive, altering the balance within marine ecosystems (Yamano et al., 2011). Overall, the environmental observations reported by participants align with these ecological studies, confirming that rising sea surface temperatures and associated phenomena like coral bleaching and poleward species shifts are additional pressures on marine fisheries. This underscores the necessity for management strategies that adapt to these changes, including establishing networks of marine protected areas and developing comprehensive responses to the multifaceted impacts of climate change on marine ecosystems (Keller et al., 2009).

In terms of adaptive responses, fishermen primarily relied on traditional knowledge systems. The widespread use of seasonal calendars (68.3%), shift to deeper waters (58.3%), and peer-based weather forecasting illustrate a form of low-tech resilience rooted in cultural practice. However, these coping strategies are short-term and reactive. Without scientific tools, early warning systems, or government support, their long-term sustainability remains uncertain—especially as climate events intensify.

Traditional knowledge systems play a crucial role in enhancing the resilience of fishing communities by leveraging indigenous practices and ecological wisdom. In Newfoundland and Labrador, Canada, local ecological knowledge (LEK) has evolved with fishing practices and adapted to policy shifts, economic demands, and ecological changes (Murray et al., 2006). Such adaptive responses, based on traditional knowledge, are instrumental for community resilience, especially in rapidly changing environments.In Hawaii, despite the breakdown of their traditional fisheries management system post-Western contact, communities have revitalized local traditions and resource knowledge to manage marine resources sustainably (Friedlander et al., 2013). This renaissance in community-based management indicates the potential of traditional knowledge to bridge past practices with contemporary sustainability needs, even as resources decline.

Customary marine tenure (CMT) systems exemplify the potential of traditional knowledge to manage marine resources sustainably despite external pressures (Ruddle et al., 1992). Such systems, common in the Pacific Basin, demonstrate the efficacy of Indigenous ecological knowledge in ensuring sustainable yields and equitable resource access, with resilience to environmental and sociopolitical changes.In Alaska, resilience strategies in fishing communities are reflected in their adaptation to ecological uncertainties and regulatory environments. Communities have historically diversified their livelihoods, which has allowed them to persist despite changes (Himes-Cornell & Hoelting, 2015). This showcases the importance of integrating traditional knowledge with contemporary management practices to foster long-term sustainability and community resilience.

The effectiveness of participatory methods—such as seasonal calendars, community mapping, and focus group discussions—was another significant outcome of this study. Over 90% of participants reported that these tools helped them express their concerns more clearly and reflect on observed changes. These methods not only captured rich, contextual data but also empowered the fishermen as co-creators of knowledge. This supports the growing literature on participatory approaches as crucial for climate adaptation planning in Indigenous and coastal communities (Reed, 2008).

Island-wise variation in awareness also presents valuable insight. Minicoy, with its exposure to offshore tuna fisheries and prior NGO interventions, had the highest awareness (30%), while Andrott and Amini showed lower awareness and fewer adaptive strategies. These discrepancies highlight the need for context-specific education and outreach programs, rather than uniform top-down approaches. The effectiveness of context-specific education and outreach programs in addressing climate change among island communities can be markedly improved when tailored to the specific needs

and characteristics of these communities. Island communities, particularly in regions like the Pacific and Caribbean, face unique challenges due to their geographical and socio-economic conditions, making targeted approaches more beneficial than uniform, top-down strategies.

Island communities are often among the first affected by climate change impacts, such as rising sea levels and changing weather patterns. These communities are not merely isolated or impoverished; they are globally connected and possess unique knowledge that must be integrated into climate solutions for justice and equity (Lazrus, 2012). To effectively engage these communities, local perceptions of risk and adaptive capacities must be understood and recognized, allowing for community agency in adaptation strategies.

Education plays a crucial role in enhancing climate change awareness and fostering sustainable practices within these communities. Traditional systems of environmental governance in peripheral island communities highlight the need for interventions that target community-level awareness, as top-down approaches have proven ineffective in fostering sustainable adaptation A multi-layered, integrative approach to climate adaptation planning, which includes collaboration across disciplines and stakeholders, can be particularly effective in small island developing states (SIDS) and coastal areas. This approach aligns various adaptation strategies across local and national levels, ensuring better planning outcomes over time (Hafezi et al., 2018).Moreover, the integration of traditional knowledge, like oral narratives in rural communities in Fiji, provides valuable insights into environmental changes and community responses (Janif et al., 2016). Preserving and incorporating this knowledge into adaptation planning can strengthen community resilience and ensure self-sufficiency. Efforts should also be made to address religious and fatalistic views, which are prevalent in some communities, by providing clear and pragmatic information about climate change and its impacts.A place-based engagement framework, which considers cultural values and community-specific meanings, has the potential to resonate effectively with diverse audiences. This approach empowers local actions and engages citizens in meaningful ways, allowing for adaptation strategies that are aligned with community values and needs (Schweizer et al., 2013).The study underscores that while climate change is already being experienced at the grassroots level, formal awareness and institutional support are lagging. Policymakers and development agencies must recognize that local communities possess deep ecological knowledge that can be leveraged in adaptation strategies. Bridging the gap between traditional knowledge and scientific understanding through participatory education and co-management frameworks could significantly enhance community resilience.

Conclusion

This study provides valuable insights into the awareness, perceptions, and adaptive behaviours of small-scale fishermen in the Lakshadweep Islands in relation to climate change. While scientific understanding of climate change was limited, experiential and traditional knowledge was widespread. Fishermen across all six islands have observed significant changes in marine ecosystems, including declining fish stocks, coral bleaching, and increased weather unpredictability. Their coping mechanisms—rooted in tradition, peer networks, and ecological observation—highlight both resilience and vulnerability. Participatory tools proved highly effective in surfacing these community-based narratives and facilitated deeper engagement. The findings underscore the urgent need for integrated adaptation strategies that bridge local ecological knowledge with scientific understanding. Without targeted interventions, the sustainability of these fragile communities—and the ecosystems they depend upon—remains at risk.

Policy Implications and Recommendations

This study highlights several critical policy implications and actionable recommendations to enhance climate resilience among fishing communities. Firstly, the limited awareness of scientific climate change concepts among fishers underscores the need for localized, vernacular-based climate education that is culturally relevant and sensitive to literacy levels. Recognizing and integrating traditional ecological knowledge—such as ecological memory and seasonal indicators—into formal fisheries and climate adaptation policies is equally important. Given the significant variation in climate awareness and adaptation strategies across different islands, a one-size-fits-all approach is inadequate. Instead, policies must be tailored to island-specific vulnerabilities and capacities. Institutional support is essential; government agencies and local panchayats should facilitate access to climate-resilient infrastructure, early warning systems, and alternative livelihood training, especially in highly vulnerable zones. Moreover, the effectiveness of participatory tools demonstrated in this study calls for the establishment of participatory governance frameworks that involve communities directly in knowledge generation and decision-making processes.

To operationalize these insights, several key recommendations are proposed. Climate awareness toolkits should be developed in local languages such as Malayalam and Jasari, using visual and audio formats to enhance accessibility and cultural resonance. Training local youth as ‘climate communicators can help bridge the gap between scientific knowledge and traditional practices. Institutionalizing community-generated seasonal calendars and risk maps into fisheries management and disaster preparedness is crucial for localized planning. Strengthening collaborations between NGOs, academic institutions, and local governance bodies can ensure long-term participatory research and responsive policymaking. Diversifying livelihoods through sustainable aquaculture, eco-tourism, and reef conservation will reduce dependency on wild fisheries and improve economic resilience. Finally, establishing an island-level Climate Watch Forum will provide a collaborative platform for fishers, researchers, NGOs, and local officials to regularly share marine and climate-related observations, warnings, and updates, fostering adaptive and responsive local action.

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