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Indigenous Knowledge and Practices on Disaster Readiness and Risk Reduction in Coastal Areas

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Abstract — This study assessed indigenous knowledge on disaster readiness and risk reduction in coastal areas of Calbayog City. It examined respondents' indigenous knowledge, including wind patterns, tidal changes, cloud formations, flora and fauna behavior, and celestial bodies. This indigenous knowledge had been used by the community to predict natural hazards.
A descriptive assessment method was used, utilizing a structured questionnaire as the primary data collection tool. The sample included six (6) barangays and 284 respondents. The standardized instruments measured the indigenous knowledge and indigenous practices on a five-point Likert scale. Statistical methods, including mean, median, mode, frequency counts, percentages, standard deviation, and cross-tabulations are used to evaluate the prevalence and significance of indigenous knowledge and practices in disaster readiness and risk reduction.
Results indicated strong reliance on traditional knowledge, particularly wind and weather patterns. The findings emphasized the potential benefits and obstacles of incorporating traditional knowledge into contemporary disaster risk reduction strategies, underscoring the importance of creating policies that are culturally appropriate and locally applicable. The study recommended that local government units document and integrate indigenous knowledge into formal disaster management frameworks. Establishing community knowledge exchange programs was suggested to preserve and enhance traditional disaster preparedness practices. Such initiatives could lead to better resilience and more effective disaster response strategies in coastal communities in Calbayog City.

Keywords — Indigenous Knowledge, Disaster Readiness, Risk Reduction, Coastal Communities, Indigenous Practices

I. Introduction

The significance of indigenous knowledge in disaster management and risk reduction had gained increasing recognition in recent years. The above statement underscored the need to integrate traditional wisdom with modern scientific approaches in addressing natural disasters, particularly in vulnerable coastal regions. Asian communities, including those in the Philippines,

faced substantial risks from various natural hazards. These included earthquakes, tsunamis, cyclones, droughts, landslides, and floods. Coastal areas in Asia were particularly susceptible to an increasing range of stresses and shocks, which were further exacerbated by climate change. The impacts of these phenomena were already evident across many parts of Asia (Hiwasaki et al., 2014). The Philippines ranked highest in the World Risk Index for the third consecutive year, scoring 46.91 in the 2024 World Risk Report (WorldRiskReport 2024 Focus: Multiple Crises, n.d.), was exceptionally vulnerable to natural hazards. Recent years had seen the Philippines grappling with numerous natural disasters, resulting in severe damage to its low-lying and coastal regions. A prime example was Super Typhoon Haiyan in 2013, considered one of the strongest storms to make landfall on record (Anthony Reyes et al., n.d.). This catastrophic event devastated the Visayas region in November 2013, affecting eight regions in total. The aftermath was staggering: 6,300 citizens lost their lives, 28,689 were injured, 1,061 individuals remained unaccounted for, and the economic damage amounted to Php 95,483,133,070 (US$ 1.87 billion) (NDRRMC 2013). In this context, the value of indigenous knowledge became paramount. Cornelio and Castro (2016) define indigenous knowledge as the cumulative bodies of knowledge, skills, practices, and representations maintained and developed by communities with long histories of interacting with the natural environment. This knowledge provided an ideal framework for sustainable development by linking the past, present, and future. The Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) offered a more comprehensive definition, describing indigenous and local knowledge as "the multi-faceted arrays of knowledge, know-how, practices, and representations that guide societies in their innumerable interactions with their natural surroundings" (MoSTE, 2015). Similarly, Shin and Månsson (2017) characterized it as "a body of different knowledge and practices of societies accumulated through a continuous interaction with their natural surroundings." These definitions collectively emphasized the accumulated wisdom and understanding that indigenous peoples and local communities had evolved over generations through direct interaction with their environment.

The role of indigenous knowledge in disaster risk reduction and management was increasingly recognized. Hiwasaki and Shaw (2014) argued that such knowledge played an integral role in reducing risk and improving disaster preparedness and response in contemporary times. Dalisay (2014) highlighted how cultural groups had demonstrated resilience amid potentially devastating hazards, underscoring the value of local knowledge for disaster risk reduction and mitigation. According to research, indigenous knowledge had proven vital to biodiversity conservation (Kosoe, Adjei & Diawuo, 2019). Additional studies had documented the significant role of local knowledge in forest and wildlife protection (Mavhura & Mushure, 2019). Indigenous approaches had also demonstrated effectiveness for flood prevention and management, as shown in multiple reports (Mavhura et al., 2013; Mavhura, Collins & Bongo, 2017). Research further indicated the relevance of traditional knowledge for climate change adaptation and response (Savo et al., 2016; Mugambiwa, 2018; Manrique, 2018). Indigenous methods had likewise aided the examination of environmental shifts over time (Savo et al., 2014), and local forecasting techniques had been validated for weather prediction (Jiri et al., 2016).

The importance of indigenous knowledge in disaster preparedness and survival had been emphasized in global studies on disaster risks and management (Quilo et al., 2015). However, despite a century of disaster studies, the application of this knowledge remained challenging. Indigenous knowledge of disaster risk reduction is often overlooked, even when communities attempt to share it. Practitioners had identified several obstacles, including lack of documentation, knowledge not being universal across generations, highly contextualized information, and difficulties in achieving scientific validation (Gaillard & Mercer, 2013; Munsaka & Dube, 2018). Given this context, there was a pressing need to explore and document indigenous knowledge related to disaster readiness and risk reduction, particularly in vulnerable coastal areas such as Calbayog City. This study aimed to address this gap by identifying and analyzing local indigenous knowledge and practices pertaining to disaster preparedness and risk reduction in the coastal areas of Calbayog City.

This study focused on assessing indigenous knowledge for disaster readiness and risk reduction in coastal areas of Calbayog City. Specifically, it answered questions on the indigenous knowledge as perceived by the respondents themselves in terms of wind patterns, tidal changes, cloud color, and formation, flora and fauna behavior, and celestial bodies. It was conducted in six barangays: Baay, Bagacay, Cagnipa, Carayman, Maguinoo, and Malaga. These barangays were identified with moderate to high levels of hazard susceptibility for flood, landslide, storm surge, and coastal erosion based on the Hazard Inventory Susceptibility Matrix, Calbayog City, 2009 & 2016 (Calbayog City Comprehensive Development Plan 2021-2026 Climate and Disaster Risk Assessment Volume 3).

Literature Review

The Philippines, ranked third in the 2018 World Risk Index among countries most prone to natural disasters, faced significant challenges due to its geographical location. Situated in the Pacific Typhoon belt and between major tectonic plates, the nation was susceptible to typhoons, earthquakes, landslides, and volcanic eruptions. On average, the Philippines experienced 20 typhoons per year, with 5 or 6 being particularly devastating. The intensity of these typhoons was increasing due to rising sea surface temperatures and global warming, exacerbating the risks faced by the country.

To address these disaster risks, the Philippine government enacted Republic Act 10121 in 2010 or the Philippine Disaster Risk Reduction and Management Law (RA 10121, 2010). This law aimed to strengthen the disaster risk reduction and management (DRRM) system by providing DRRM frameworks and institutionalizing a national DRRM plan. The Act specifically stated that disaster risk reduction and climate change measures should have been "gender-responsive, sensitive to Indigenous knowledge systems, and respectful of human rights." However, the integration of indigenous knowledge systems in implementing DRR preventive, emergency, recovery, and rehabilitation responses remained limited. This lack of integration reinforced the

notion that local-indigenous knowledge is unreliable, unfalsifiable, and unfit for inclusion in local DRR plans, activities, and programs.

The National Disaster Risk Reduction and Management Plan (NDRRMP) 2011-2028 acknowledged the importance of non-monetary resources, including community-based good practices and Indigenous DRRM practices. However, the plan only briefly mentioned "indigenous practices" when identifying priorities in its four thematic areas: prevention and mitigation, preparedness, response, and rehabilitation and recovery. Indigenous communities lacked awareness of the National Disaster Risk Reduction and Management (NDRRM) plan and their designated roles within it. Moreover, indigenous knowledge and practices offered invaluable insights into how these populations had historically endured various hazards, underscoring the importance of integrating such wisdom into disaster preparedness strategies (Cuaton & Su, 2020). Despite these challenges, the importance of indigenous knowledge in disaster risk reduction was increasingly recognized globally. In the study and practice of DRR, considerable evidence had been gathered in the past decades to argue that local-indigenous knowledge and practices were essential in improving disaster preparedness, response, and recovery (Shin & Månsson, 2017).

The interpretation of cloud patterns to forecast weather was a widespread practice among indigenous communities. Lefale (2015) documented how Pacific islanders used cloud observations for short and long-term weather predictions. Berkes (2019) validated these practices through scientific studies, demonstrating their effectiveness for planning and preparation in the face of changing weather conditions. Indigenous knowledge of flora and fauna behavior serves as an early warning system for environmental changes and potential disasters. Ford (2017) illustrated how changes in animal behavior or plant growth patterns were used to predict impending weather events or environmental shifts. Turner (2016) further emphasized the role of this knowledge in biodiversity conservation and sustainable resource management. Observations of celestial bodies played a significant role in indigenous knowledge systems, aiding in navigation and timekeeping. Chamberlain (2012) described how various indigenous cultures used star patterns for navigation, particularly in oceanic voyages. Periodicities (2015) highlighted the sophisticated astronomical knowledge embedded in many indigenous cultures, demonstrating a deep understanding of celestial cycles and their relationship to earthly phenomena.

Indigenous knowledge systems were deeply intertwined with cultural identity and heritage. Battiste and Henderson (2015) emphasized how rituals, stories, and songs served as vehicles for encoding and transmitting environmental knowledge across generations. The literature provided strong support for the value of indigenous knowledge in disaster readiness and risk reduction. It emphasized the need for policies that recognized, preserved, and integrated this knowledge with modern scientific approaches to enhance community resilience and improve disaster management strategies. This integration not only respected and valued traditional wisdom but also created more effective, culturally appropriate, and sustainable disaster risk reduction strategies. Understanding how indigenous knowledge contributes to disaster readiness was critical to developing effective

disaster management strategies. Indigenous communities had developed practices over generations that offered valuable insights into predicting and responding to natural hazards. A study by Irumva et al. (2021) investigated how traditional weather forecasting methods could be integrated with modern techniques. It found that while traditional methods, which used atmospheric and biological indicators such as animal behavior, offered practical insights, they were not widely understood or utilized. The study identified gaps in both traditional and modern weather forecasting systems and suggested that combining these approaches could enhance prediction accuracy. Integrating indigenous knowledge with modern science could have improved disaster preparedness and management, especially in coastal areas.

Israel and Sierra (2023) examined the vulnerability of San Sebastian, a fishing village in Lagonoy, Philippines, to weather-related disasters and the need for sustainable climate adaptation. They explored indigenous fishing practices and evaluated how local fishers and officials adapted to climate change. Using qualitative and quantitative methods, including focus group discussions and interviews with 25 experts, the study identified eight vital adaptive strategies and noted a general willingness among fishers to engage in communal environmental protection efforts. However, the study also highlighted concerns about the unfair treatment of local fishers and inadequate responses to issues like overfishing by temporary poachers.

Hutton & Allen (2020) explored how traditional ecological knowledge (TEK) could enhance coastal management and address climate change hazards in coastal Virginia. The study involved the Pamunkey Indian Tribe, who used TEK in a mapping exercise to inform flood management and other coastal issues. By examining sea level rise projections for 2040, 2060, and 2080 and creating a resilience matrix, the study set benchmarks for disaster preparedness and included oral histories for context. Findings emphasized the need to protect housing and heritage sites and ensure access to the Reservation.

The study of Hiwasaki et al. (2015) explored how local and indigenous knowledge in Southeast Asia aided coastal and island communities in dealing with climate change and related hazards. The study highlighted how these communities in Indonesia, the Philippines, and Timor-Leste used observations of environmental and celestial changes to predict hazards and applied local materials and methods for prevention and adaptation. Rituals, ceremonies, and customary laws fostered environmental respect, strengthened social ties, and enhanced resilience. The research involved documenting and analyzing this knowledge to integrate it with scientific methods, aiming to develop effective climate hazard management strategies. The study suggested that combining local knowledge with science could have benefited research, education, and policymaking, and emphasized the importance of preserving and promoting this knowledge to boost community resilience.

Similarly, Santha et al. (2014) revealed that local knowledge systems were crucial for predicting natural hazards and reducing disaster risk among traditional workers in Kerala. It described how these communities used their understanding of biotic, oceanic, atmospheric, and

celestial factors to forecast coastal hazards, known locally as "kolu." The research, conducted through participatory inquiry techniques and in-depth interviews with 400 fishing households across 20 marine villages, highlighted the socially constructed nature of these hazards as a holistic phenomenon. The study emphasized the need for effective community-based early warning systems deeply integrated into marginalized, resource-dependent communities' daily lives and livelihood struggles.

The study by Wialdi et al. (2021) explored how indigenous coastal communities in Padang, West Sumatra, used traditional knowledge to mitigate earthquake risks. Through interviews and literature reviews, it highlighted the integration of local wisdom and cultural practices in disaster risk reduction. Communities used natural signs as early warning systems and focused on raising awareness and improving their response to earthquakes. The study emphasized a combined approach of physical development and socio-cultural methods, reflecting a comprehensive disaster management strategy. It stressed the importance of incorporating local wisdom to enhance resilience in earthquake-prone areas like Padang.

Zulfadrim et al. (2019) explored the role of indigenous knowledge in disaster risk reduction and response, emphasizing the need to integrate it with modern scientific methods. Conducting ethnographic research in the Mentawai Islands of Indonesia, the study gathered primary data through in-depth interviews and secondary data from various sources. The findings revealed that indigenous knowledge, gained through long-term observation and interaction with natural events, was categorized into various types, with technical knowledge being more amenable to integration with scientific understanding. The study highlighted the value of indigenous knowledge in disaster management and suggested that this approach should be applied to other indigenous communities to enhance disaster preparedness and response.

However, Elma and Mirandilla (n.d.) conducted a study exploring traditional knowledge and practices for disaster risk reduction and climate change adaptation in Sorsogon province. They used a phenomenological approach and held focus group discussions with elderly participants from Prieto Diaz, Casiguran, Irosin, and Sta. Magdalena. The goal was to identify key practices based on Deken’s four pillars of local knowledge, which included observing animal behavior, recognizing environmental signs, noting unique disaster signals, and understanding weather-related superstitions. The study found that practices such as ringing bells and interpreting animal and environmental cues were culturally significant and passed down through generations.

The study of Cuaton & Su (2020) investigated how local-indigenous knowledge among the Mamanwa people in Basey, Samar, had been used for disaster risk reduction and environmental management after Typhoon Haiyan in 2013. Their ethnographic study, conducted from late 2018 to early 2020, highlighted how the Mamanwas utilized traditional knowledge for emergency evacuation, post-disaster recovery, food security, and weather forecasting. The study also examined the limited integration of this knowledge into state policies such as the Disaster Risk Reduction and Management Act and the Indigenous Peoples Rights Act, along with the social

challenges faced, including prejudice and discrimination. Efforts to preserve and transmit this knowledge to younger generations were also discussed, with a call for better inclusion of local-indigenous knowledge in policy and meaningful participation of Indigenous Peoples in disaster management.

The above-mentioned studies on indigenous knowledge highlighted its critical role in disaster response and preparedness. Local communities used observations of weather patterns, animal behaviors, and celestial events to predict natural hazards, with this knowledge being passed down through generations. Integrating this traditional wisdom with modern science enhanced disaster management strategies, leading to more effective and culturally relevant early warning systems and disaster plans. However, this indigenous knowledge was increasingly at risk due to climate change, technological advances, and cultural shifts, resulting in a decline in its transmission to younger generations. Additionally, official disaster management policies often failed to fully incorporate this valuable knowledge. The findings underscored the need to document, preserve, and integrate traditional practices into formal disaster management plans. By doing so, communities could have become more resilient and better prepared for disasters, ensuring that disaster management is both sustainable and inclusive.

II. Methodology

This study aimed to determine the indigenous knowledge and practices on disaster readiness and risk reduction in coastal areas of Calbayog City. It employed a descriptive assessment method, this approach was particularly suitable for this research as it allowed systematic collection, analysis, and presentation of data in a clear and accessible manner, serving as a foundational research design. Descriptive assessment is especially valuable when examining phenomena about which there is limited existing knowledge, as was often the case with indigenous practices. As Dulock (1993) noted, this method focused on describing the characteristics and current state of phenomena without attempting to determine cause-and-effect relationships. This aligned perfectly with the study's goal of documenting and observing the present status of indigenous knowledge and practices related to disaster readiness and risk reduction in the coastal areas of Calbayog City.

The study utilized a structured questionnaire as the primary data collection tool. This instrument was designed to gather comprehensive information on three main areas: indigenous knowledge, and indigenous practices. The study collected data on age, sex, civil status, and educational attainment, and years of residency providing crucial context for understanding the distribution of indigenous knowledge across different segments of the community. The indigenous knowledge section explored respondents' traditional understanding of environmental indicators related to disaster prediction and preparedness, including wind patterns, tidal changes, cloud formations, flora and fauna behavior, and celestial bodies. The researcher-made survey questionnaire ensured consistency in data collection across all respondents, allowing for

systematic analysis and comparison while capturing the nuances of indigenous knowledge and practices.

This study employed a purposive sampling technique to select respondents from six barangays in Calbayog City: Baay, Bagacay, Cagnipa, Carayman, Maguinoo, and Malaga. These areas were identified as having moderate to high levels of hazard susceptibility to floods, landslides, storm surges, and coastal erosion. The number of respondents per barangay was determined based on the 2020 population census, ensuring a comprehensive representation of indigenous knowledge and practices.

To ensure the accuracy and usefulness of the data collected, a set of criteria was used to select the respondents for this study. In order to ensure a comprehensive understanding of the local indigenous knowledge and practices relevant to disaster preparedness, participants have resided in the area for a minimum of six years. In order to present a mature perspective on the subject, only individuals who were at least eighteen years old were included. Since these viewpoints are crucial to the research, participants were selected based on their familiarity with indigenous knowledge and practices to disaster preparation. Additionally, a balanced and inclusive perspective in the study results was ensured by maintaining an equal number of male and female participants.

These barangays were strategically chosen based on their identification in the Hazard Inventory Susceptibility Matrix of Calbayog City for 2009 and 2016 as having moderate to high levels of susceptibility to floods, landslides, storm surges, and coastal erosion (Calbayog City Comprehensive Development Plan 2021-2026 Climate and Disaster Risk Assessment Volume 3).

The data-gathering procedure in this study involved several systematic steps to ensure a rigorous and ethical research process. Initially, the researcher obtained necessary permissions from the City Disaster Risk Reduction and Management Office (CDRRMO), barangay local government units (BLGUs), community members, and other relevant authorities. Upon securing these approvals, the researcher developed structured survey questionnaires designed to capture community members' indigenous knowledge and practices related to disaster preparedness and risk reduction.

Following coordination with barangay councils, the researcher scheduled data collection sessions. Prior to administering the survey, respondents will be thoroughly briefed on the study's purpose, the voluntary nature of their participation, and instructions for completing the questionnaire. To enhance accessibility and understanding, the questionnaires were translated into Waray-Waray and administered in convenient community locations. Respondents were afforded ample time to provide comprehensive responses. To maintain consistency and reliability, standardized instructions were used during questionnaire administration. Upon completion, the collected data underwent careful review to ensure accuracy and completeness. Subsequent data entry and coding processes prepared the information for statistical analysis using appropriate software tools.

Following the data analysis, the researcher meticulously interpreted the findings to generate comprehensive insights and conclusions. These were presented through detailed reports, charts, graphs, and descriptive summaries. Throughout the entire process, the researcher adhered to strict ethical standards, ensuring data confidentiality and respondent anonymity. Informed consent was obtained from all participants, and they were made aware of their right to withdraw from the study at any time without consequence. This approach ensured the research maintained high ethical standards while gathering valuable insights into indigenous knowledge and practices for disaster readiness and risk reduction.

The study used a two-part questionnaire to assess the respondents' knowledge of disaster risk reduction and readiness. The first part gathered personal information such as age, sex, civil status, and educational attainment. The second part consisted of a five-point Likert scale questionnaire with 50 items in total, divided into two subscales—Indigenous knowledge and Indigenous practices on disaster risk and readiness in coastal areas of Calbayog City.

This tool underwent validation to ensure its reliability and validity ($\alpha = 0.83$), ensuring that it captured relevant data with credibility and accuracy (Shi, J. Mo, X. · Sun, Z., 2012). Using this tool provided a comprehensive understanding of engagement levels, allowing for valuable insights and conclusions to be drawn for the study.

The researcher assisted the respondents in completing the questionnaire by providing guidance and translating the indicators to Waray-Waray to ensure understanding. This questionnaire was a five-point Likert scale following from Likert R. A. (1932).

The data analysis for this study employed a range of statistical tools to address the research questions effectively. For the demographic profile of respondents, descriptive statistics included frequency counts, percentages, and measures of central tendency (mean, median, mode) which were used to analyze age, sex, civil status, and educational attainment. This provided a comprehensive overview of the sample population's characteristics. To examine indigenous knowledge related to wind patterns, tidal changes, cloud color and formation, flora and fauna behavior, and celestial bodies, the analysis utilized frequency counts, percentages, and mean scores. These methods will helped determine the prevalence and perceived importance of different types of indigenous knowledge among the respondents. Similarly, for indigenous practices in cultural, food security, communication, emergency evacuation, and shelter building techniques, frequency counts, percentages, and mean scores were calculated to evaluate their prevalence and perceived effectiveness. Additionally, cross-tabulations and chi-square tests were employed to explore relationships between demographic variables and specific types of indigenous knowledge or practices. The results of these analyses were presented using tables, charts, and graphs to facilitate clear interpretation. This comprehensive analysis will provide valuable insights into the indigenous knowledge and practices related to disaster readiness and risk reduction in Calbayog City's coastal areas, forming a solid foundation for evidence-based policy recommendations.

III. Results and Discussion

The results reveal an overall weighted mean of 4.16 (SD=1.12), indicating that respondents generally "Agree" with statements regarding indigenous knowledge of wind patterns for disaster prediction. The highest-rated statement was "Community traditional stories or beliefs about wind patterns have been passed down through generations and are still relevant today" (M=4.57, SD=0.81), achieving a "Strongly Agree" rating. This was followed by "When these winds 'fight' or interact with each other, a combination of weather and possible hazards will happen" (M=4.48, SD=0.90), "The changing wind patterns, such as sudden shifts in wind direction and a strong sound from the sea that is heard can indicate an approaching disaster" (M=4.12, SD=1.11), and "Irregular or erratic wind patterns, such as sudden gusts or calm periods, can be indicators of an approaching typhoon" (M=3.93, SD=1.22). The lowest-rated statement, though still within the "Agree" category, was "A significant increase in wind speed, along with sudden drops in temperature or changes in humidity, can serve as warning signs" (M=3.68, SD=1.24). These findings demonstrate strong alignment with the Traditional Ecological Knowledge (TEK) theory that underpins this study. As described by Berkes (2018), TEK emphasizes indigenous communities' deep-rooted environmental understanding based on generations of observation and interaction with the natural world. The high agreement with statements about wind patterns confirms that coastal communities in Calbayog City have developed sophisticated environmental interpretation systems, particularly regarding wind behavior as disaster indicators. This supports Nakashima et al.'s (2018) assertion about the reliability of traditional early warning systems and their potential integration into modern disaster management frameworks. The implications of these findings are substantial for disaster risk reduction efforts. They provide empirical support for Reyes et al.'s (2020) proposal that integrating indigenous knowledge with scientific approaches is increasingly valuable, though requiring a clearly developed framework.

The results show an overall weighted mean of 3.65 (SD=1.27), indicating that respondents generally "Agree" with statements regarding indigenous knowledge of tidal changes for disaster prediction. The highest-rated statement was "A rapid rise in sea level or quick flooding in areas that are typically safe can indicate an incoming disaster" (M=3.95, SD=1.09), followed closely by "Unexpected changes in tide levels, such as unusually high or low tides, and deviations from the expected timing of tides, such as sudden changes in the tidal schedule, can signal an approaching disaster like a tsunami or storm surge" (M=3.94, SD=1.13). Both statements fall within the "Agree" category. Another statement in the "Agree" category was "Unusual changes in water movement, such as stronger currents or unexpected circular movement" (M=3.67, SD=1.19). The remaining statements - "The foul odor emanating from the sea signified the coming of a storm or typhoon" (M=3.38, SD=1.39) and "Increased erosion or unusual patterns of sediment movement on beaches can indicate significant weather events or geological activity" (M=3.30, SD=1.37) - both received ratings in the "Neither Agree nor Disagree" category. These findings reflect the varying degrees of reliance on different tidal indicators among coastal communities in Calbayog City. The stronger agreement with statements regarding observable physical changes in water behavior aligns with

White's (2017) observation that coastal communities have long recognized tidal movements and their relationship to weather events. As noted in the literature review, this knowledge is "crucial for sustainable resource management in coastal areas." The respondents' agreement with statements about rapid sea level changes and unexpected tidal patterns demonstrates how these communities have developed practical environmental monitoring skills based on generations of observation. The mixed responses may indicate that some types of tidal knowledge are more widely distributed than others, possibly reflecting what Gómez-Baggethun et al. (2017) described as "hybrid knowledge systems" where traditional understanding integrates with modern observations. These results have important implications for disaster risk reduction efforts. The moderate agreement with tidal knowledge statements supports Hiwasaki et al.'s (2014) argument that "local and indigenous knowledge plays an integral role in reducing risk and improving disaster preparedness and response in contemporary times." However, the neutral ratings for some indicators suggest that certain aspects of indigenous tidal knowledge may be eroding or less widely shared within the community. This aligns with concerns raised in the literature review about the challenges facing indigenous knowledge systems, including "lack of documentation, knowledge not being universal across generations, highly contextualized information, and difficulties in achieving scientific validation" (Gaillard & Mercer, 2013; Munsaka & Dube, 2018).

The results show an overall weighted mean of 3.63 (SD=1.21), indicating that respondents generally "Agree" with statements regarding indigenous knowledge of cloud patterns for disaster prediction. The highest-rated statement was "The formation of anvil-shaped cumulonimbus clouds can indicate severe thunderstorms or tornadoes" (M=3.89, SD=0.99), followed by "Abnormal speed in the movement of clouds across the sky can suggest the approach of a powerful storm or other severe weather events" (M=3.63, SD=1.13), "An unusual color in the sky, such as a reddish or orange hue, can indicate severe weather conditions or an approaching disaster, such as a storm or volcanic eruption" (M=3.58, SD=1.7), and "Unusual or irregular cloud patterns, such as unusual streaks or formations, can be a warning sign of potential disasters" (M=3.53, SD=1.23). All these statements fall within the "Agree" category. The statement "Rapid changes in cloud formation, such as the sudden appearance of dense, dark clouds, can signal an approaching storm or severe weather event" (M=3.49, SD=1.26) received a rating in the "Neither Agree nor Disagree" category. These findings demonstrate how coastal communities in Calbayog City utilize cloud observations as part of their indigenous early warning systems. The moderate to strong agreement with most cloud-related indicators aligns with Lefale's (2015) documentation of how Pacific islanders use cloud observations for weather predictions. As noted in the literature review, these communities have developed sophisticated systems for interpreting atmospheric changes through careful observation of cloud formations and coloration. The highest agreement with the statement regarding anvil-shaped clouds suggests community familiarity with specific cloud formations that presage severe weather, reflecting the accumulated observational knowledge that Berkes (2019) validated through scientific studies. This traditional knowledge enables communities to recognize specific meteorological indicators that precede dangerous weather events, allowing for timely preparation and response. These results have significant implications for enhancing local disaster

preparedness systems. The moderate agreement with cloud-based indicators supports what Hiwasaki et al. (2014b) documented regarding indigenous communities' use of environmental observations for predicting hazards. The findings suggest that cloud observation remains an important component of local early warning systems in Calbayog City, though perhaps with varying levels of distribution across the community. The findings align with the Philippine National Disaster Risk Reduction and Management Plan's acknowledgment of indigenous DRRM practices as valuable non-monetary resources.

The results show an overall weighted mean of 3.48 (SD=1.35), indicating that respondents generally have a "Neither Agree nor Disagree" stance regarding statements about flora and fauna behavior as disaster indicators. Among the statements, two received ratings in the "Agree" category: "The sudden disappearance of birds or migration serves as a warning sign of an incoming disaster" (M=4.04, SD=1.11) and "Have you noticed these signs before a storm enters your home: frogs, fireflies, and winged termites? The winged termites would swarm around fluorescent bulbs and wiring" (M=3.76, SD=1.28). The remaining statements fell within the "Neither Agree nor Disagree" category: "Fast movement of sea snakes and hermit crabs going inland or climbing up trees all forewarn storms or typhoons" (M=3.42, SD=1.29), "When insects like crickets suddenly stop making a sound for two-three minutes during the night, an earthquake is about to come" (M=3.27, SD=1.29), and "When banana tree leaves and branches of other trees fall to the ground without strong wind is a warning sign of storms" (M=2.94, SD=1.48). These findings reveal interesting patterns in how coastal communities in Calbayog City perceive animal behavior as potential disaster indicators. The stronger agreement with statements regarding bird migration and insect behavior suggests these particular indicators remain more widely recognized within the communities. This aligns with Ford's (2017) illustration of "how changes in animal behavior or plant growth patterns are used to predict impending weather events or environmental shifts." The higher agreement with bird migration as a disaster indicator supports what was documented by Molina & Neef (2016) regarding the Agta people, who "observe natural indicators such as animal behavior and atmospheric changes to anticipate typhoons and heavy rains, prompting timely preparatory actions." Birds, being more visible and having clear migratory patterns, may serve as more recognizable indicators compared to subtle changes in insect behavior or plant conditions. The neutral overall response to flora and fauna indicators contrasts somewhat with the literature on indigenous ecological knowledge. This may reflect what C. Pelone & Fermil (2022) found among the Ata Mandaya tribe, where "indigenous knowledge is gradually eroding due to climate change, market integration, technological advances, and cultural shifts, leading to a waning interest among younger generations in preserving these traditional practices." The varying levels of agreement across different indicators suggest that certain aspects of indigenous ecological knowledge may be better preserved than others within these coastal communities. These findings have important implications for disaster risk reduction efforts. As noted by Dalisay (2014), cultural groups have "demonstrated resilience amid potentially devastating hazards, underscoring the value of local knowledge for disaster risk reduction and mitigation."

The results show an overall weighted mean of 3.32 (SD=1.34), indicating that respondents generally have a "Neither Agree nor Disagree" stance regarding statements about celestial bodies as disaster indicators. Among the statements, only one received a rating in the "Agree" category: "Community knowledge often associates the phases of the moon with tidal patterns and potential storm surges, as certain phases are known to bring higher tides and increased flood risks" (M=3.84, SD=1.06). The remaining statements fell within the "Neither Agree nor Disagree" category: "A sudden decrease in star visibility due to cloud cover can indicate approaching weather changes or storms" (M=3.45, SD=1.26), "The appearance of halos or rings around the sun or moon, often caused by ice crystals in the upper atmosphere, indicates an incoming storm or bad weather" (M=3.27, SD=1.46), "An unusual increase or decrease in the brightness of the sun or moon can sometimes indicate atmospheric changes associated with severe weather" (M=3.08, SD=1.27), and "Increased meteor activity or unusual patterns in meteor showers can be considered signs of atmospheric disturbances" (M=2.98, SD=1.47). These findings reveal interesting insights about how celestial observations are incorporated into indigenous knowledge systems in coastal Calbayog City. The stronger agreement with the statement about moon phases and tidal patterns aligns with what Chamberlain (2012) described regarding indigenous cultures' use of celestial bodies for navigation and environmental prediction. This connection between lunar cycles and tidal phenomena represents practical knowledge that directly impacts coastal communities' daily activities and safety measures. These results have important implications when considered in light of the theoretical framework underpinning this study. Communities may prioritize certain types of environmental indicators based on their cultural frameworks and historical experiences with disaster events. As communities face increasing environmental challenges, these knowledge transmission systems may require additional support to preserve valuable traditional insights about celestial-environmental relationships.

IV. Conclusion

Indigenous knowledge related to wind patterns remains strongly preserved in coastal communities, with intergenerational transmission of beliefs and observations still actively occurring, indicating the continued relevance of traditional meteorological understanding in these disaster-prone areas. Communities demonstrate varying levels of agreement with different categories of indigenous knowledge, with stronger preservation of wind-related knowledge compared to more neutral stances on flora/fauna indicators and celestial observations, suggesting uneven distribution or potential erosion of certain knowledge categories. The findings revealed stronger preservation and agreement with knowledge-based elements suggesting potential evolution in how communities prepare for and respond to disasters. Local government units (LGUs) in Calbayog City should document and preserve indigenous knowledge related to wind patterns and tidal changes, creating a local knowledge database that can be integrated into the City Disaster Risk Reduction Management Office's (CDRRMO) early warning systems.

REFERENCES

[1] Anthony Reyes, J. L., Alexis Ayo, K. R., Paula Baluyan, M. M., & Sam Ralei Balaguer, A. B. (n.d.). Indigenous Knowledge in Disaster Risk Reduction: The Tales of Three Islands (San Miguel, Camotes and Alabat) in the Philippines.
[2] Battiste, M., & Henderson, J. Y. (2015). Protecting Indigenous Knowledge and Heritage: A Global Challenge. Purich Publishing.
[3] Berkes, F. (2019). Sacred Ecology (4th ed.). Routledge.
[4] Chamberlain, V. D. (2012). When Stars Came Down to Earth: Cosmology of the Skidi Pawnee Indians of North America. Ballantine Books.
[5] Cornelio, J.S and de Castro, D. F. (2016). The State of Indigenous Education in the Philippines Today.
[6] Cuaton, G. P., & Su, Y. (2020). Local-indigenous knowledge on disaster risk reduction: Insights from the Mamanwa indigenous peoples in Basey, Samar after Typhoon Haiyan in the Philippines. International Journal of Disaster Risk Reduction, 48. https://doi.org/10.1016/j.ijdrr.2020.101596
[7] Dulock HL. Research Design: Descriptive Research. Journal of Pediatric Oncology Nursing. 1993;10(4): 154-157.doi:10.1177/104345429301000406
[8] Elma, M., & Mirandilla, L. (n.d.). The Practicality and Applicability of Using Indigenous Knowledge for Disaster Risk Reduction and Climate Change Adaptation in Four Municipalities in the Province of Sorsogon, Philippines.
[9] Ford, J. (2017). Indigenous Knowledge and Climate Change Adaptation: Insights from the Inuit of Arctic Canada. Macmillan.
[10] Hiwasaki, L., Luna, E., Syamsidik, & Shaw, R. (2014). Process for integrating local and indigenous knowledge with science for hydro-meteorological disaster risk reduction and climate change adaptation in coastal and small island communities. International Journal of Disaster Risk Reduction, 10, 15–27. https://doi.org/10.1016/j.ijdrr.2014.07.007
[11] Hutton, N. S., & Allen, T. R. (2020). The role of traditional knowledge in coastal adaptation priorities: The pamunkey indian reservation. Water (Switzerland), 12(12). https://doi.org/10.3390/w12123548
[12] Irumva, O., Twagirayezu, G., & Nizeyimana, J. C. (2021). The Need of Incorporating Indigenous Knowledge Systems into Modern Weather Forecasting Methods. Journal of Geoscience and Environment Protection, 09(02), 55–70. https://doi.org/10.4236/gep.2021.92004
[13] Israel, M., & Sierra, S. (2023). Indigenous Beliefs, Knowledge and Practices on Fishing and Climate Change Adaptation. International Review of Social Sciences Research, 3(1), 23–40. https://doi.org/10.53378/352962
[14] Jiri, O., Mafongoya, P. L., Mubaya, C., & Mafongoya, O. (2016). Seasonal Climate Prediction and Adaptation Using Indigenous Knowledge Systems in Agriculture Systems in Southern Africa: A Review. Journal of Agricultural Science, 8(5), 156. https://doi.org/10.5539/jas.v8n5p156
[15] Kosoe, E.A., Adjei, P.O.W., & Diawuo, F. (2019). From sacrilege to sustainability: the role of indigenous knowledge systems in biodiversity conservation in the Upper West Region of Ghana. GeoJournal. https://doi.org/10.1007/s10708-019-10010-8
[16] Lefale, P. F. (2015). Ua ‘afa le Aso: Traditional Meteorological Knowledge of the Samoan People, the Use of Environmental Indicators for Weather and Climate. Weather, Climate, and

Society, 7(2), 110-124. Likert R. A technique for the measurements of attitudes. Archives of psychology. 1932;140(22):5-55.

[17] Manrique, D.R., Corral, S., & Pereira, Â.G. (2018). Climate-related displacements of coastal communities in the Arctic: Engaging traditional knowledge in adaptation strategies and policies Environmental Science and Policy. Vol. 85, pp. 90-100. https://doi.org/10.1016/j.envsci.2018.04.007

[18] Mavhura, E. & Mushure, S. (2019). Forest and wildlife resource-conservation efforts based on indigenous knowledge: The case of Nharira community in Chikomba district, Zimbabwe. Forest Policy and Economics. Vol. 105, pp. 83-90. https://doi.org/10.1016/j.forpol.2019.05.019

[19] Mugambiwa, S.S. (2018). Adaptation measures to sustain indigenous practices and the use of indigenous knowledge systems to adapt to climate change in Mutoko rural district of Zimbabwe. Jàmbá: Journal of Disaster Risk Studies. Vol. 10 No. 1. a388. https://doi.org/10.4102/ jamba.v10i1.388.

[20] MoSTE (2015). Indigenous and Local Knowledge and Practices for Climate Resilience in Nepal, Mainstreaming Climate Change Risk Management in Development, Ministry of Science, Technology and Environment (MoSTE), Kathmandu, Nepal.

[21] Nakashima, D., McLean, K. G., Thulstrup, H. D., Castillo, A. R., & Rubis, J. T. (2018). Weathering Uncertainty: Traditional Knowledge for Climate Change Assessment and Adaptation. UNESCO. NDRRMC (National Disaster Risk Reduction and Management Council) 2013. Final Report Re Effects of Typhoon 'Yolanda' (Haiyan) (Government

[22] Update). Quezon City, Philippines: NDRRMC. http://www.ndrrmc.gov.ph/ attachments/article/1329/FINAL_REPORT_re_Effects_of_Typhoon_YO LANDA_(HAIYAN)_06-09NOV2013. pdf. Accessed 21 January 2017.

[23] Periodicities, E. (2015). In Skywatchers of Ancient Mexico and Skywatchers, Anthony Aveni's (1980, 80; 2001, 78) classic works on New World archaeoastronomy, one finds a table listing 25 eclipse cycles, varying in length from about 3 years to 76 years. They are all integral multiples of the lunar. Cosmology, Calendars, and Horizon-Based Astronomy in Ancient Mesoamerica, 285.

[24] RA 10121: An Act Strengthening The Philippine Disaster Risk Reduction And Management System, Providing For The National Disaster Risk Reduction And Management Framework And Institutionalizing The National Disaster Risk Reduction And Management Plan, Appropriating Funds Therefor And For Other Purposes. (2010, May 27). Retrieved from https://www.lawphil.net/statutes/repacts/ra2010/ra_1 0121_2010.html

[25] Santha, S. D., Gahana, P., & Aswin, V. S. (2014). Local knowledge, early warning and coastal hazards: Participatory inquiry among fishworkers in Kerala, India. Action Research, 12(3), 273–292. https://doi.org/10.1177/1476750314532504

[26] Savo, V., Lepofsky, D., Benner, J.P., Kohfeld, K.E., Bailey, J., & Lertzman, K. (2016). Observations of climate change among subsistence-oriented communities around the world. Nature Climate Change. Vol. 6, pp. 462-474. DOI: 10.1038/NCLIMATE2958.

[27] Shi, J. · Mo, X. · Sun, Z. (2012). Content validity index in scale development Zhong Nan Da Xue Xue Bao Yi Xue Ban. 2012; 37:152-155

[28] Shin, Y. & Månsson, P. (2017). Integrating Local Knowledge into Disaster Risk Reduction: Current Challenges and Recommendations for Future Frameworks in the Asia-Pacific. Division of Risk Management and Societal Safety. Lund University. Sweden. Available at: https://pdfs.semanticscholar.org/e8e9/70ad720d656cc8ef0eda31a77ce05e0c681f.pdf

[29] Turner, N. J., & Bhattacharyya, J. (2016). Salmonberry Bird and Goose Woman: Birds, Plants, and People in Indigenous Peoples' Lifeways in Northwestern North America. Journal of Ethnobiology, 36(4), 717-745.
[30] Wialdi, P. F., Putera, R. E., Kusdarini, Ariany, R., Valentina, T. R., & Dermawan, R. (2021). Local wisdom of coastal communities in mitigating earthquake disaster risk reduction. E3S Web of Conferences, 331. https://doi.org/10.1051/e3sconf/202133104001
[31] WorldRiskReport (2024). Focus: Multiple Crises. (n.d.).
[32] Zulfadrim, Z., Toyoda, Y., & Kanegae, H. (2019). The Integration of Indigenous Knowledge for Disaster Risk Reduction Practices through Scientific Knowledge: Cases from Mentawai Islands, Indonesia. International Journal of Disaster Management, 2(1), 1–12. https://doi.org/10.24815/ijdm.v2i1.13503