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Understanding Coastal Management Dynamics In Tagkawayan, Quezon, Philippines: A Triangulation Approach

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ABSTRACT:
Ensuring sustainable coastal management practices requires a comprehensive understanding of the interplay between local knowledge, best practices, and existing management initiatives. This study investigates coastal management dynamics in Tagkawayan, Quezon, Philippines, employing a multifaceted approach termed CLEMENTE (Coastal Local Knowledge, Management Efforts, and Needs Triangulation). A stratified random sampling technique was used to select a representative sample of 119 registered fisherfolk who participated in semi-structured interviews, capturing their local ecological knowledge (LEK) on the relationships between biodiversity, economic well-being, and environmental health. Data triangulation was achieved by complementing the LEK collection with interviews of key informants from relevant Local Government Unit (LGU) offices, exploring their plans and programs for coastal management. This CLEMENTE approach transcends the limitations of singular data collection methods. By triangulating findings from fisherfolk (LEK), LGU officials (plans and programs), and the inherent context gleaned from secondary data (existing documents and reports), the study offers a holistic understanding of how local knowledge, best practices, and LGU initiatives interact to shape coastal resource management in Tagkawayan. Overall, the findings depict a community that recognizes the importance of responsible resource management and the value of collaboration. However, there's a need to address the gaps between awareness and action. Thus, this approach is helpful to assess the coastal management dynamics of the study area. And can be applied in other fishing communities to assess the alignment between existing management efforts and the lived experiences of stakeholders, ultimately promoting more sustainable coastal management practices.

KEYWORDS: *Coastal management, Local ecological knowledge (LEK), Triangulation Method, Stakeholder engagement, Sustainable fishery.*

1) INTRODUCTION:

Scenarios, serving as plausible and alternative narratives of the future, offer a powerful tool to explore potential outcomes and guide decision-making [1,2,3]. Scenario development, a systematic method to envision probable futures, can be applied across various disciplines [4]. It allows for the description of future conditions, highlighting events that propel progress and illuminate pathways towards a better future.Participatory Scenario Planning (PSP) takes this a step further by utilizing qualitative and participatory workshop techniques [5]. Stakeholders, including fisherfolk, actively express their perspectives, experiences, and resource utilization practices [6]. This collaborative approach fosters the development of scenarios that address environmental issues and concerns. By combining these scenarios, potential changes, risks, and opportunities are identified, ultimately promoting community resilience [7].PSP fosters unity among stakeholders, encouraging the development of shared solutions for environmental problems [8]. As awareness of scenario development processes increases, stakeholders become empowered to generate valuable insights, leading to successful environmental stewardship practices [9]. This approach fosters integrated actions for a sustainable future, guiding societies towards a paradigm shift in their approach to environmental management [10].Scenario-based community design allows designers and community members to collaboratively address uncertainties in future growth [11]. It facilitates the development of alternative design solutions to envision and plan for diverse possibilities [12]. PSP can also be used for modeling biodiversity and ecosystem services. This application raises awareness and assists policymakers in identifying uncertainties regarding future environmental

conditions. The evaluation of these uncertainties allows for a more comprehensive understanding of potential consequences associated with proposed pathways [13].

Ultimately, scenario development provides a framework for predicting a desirable future and outlining strategies to achieve it [14,15]. Scenarios not only depict desired futures but also explore undesirable possibilities, fostering valuable insights into the uncertainties inherent in coastal zone management [16,17]. These "storylines" often involve varying degrees of quantification, providing a roadmap for achieving a desired future state [18,19].Tagkawayan, Philippines, has a long history of fishing and farming as its primary source of livelihood, dating back to its founding in 1941. The municipality experienced a period of significant development in the early 1980s, becoming the province's prawn hatchery capital and generating employment opportunities. However, this period also coincided with intensified coastal ecosystem degradation. The influx of investors and commercial fishing practices, particularly the destructive use of trawl gear, significantly impacted marine habitats. This resulted in declining fish catches for local fishers, ultimately leading to some resorting to illegal and destructive fishing methods like dynamite fishing to sustain their families.Fortunately, the enactment of environmental protection laws helped curb this detrimental trend. The establishment of the Awasan Reef Marine Protected Area (MPA) in 2002 further contributed to conservation efforts. However, there is a paucity of research exploring the perceptions and participation of Tagkawayan's fisherfolk in coastal management and marine resource protection.

This research aims to address this gap in knowledge. By evaluating the fisher's understanding of sustainable coastal resource use, the study seeks to determine their potential role in co-management of the area's coastal ecosystem. Specifically, the study investigates how fisherfolk envision a sustainable future for the coastal environment. This information will be crucial for developing effective plans and programs promoting the sustainable utilization of Tagkawayan's coastal and marine resources.

Theoretical and Legal Framework

This study is anchored on established theoretical models that emphasize participatory, systemic, and transformative approaches to community-based resource management. First, the Participatory Development Theory, advocated by Robert Chambers (1994), underlines the significance of involving community members directly in shaping development policies and actions. Within this context, the study acknowledges the role of fisherfolk not as passive recipients but as vital partners in crafting coastal management strategies. Their local ecological knowledge is treated as a legitimate and valuable source of information that complements scientific data and institutional plans. Second, the Social-Ecological Systems (SES) Framework of Elinor Ostrom (2009) provides the foundation for examining the dynamic interactions between people, institutions, and ecosystems. This perspective is essential in understanding how human behavior, governance mechanisms, and environmental conditions interconnect, especially in fragile coastal communities like Tagkawayan. The triangulated data from fisherfolk, LGU programs, and documentary analysis reflects this interconnectedness. Additionally, the study draws upon the Theory of Change by Carol Weiss (1995), which provides a structured way of linking long-term goals to necessary steps and interventions. In this research, the scenario-building exercise with fisherfolk reflects a local articulation of desired futures and the pathways toward achieving them. By identifying root causes, solutions, and strategic interventions, the participants visualize transitions toward sustainable coastal resource management.

These theoretical foundations are further supported by key national laws and legal frameworks that promote environmental protection and participatory governance. Republic Act No. 8550, known as the Philippine Fisheries Code of 1998 (as amended by R.A. 10654), recognizes the importance of fisherfolk in managing aquatic resources. It mandates the involvement of local communities in fisheries management and highlights co-management approaches as necessary for the sustainability of coastal ecosystems. Republic Act No. 9003, or the Ecological Solid Waste Management Act of 2000, provides a legal basis for community participation and local government accountability in addressing coastal pollution—one of the concerns raised by fisherfolk during the study.The Local Government Code of 1991 (Republic Act No. 7160) delegates authority to LGUs in managing their natural resources, enabling them

to enact ordinances, create marine protected areas, and implement localized coastal management programs. The study's inclusion of LGU plans and initiatives aligns with this legislative framework.

On the global stage, the study aligns with the principles of Sustainable Development Goal 14 of the United Nations—"Life Below Water"—which calls for the conservation and sustainable use of oceans and marine resources. By documenting local experiences and aligning them with institutional responses, this research contributes to efforts in realizing both national and international commitments to marine sustainability.

Hence, the integration of participatory development, social-ecological systems thinking, and change theory, supported by a strong legal foundation, establishes a comprehensive framework for understanding and strengthening coastal resource management in Tagkawayan.

2) METHODS AND METHODOLOGY:

Tagkawayan, located in the eastern part of Quezon Province, is a coastal municipality that forms part of the Ragay Gulf's extensive shoreline. Its strategic position along the gulf makes it an important area for small-scale fisheries and coastal resource use. The town's proximity to marine ecosystems and its dependence on coastal and marine resources for local livelihoods highlight its ecological and socio-economic significance in the Bicol-Quezon coastal corridor.. The selected barangays (Aldavoc, Magsaysay, Rizal, and Sabang) were chosen due to the presence of the major landing site and a people's organization representing local fisherfolk.

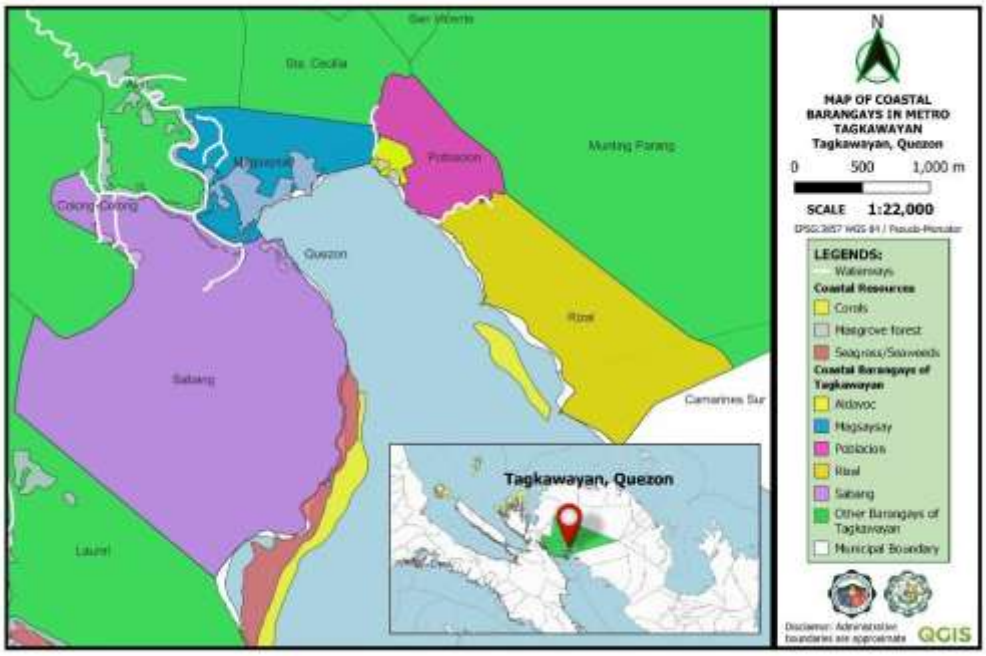

Figure 1 : The Study Site

DATA COLLECTION METHOD:

This study employed a Participatory Scenario Planning (PSP) approach through a focus group discussion cum workshop involving 13 active fisherfolk members selected by the Fisher Folks Association President. PSP offers a robust method for incorporating local knowledge and perspectives into coastal resource management planning.

WORKSHOP STRUCTURE:

The workshop comprised several key elements:

1. **Baseline Information:** An overview of the coastal ecosystem's ecological and economic importance was provided, followed by a presentation on the current status of Philippine coastal zones. This context setting ensured participants were equipped with relevant background knowledge.
2. **Knowledge Assessment:** Activities were designed to assess participants' knowledge of the local ecosystem's current state, the impact of human activities, and existing coastal resource management practices.
3. **Participatory Analysis:** Facilitated discussions employed tools like Problem Tree Analysis (identify and analyze root causes of problems) and Objective Tree Analysis (develop goals and strategies to address problems).
4. **Future Envisioning:** Participants collaboratively envisioned a future scenario for the coastal environment, considering both desirable and undesirable possibilities.

DATA ANALYSIS:

Thematic analysis was employed to analyze the qualitative data collected from the focus group discussion cum workshop involving 13 fisherfolk members. This approach involved systematically identifying, coding, and interpreting recurring themes within the discussions. The analysis focused on three key areas:

1. **Knowledge of the Coastal Ecosystem:** This analysis explored the participants' understanding of the local ecosystem's composition, its ecological functions, and its economic importance to their livelihoods.
2. **Perceptions of Human Impacts:** Thematic analysis identified the human activities perceived by fisherfolk to have the most significant negative impacts on the coastal environment. These may include destructive fishing practices, pollution, or coastal development.
3. **Envisioned Future for Coastal Management:** The analysis focused on the key elements of the future scenario envisioned by the participants for the coastal environment. This included aspects like a healthy and abundant marine ecosystem, improved resource management practices, and sustainable livelihoods for fisherfolk.

3] RESULTS AND DISCUSSION

The focus group discussions revealed the fisherfolks' perceptions of the current condition of Tagkawayan's coastal environment. Participants generally rated the health of mangrove forests and seagrass beds as "very good" (Figure 2). This positive perception may be attributed to the effectiveness of municipal ordinances prohibiting the cutting of mangrove trees. The participants acknowledged the awareness of penalties for violating these regulations and expressed their community's participation in tree-planting projects, contributing to mangrove conservation. Similarly, seagrass beds, recognized as crucial habitat for fish and marine organisms like sea turtles, were viewed favorably. While natural calamities were acknowledged as a

Figure 2. Participants' Perception on the Present Condition of the Coastal Environment

Habitat	Very Good	Good	Fair	Poor	Issues and causes
 Mangroves (Bakauan)	✓				"The reason it is very good is because of we are planting mangroves. We, the fishermen, are prohibited from cutting mangroves because there is a law that forbids cutting them."
 Sea grasses	✓				"It is very good because many marine creatures, including fish and sea turtles, live here. Nothing destroys it except for natural calamities."
 Coral Reefs (Bahura)		✓			"It is good because it has already been damaged by illegal fishing methods like bombing and poisoning. It is also seldom for people to take them for use as construction materials."
 Beach (Baybayin)		✓			"It is beneficial because they are being developed into tourist spots.
 Rivers (Ilog)		✓			"It is good because there is a law that bans dumping garbage."

source of disturbance, overall, seagrass beds were perceived to be in good condition. Coral reefs were rated as "good," with participants highlighting the threat posed by occasional illegal fishing practices such as blasting and poisoning. These destructive methods not only harm coral reefs but also negatively impact associated marine life. While illegal coral collection for construction materials was perceived as less prevalent, continued vigilance was emphasized. Beaches, recognized for their aesthetic value and potential as tourist destinations, were rated as "good." Finally, rivers were viewed as being in "good" condition due to regulations protecting them from degradation by solid waste. Thus, these findings align with the growing recognition of the importance of local knowledge in environmental management [20]. The fisherfolks' daily interactions with the coastal environment provide them with crucial insights into its health and the impacts of human activities [21]. Integrating this ecological knowledge with scientific understanding can enhance adaptive capacity and inform effective policymaking. Furthermore, the study

highlights the potential of community-based conservation efforts [22]. The participants' positive perceptions of certain aspects of the coastal environment, such as mangrove forests and seagrass beds, suggest the success of existing conservation measures, including regulations and tree-planting projects. This reinforces the significance of fostering collaboration between local communities, policymakers, and scientists for sustainable resource management.

Moreover, this section focuses on the fisherfolk's perceptions of human activities impacting Tagkawayan's coastal ecosystem, aligning with the study's objective to understand their perspectives on environmental threats. And Table 1 provides a summary of participants' perceptions regarding the frequency of various human activities impacting the local coastal ecosystem. The activities are categorized as "Often," "Sometimes," and "Not happening," based on the responses from the participants.

The participants identified several concerning issues they observed "often"

Decreased Fish Size and Abundance: Reports of "smaller-sized fish being caught" and the "disappearance of once abundant fishes" suggest potential overfishing or habitat degradation.

Increased Fishing Pressure: "Increasing conflicts between fishing sectors" and "fishers traveling longer distances to catch fish" highlight competition for diminishing resources.

Coastal Pollution: Observations of "domestic waste on coastal areas" raise concerns about water quality degradation.

While illegal fishing practices ("dynamite fishing," "cyanide," etc.) were identified as "sometimes happening," this doesn't negate their potential impact. Additionally, activities like "quarrying of sand" and "seasonal water runoff from animal domestication" were also perceived as occasional threats. These findings underscore the fisherfolk's awareness of human activities contributing to coastal ecosystem degradation. Their insights are crucial for developing effective management strategies that address these concerns and promote sustainable resource use. The challenges faced by this coastal community echo the struggles unfolding in marine ecosystems worldwide. Declining fish stocks, habitat destruction, and pollution threaten not only the environmental health of our oceans but also the livelihoods of countless communities who depend on them [23]. However, the story in Tagkawayan offers a glimmer of hope. Through open communication and collaboration between community members, researchers, and local government, a path towards a sustainable future is being charted.

Table 1. Perceived Environmental Issues

Activity	**Often**	**Sometimes**	**Not Happening**
Small-Sized fishes being caught	✓		
Increasing conflicts and discussions between different fishing sector	✓		

Use of illegal fishing method/gear a. Dynamite b. Cyanide c. Compress or fishing d. Poison fishing e. Fine meshed nets		✓ ✓ ✓ ✓	
Fishers travelling longer distances to catch fish	✓		
Cutting of mangroves for firewood, house constructions and other domestic uses			✓
Intrusion of commercial fishing into municipal waters			✓
Disappearance of once abundant fishes	✓		
Conversion of mangroves to fishponds			✓
Presence of seawalls/coastal construction on foreshore and beach areas			✓
Siltation		✓	
Agricultural runoffs in coastal areas	✓		
Marine and sand mining and quarrying		✓	

The problem tree analysis (Figure 3) served as a catalyst for collective action, fostering a shared understanding of the issues and empowering the community to become active participants in their own future [24].

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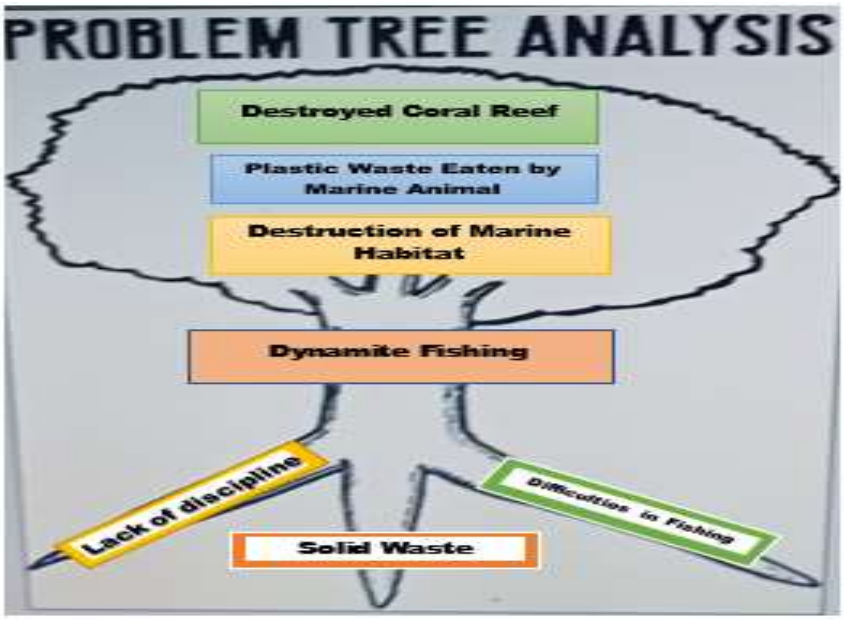

Figure 3. Problem Tree Analysis

The envisioned solutions, captured in the objective tree (Figure 4), represent a multi-pronged approach with the potential to reverse negative trends and restore the health of the coastal ecosystem. Habitat restoration efforts, including the installation of artificial reefs, aim to provide a haven for fish populations to recover. Recognizing the importance of stricter enforcement, the community emphasized the need to deter illegal activities. Education campaigns were identified as a critical tool to empower the community with knowledge and encourage sustainable fishing practices.

The community's ultimate goal – a clean and healthy sea teeming with diverse marine life – served as a powerful unifying force. The positive response towards local government initiatives aimed at restoring coastal health fostered optimism. The willingness to report illegal activities and actively participate in educational programs further exemplified the community's commitment to a sustainable future.

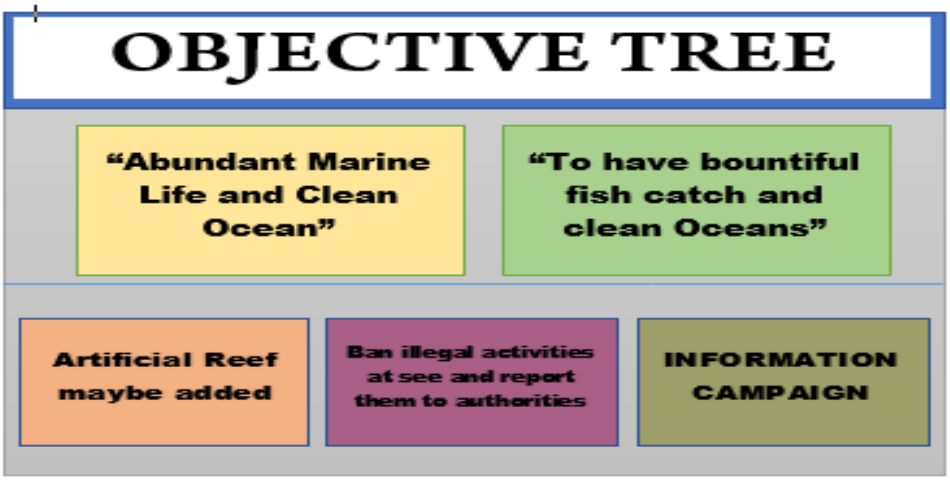

Figure 4. Objective Tree

This section dives into the hopes and aspirations of the coastal community, specifically how they envision the future of their environment in twenty years. Through a participatory exercise, fisherfolk were invited to illustrate their desired future scenario.

A Thriving Seascape:

Figure 5. Output 1 of the envisioned future

The first illustration (Figure 5) depicts a scene brimming with life and abundance. Here, happy people enjoy the coastal scenery, while fishers engage in their activities amidst a diverse and thriving marine ecosystem. Coral reefs, seagrass beds, and mangrove forests have fully recovered, providing essential breeding grounds for fish populations. This image represents the community's ultimate goal: a healthy and productive coastal environment.

A Journey Through Time

The second illustration (Figure 6) serves as a visual timeline, showcasing the past, present, and desired future of the coastal area. Labeled "ITO NOON" (Those Days), it depicts a period of plentiful marine resources with larger fish catches in nearby fishing grounds.The stark contrast arrives with "ITO NGAYON" (The Present Day). Here, the illustration portrays the current struggles faced by the community. Reduced fish populations necessitate longer fishing trips to distant grounds, often yielding insufficient catches. The presence of plastic waste entangled in nets further highlights the growing environmental concerns.

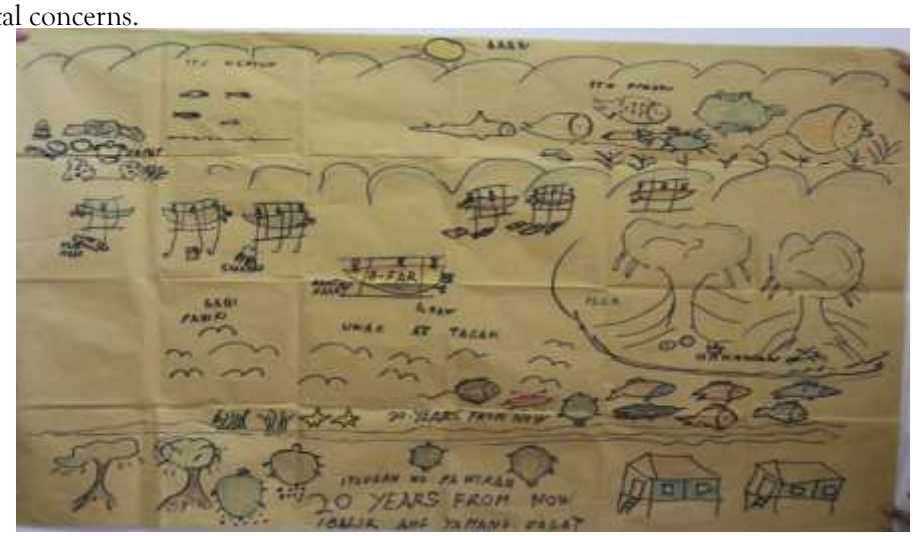

Figure 6 Output 2 of the Envisioned Future

Hope for a Sustainable Future:

Looking towards the future, labeled "AFTER TWENTY YEARS" (After Twenty Years), the illustration reflects the community's aspirations. The participants acknowledge the increased plastic pollution, particularly pandemic-related waste like discarded face masks. However, they emphasize the importance of sustainability and community cooperation in supporting initiatives by the Bureau of Fisheries and Aquatic Resources (BFAR). The fisherfolk yearn for alternative income sources to lessen dependence on fishing, allowing the marine ecosystem a chance to recover. Their ultimate vision is a return to the past – a healthy sea teeming with diverse marine life, minimal human activity on the shore, and a healthy ecosystem that supports abundant fish stocks. This future, they believe, is achievable through collective responsibility, particularly among those living along the coast. They emphasize their commitment to reporting illegal fishing activities to ensure the long-term sustainability of the marine environment. The story of this coastal community transcends a mere description of local challenges. It embodies the universal struggle for a balance between humanity's needs and the well-being of our oceans. The fisherfolk's voices, filled with both concern and hope, paint a vivid picture of the delicate state of marine ecosystems around the world. However, their narrative also offers a powerful message of resilience and collaboration. The problem tree analysis served as a catalyst for collective action, fostering a shared understanding of the issues and empowering the community to become active participants in their own future. Their envisioned solutions – habitat restoration, stricter enforcement, and educational campaigns – represent a multi-pronged approach with the potential to reverse negative trends. The fisherfolk's ultimate goal – a return to a healthy and abundant sea – aligns perfectly with broader conservation efforts. Their commitment to sustainable practices, along with their willingness to collaborate with researchers, local government, and each other, positions them as agents of change. Their story serves as a beacon of hope, inspiring other coastal communities facing similar challenges to chart a course towards a more sustainable future for themselves and generations to come.

4] MOVING FORWARD: A CALL TO ACTION

The challenges faced by this community necessitate a multi-faceted approach. Increased government support for sustainable fishing practices and stricter enforcement of regulations are crucial. Investments in habitat restoration projects, such as the creation of artificial reefs, can provide vital sanctuaries for marine life. Educational programs empowering communities with knowledge about sustainable fishing practices and the importance of environmental protection are equally essential.

A Ripple Effect of Change

The success of this community's endeavors has the potential to create a ripple effect of positive change. By sharing their experiences and solutions with other coastal communities, they can inspire a collaborative movement towards ocean conservation. This groundswell of collective action can empower communities to advocate for stricter environmental policies and promote responsible fishing practices on a broader scale. Ultimately, the story of this coastal community serves as a testament to the power of human ingenuity and collaboration in charting a course towards a brighter future for our oceans.To build upon the valuable insights gained from this study, future research can delve deeper into several key areas: Socioeconomic Impact Assessments: In-depth studies are needed to explore the social and economic impacts of proposed solutions, such as the creation of alternative livelihood opportunities for fishers. This information can be crucial for policymakers in developing effective strategies. Long-Term Monitoring: Establishing long-term monitoring programs is essential to track the effectiveness of implemented solutions, such as habitat restoration projects. This data will be vital for evaluating their long-term success and informing future adjustments. Intergenerational Knowledge Transfer: Research investigating traditional knowledge and fishing practices held by elder fisherfolk, alongside their perspectives on environmental changes, can be a valuable resource. Integrating this knowledge into future management strategies can promote a more holistic approach. Scalability and Replication: Studies exploring the potential for scaling up and replicating the community's successful strategies in other coastal regions

facing similar challenges can significantly contribute to broader ocean conservation efforts. By identifying transferable elements, researchers can inform the development of adaptable management plans for various contexts. By focusing on these areas of future research, we can build upon the knowledge gained from this community and contribute to the development of robust and sustainable management plans for coastal ecosystems around the world. This will ensure the well-being of these vital marine environments for generations to come.

5] ACKNOWLEDGEMENT This study was supported by the Department of Science and Technology – Accelerated Science and Technology Human Resource Development Program (DOST-ASTHRDP). The researcher acknowledges the Local Government Unit of Tagkawayan for fieldwork assistance, the Southern Luzon State University – Faculty and Staff Development Program (SLSU-FSDP) for additional funding support, and the University of the Philippines Los Baños (UPLB) for the technical input.

6] DATA AVAILABILITY:
The data supporting the findings of this study are available from the corresponding author upon reasonable request. Certain data may be subject to confidentiality agreements with the LGU of Tagkawayan and other partner institutions.

7] CONFLICT OF INTEREST: The author declare that there is no conflict of interest".

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