Psychological impacts of aquatic ecosystem degradation on mental health and social dynamics of coastal communities and fisheries

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Abstract

Coastal societies obtain various ecological, economic, and cultural services from aquatic ecosystems. However, increasing pollution, overfishing, habitat loss, and climate change-driven alterations are not only threatening ecosystems and aggravating the psychological stress of those who rely on them, but also targeting the psychological resilience of the people who depend on them. There's growing evidence indicating environmental degradation activates stressors, anxiety, and a decrease in social cohesion, yet the opposite seems to be the case within the fishery's dependent regions. This type of integrated research considers the impact of the degradation of aquatic ecosystems on the mental health of coastal communities. It analyzes how these ecosystems affect social cohesion/ disintegration, as well as the sustainability of livelihoods dependent on fisheries. The research was conducted as a mixed-methods study. The mental health level of the community was assessed using various questionnaires, and water quality, biodiversity level, and various fishery parameters were assessed during in-depth interviews with fishers and community members, as well as during the environmental assessment. The quantitative data were analyzed using advanced statistical methods, while the qualitative data were analyzed thematically. Based on the results, those individuals who experienced

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ecological grief and anxiety, and stress in fish stocks and water quality were aggravated. Environmental degradation and psychological distress were seen as major indicators of these ecosystems. The results further highlight the importance of the socio-ecological system, underscoring the need to couple community mental health with environmental restoration. In order to reduce the long-term impacts, it is necessary to have sustainable fisheries management, social safety nets, and the implementation of strategies to build resilience.

Keywords: Aquatic ecosystem degradation, Mental health, Coastal communities, Fisheries, Social dynamics, Ecological grief, Environmental stress

Introduction

Aquatic ecosystems are important for the sustenance and well-being, and the cultural identity, of people in coastal communities due to the range of services these ecosystems provide (e.g., shoreline protection, nutrient cycling, habitat stability, and employment). These ecosystems are also a key source of food, income, and economic activity in the form of fisheries, aquaculture, and tourism (Bosco, 2025). For coastal communities, the diverse services provided by aquatic ecosystems are tied to the social fabric, traditions, and psychological well-being, and resilience of the community. Unfortunately, the last several decades have seen increasing degradation of aquatic ecosystems due to human and climate stressors (Pichler, Connell and Mcafee, 2025). For instance, agricultural pollutants, industrial discharge, and marine debris have lowered water quality and altered species composition. Resource availability and fish population stability have also been negatively impacted by unregulated and destructive fishing practices (Brinda and Sindhu, 2024). Coastal development and land use changes have created sedimentation, which, in turn, smothered habitats. Climate change has also increased the stress on marine organisms through rising sea temperatures and ocean acidification (Cianconi, Betrò and Janiri, 2020). Collectively, these disturbances have threatened not only the ecological health of these systems but the livelihoods of communities in coastal areas as well (De Carvalho *et al*., 2025).

Environmental changes always have negative consequences, especially physical changes, and their consequences on psychological effects on people remain unassessed concerning the degradation of the environment. Those who depend directly on the environment and experience a loss of biodiversity and changes in water quality become anxious and emotionally distressed. Loss of quality fish and changes in water, people become disheartened and feel ecological loss (N'Guetta *et al*., 2025; Kudeshova, 2025). Loss of economically active fishery and derived social instability and loss of cohesion lead to tensions on mental health (Hugh *et al*., 2024 Pienkowski *et al*., 2024). Those coastal areas with strong dependence on natural ecosystems and have few diversified means of earning are more vulnerable socio-economically and ecologically (Khaledi, Owfi and Pahlevan, 2025). Existing research on the degradation of ecosystems on social structures and

mental loss has largely been neglected. There are only a few studies that combine mental analysis of a community with ecological assessment of the environment. A wider gap of loss of ecosystems also includes less focus on social loss. There are more studies that focus on loss of mental health and loss of social cohesion. More studies focused on economics and ecologies (Kabir *et al*., 2025).

To address this gap, the present study examines the psychological impacts of aquatic ecosystem degradation on coastal communities and fisheries-dependent households. Specifically, the study aims to

(i) To assess the relationship between ecosystem degradation indicators and mental health outcomes;

(ii) To analyze how changes in aquatic environments affect community dynamics, social cohesion, and livelihoods; and

(iii) To identify the socio-ecological factors that contribute to community vulnerability and resilience.

It is hypothesized that increased degradation of aquatic ecosystems is associated with heightened psychological distress and disruptions in social stability among coastal populations.

Materials and Methods

This research took place in small-scale artisanal fishery-dependent coastal community ecosystems. The zone under consideration encompasses a tropical coastal area with monsoon-influenced nearshore marine and estuarine ecosystems. Recently, the zone has displayed environmental changes, namely poor water quality, sedimentation, fish stock decrease, extinction of coastal flora, and the abrupt loss of coastal vegetation. The environmental changes stem from poor coastal governance, agricultural runoff, and the inappropriate disposal of wastes, coupled with overfished ecosystems and climate changes such as sea level rise and erosion. The study area has several generations of fishing families, weak livelihood diversification, and low education, coupled with strong bonds and a high cultural interest in marine resources, resulting in a situation of high distress when compared to other communities' socio-economically which is illustrated in Figure 1.

To analyze implications of ecological degradation on social-psychological systems, a mixed-method approach was adopted, and for a wide-ranging response, data were collected and synthesized in a variety of research frameworks. Allows for proportional representation of the fishermen, fish processors, fisher youths, and community leaders. The DASS-21 was one of the numerous instruments employed in assessing the communities' level of stress, anxiety, and psychological well-being along a continuum of standard depression, anxiety, and stress variables.

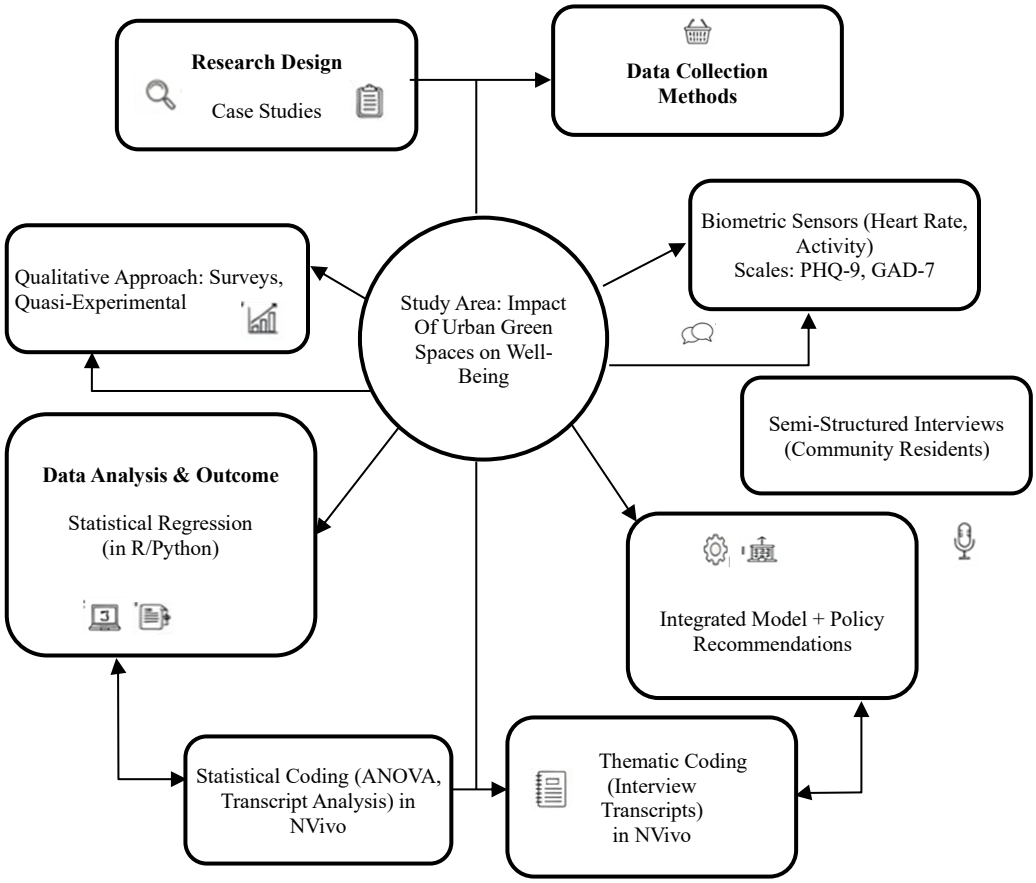

Figure 1: Framework for examining the impact of urban green spaces on well-being.

Research Assistants, well-versed in those tools, administered response protocols individually in compliance with the DASS and the GHQ, which were professionally considered and ethically determined instruments for communities. While variable data was externally verified, qualitative data were sought concomitantly through the primary informants, fishers, and the fish processing pipeline. Social intercessory and protective response cohesion of the community in the context of a modified environment, and the navigational resource deprivation of the community were the major topics of the structuring for the focus group discussions and the individual interviews. The content of the interviews was recorded for accurate representation at the stage of synthesis.

A variety of data was collected to understand how much of the ecosystem has been lost. Using traditional field and laboratory methods, the following water quality indicators were captured: dissolved oxygen levels, turbidity, pH, nutrient levels, biological oxygen demand, and salinity. Footage and pictures of the fish landing sites allowed for the identification of the biodiversity indicators (namely, fish species and catch composition), which were captured through daily monitoring. Longitudinal changes were validated through field data collected over time. Using satellite remote sensing data (where available), sediment deposition and coastal vegetation for the exact sites of the field HVZ observations were captured. Collected data from the mental health and environment surveys were described and analyzed (Kabir *et al*., 2024). Using

ANOVA, correlation, and multiple regression, mental health was assessed for the environment and was subjected to structural equation modeling (SEM) to explore the relationships (pathways) from degradation to the mental health and social outcomes (Koohpaei and Khandan, 2015). For the layered, polyphonic narratives of the FG, we used qualitative data analysis software to code them inductively and thematically to construct stressors, community changes, and ecosystems. Data was examined for missing values, discrepancies, and outliers, and whenever appropriate, z-score standardization and log-transformation were used. The relevant institutional review board approved the study, while the participants were given informed consent, and the study maintained strict confidentiality, anonymity, and cultural sensitivity throughout the course of the research.

The analysis of some water quality indicators, which include dissolved oxygen content, turbidity, pH, nutrients, biological oxygen demand, and salinity level, was done with conventional field and laboratory techniques. Daily monitoring allowed integration of photos and videos of fish landing sites for verification of biodiversity indicators (i.e., fish species and composition of the catch) and biological collection. Longitudinal validation applied to field data collected over time. Where available, satellite remote sensing data were used to capture sediment deposition and coastal vegetation for the particular sites of field HVZ observations (Bruno and Muraleedaran, 2025). The data collected from the surveys on mental health and the environment were described and analyzed. Environmental mental health data were assessed using ANOVA, correlation, and multivariate regression analyses and were then subjected to structural equation modeling (SEM) to elucidate the pathways of degradation to mental health and the social outcomes (Hagan *et al*., 2025; Geetha and Krishnamoorthy, 2024). For the multi-layered, multi-voiced stories of the FG, we used qualitative data analysis software to inductively and thematically code the data to build the narratives on community stressors, changes, and ecosystems. The dataset was checked for completeness, inconsistencies, and outliers, and where necessary, z-score standardization and log transformation were applied. The appropriate institutional review board authorized the research project, informed consent was obtained from each study participant, and the research project adhered to high levels of confidentiality, anonymity, and cultural sensitivity during the research period.

Results

According to Table 1, one can see a declining trend in species richness and catch frequency. Table 1 confirms that over the past 25 years, major species have witnessed unprecedented drops in their catch rates, which are related to the loss of biodiversity and degradation of marine habitats. The 'Ecological Significance' column makes these species more connected in terms of the functioning of ecosystems and hence the need to conserve them.

Table 1: Decline in fish species richness and catch composition.

Fish Species	Catch Frequency (2000)	Catch Frequency (2025)	% Decline in Catch Frequency	Ecological Significance
Marine Snapper (Lutjanus spp.)	450	150	67%	Indicator species for coral reef health
Grouper (Epinephelinae)	350	120	66%	Key predator species in reef ecosystems
Tilapia (Oreochromis spp.)	500	400	20%	Non-native species, but critical for local aquaculture
Sea Bass (Dicentrarchus labrax)	200	80	60%	Habitat-forming species, critical for coastal food webs
Mackerel (Scomber scombrus)	300	50	83%	Pelagic species, vital for food security in coastal areas

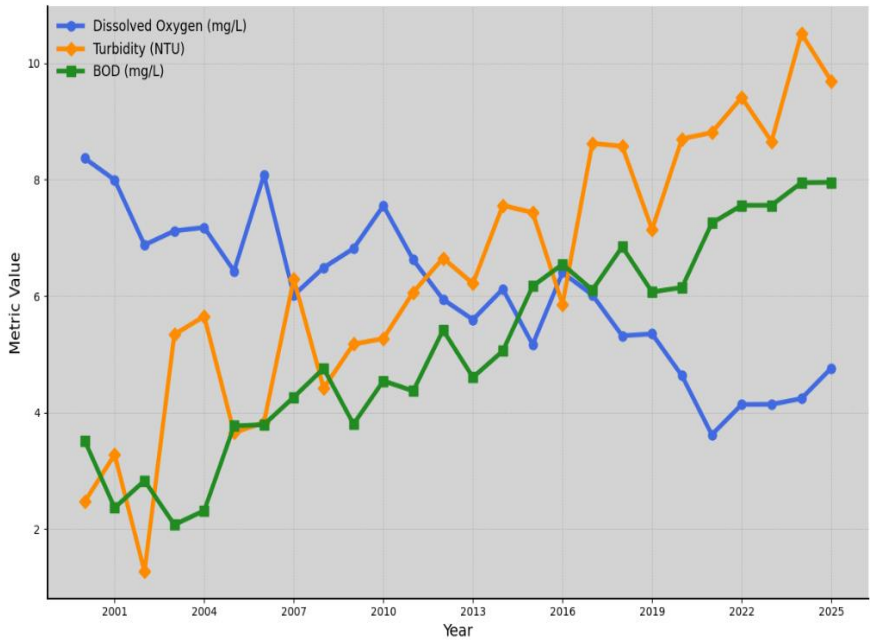

Figure 2: Water quality metrics over time (2000–2025).

Figure 2 illustrates the changing quality of water, showing the downward pattern of Dissolved Oxygen (DO) (blue), the upward pattern of Turbidity (NTU) (orange), and the upward pattern of Biological Oxygen Demand (BOD) (green) over a quarter of a century. There is a steady shift downward in DO, reflecting less oxygen and probable pollution and the eutrophication of water. There is also an increase in the turbidity of water, and thus increased sedimentation and runoff. There are higher organic pollutants, and therefore, lower oxygen. In summary, the graph is a good summary of the negative consequences on the water.

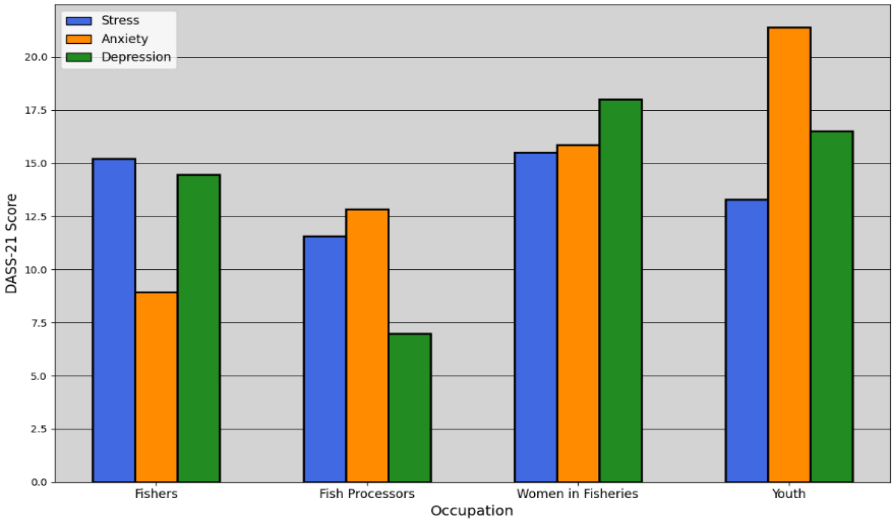

Figure 3: Stress, anxiety, and depression scores by occupation.

Figure 3 presents a comparison of the levels of stress, anxiety, and depression in the occupational sectors of the coastal communities. The highest level of stress is reported in the fishers due to volatility and uncertainty in their livelihood from dwindling fish stock. The fish processors are highly anxious due to their economic worries in the industry. Moreover, women in fisheries have the highest depression scores, possibly due to their caregiving and livelihood work. Most, if not all, the youth in the fisheries-dependent economy have future worries and are therefore the most highly anxious. The graph shows the mental health issues of these economically and environmentally unstable communities. The communities face mental health disorders due to the limited resources to ship outside the community.

Discussion

A noticeable connection between the decline of an aquatic ecosystem and the psychological effects on the coastal communities is one of the many findings that emanate from this study. More coastal communities are experiencing psychological issues like stress, anxiety, and depression as the environmental conditions of the area continue to decline from the overfishing of resources, pollution, and degradation. Fishers show the highest levels of stress among the coastal community, and this is because of the increasing instability and uncertainty of their livelihood. Resource overexploitation, such as fish, leads people to struggle with their anxiety and helplessness toward the environment. They lose reliable and familiar resources, and this drives the community to frustration. Additionally, fishery women, who continue to suffer from double and triple burdens from socio-economic and environmental pressures, are the ones to self-report higher scores of depression. These findings are consistent with other EU findings where a degraded environment leads to the ill health of the socio-economic populations, and more eco-anxiety is noted in Southeast Asian and Pacific Islands coastal communities, where overfishing, pollution, and other modern environmental psycho-distress are prevalent. It is now widely accepted in these communities that ecological decline is the cause of their stress and anxiety. Moreover, case studies focusing

on younger generations from Africa and the Caribbean Islands confirm the described intergenerational effects of environmental change, as coastal youths express worry about sustaining their livelihoods in the future and the declining sea ecosystem.

The degradation of ecosystems can be increasingly detrimental to mental health, yet communities are still displaying a significant degree of resilience. Regardless of the considerable psychological distress, the data demonstrate how these communities are employing coping mechanisms to deal with their changing surroundings. For instance, one group of fishers who previously only relied on one form of fishing to make a living has begun to pursue other means of livelihood diversification. Other fishers' women have entered fish processing to access other markets and engage in supplementary activities to alleviate the adverse effects of a decrease in fish supply. These problem-solving abilities and the collective nature of the community have been instrumental in social cohesion and community resilience to environmental stress. Although this resilience is not evenly distributed. Both the old and the economically/ psychologically most vulnerable sides of the community are those who have the greatest reliance on traditional fisheries. Thus, genuine and effective interventions need to simplify the remaining adaptive capacity focused on the most vulnerable in the community to provide for the rest of the community and determine how to balance the rest of the community during environmental change.

Environmental degradation impacts strained social bonds and conflicts within communities. As the fish stocks decline, the competition for these scarce resources becomes pronounced, and tensions increase concerning fishing rights and access to these resources. We observed conflicts between fishermen, fishermen and processors, and processors. As the resources become scarcer, the conflicts become more pronounced. There are also economic insecurities, and these conflicts are worsened by these insecurities. The youth experience more anxiety and frustration with this disengagement from the more traditional fishing and their limited employment due to this future uncertainty. The more they separate they the more they disengage from this less formally organized social systems problem. This study focuses on and clearly shows the links between the viability of the ecosystem and the psychological state of the population. The impaired elements of the ecosystems along the seacoast will economically, socially, and psychologically affect the communities dependent on the seacoast. There is a continued decline of the fisheries that people are directly dependent on, and this leads to a continued decline in the psychological state of the population. There is this decline of the natural resources and this decline of the psychological state of the population, and this becomes a public health issue. Consequently, the rehabilitation of marine ecosystems is not just a matter of ecological conservation, but also an important requirement for the psychological health of the coastal communities.

This study indicates that policymakers and fisheries managers should consider inter-sectoral management that combines marine and coastal policies more purposefully. Policies should integrate coastal community mental health and the restorative marine economy. Engaging practices in sustainable fisheries management, Community management, resource allocation, and adaptive practices will counter the negative effects of overfishing and pollution. Coastal policies should integrate mental health. Community programs that raise awareness and provide psychosocial support and coping strategies mitigate the mental health impact of ecological loss. Further, policy measures that diversify economies and reduce mono-sectoral, especially fisheries, dependence are important. A more balanced community able to face unpredictable environmental and socio-economic parameters is more resilient. Supporting alternative livelihoods, community training, and youth educational empowerment are strategies that help build balanced communities.

The study arrived at solid conclusions, although certain challenges were encountered. One such limitation includes the small sample uncovered, as such an issue can greatly hinder the broader use, or generalizability, of the research undertaken. With an expanded sample that is more representative of the public- in terms of geography, cultural and ethnic diversity, etc.- there would be a better chance at grasping the psychological ramifications of the degradation of the different ecosystems. Secondly, the research only focuses on one out of many of the world's coastal regions. This means that the results of the study will, theoretically, miss the impact that only studying one such coastal region will bring. Greater validation of the study could be undertaken through research that focuses on different coastal regions in the world and brings impact in comparison to the outcome of the regions that were already studied and documented. Also, some of the study's data were from interviews and surveys that were not very scholarly, and this could cause a certain amount of bias to creep in. The self-reporting of one's own mental health, in the surveys, could bring a level of prognosis that is not a true reflection of the stressors that result from changes in the environment. Future studies will be able to tie together qualitative and quantitative data more effectively by including genuine psychological data on mental health and on the health of the study's participants.

Conclusion

This study demonstrates the complex ways in which the degradation of ecosystems and the mental and social crises of coastal communities are interlinked. The psychological impacts of residents in community are stress, anxiety and depression due to phenomenon such as the over deterioration of the local environment, poor quality of water, reduction of fish stock and various stressors, The findings of the study show that mental health considerations as well as mental health integration are needed in the multidisciplinary field of geo-ecology, since geo-ecological decline represents an environmental and public health crisis. The findings and results call for community-based conservation and integrated ecosystem restoration to target

mental health and public ecosystem health. The findings and results suggest that local government, international and national NGO, and policymakers should address mental health in the environment and eco-psychology. Support for stress-relieved, mental and public health practices in communities, economic diversification encouraging community resilience and public health, and reduced stress and dependency on over-exploited resources are suggested in the study.

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