

Lived experiences of Artisanal Fishers: Climate change impact in marginal communities along the coast of Cogtong, Bay

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ABSTRACT

Climate change poses significant challenges, particularly for vulnerable marginal communities. This study explores its impact on artisanal fishers, focusing on their lived experiences. Employing a phenomenological approach, it captures how climate change affects their livelihoods, income, physical health, and well-being. The participants of this study were the ten (10) fisher folks from a Barangay in Candijay, Bohol. Moreover, the participants were selected using the purposive sampling method. The criteria used were: participants are not known by the researchers, recommended by the local Barangay unit, know the nature of the study, and are into fishing as a livelihood and source of income. Key findings include fish depletion leading to income instability, with many fishers unable to sustain their households due to reduced catches. Additionally, harsher conditions have increased physical strain, resulting in exhaustion and deteriorating health. These findings highlight the urgent need for policy interventions and sustainable solutions to support the resilience of small-scale fishers. The study contributes to the broader climate change discourse by advocating for targeted actions to address the challenges faced by these vulnerable communities.

1. Introduction

Climate change is a pressing global issue that affects various aspects of human life, including the livelihoods of artisanal fisher folks. These individuals depend heavily on the natural resources of oceans, rivers, and lakes to sustain their lives and support their families. However, changes in weather patterns, ocean currents, and sea levels, among other factors, have had a significant impact on their livelihoods. As ocean temperatures rise, marine ecosystems are disrupted, leading to changes in fish migration patterns and declines in fish populations. Small-scale fishers are particularly vulnerable to these changes, as they often rely on traditional fishing practices that are not well-suited to cope with the new challenges posed by climate change.

In many parts of the world, small-scale fishers are already feeling the effects of climate change. In Bangladesh, rising sea levels have led to saltwater intrusion in coastal areas, making it harder for fishers to access freshwater resources (Akter & Islam, 2019). There are three ways that climate change impacts the fishing industry. The first effect of climate change is a change in the physical and chemical environment, which includes rising sea levels, temperature, and stratification, in addition to decreasing dissolved oxygen and acidifying the ocean. Second, illnesses and shifts in the distribution and quantity of species are among the biological

conditions of the ocean that are impacted by climate change. Thirdly, it has an effect on the socioeconomic situation by causing disturbances to fishing activities and lowering fishing productivity (Rahman et al., 2021). This has disrupted local fishing practices and forced fishers to travel further afield to find the fish they need to support their communities.

In the Philippines, climate change experiences among artisanal fisher folks vary depending on their location and the resources they depend on for their livelihood. However, there are some common experiences that many artisanal fisher folks have reported, one of it is the loss of coral reefs and mangrove forests, which are critical habitats for fish and other marine organisms (Mendoza & Fernando, 2019). Coral bleaching caused by increasing sea surface temperatures has devastated many of the country's coral reefs, reducing fish populations and the livelihoods of coastal communities (Liu & Guillen, 2019). In addition to the loss of habitats, climate change has caused changes in the migration patterns of fish, leading to declines in certain species and increases in others. This has made it difficult for artisanal fishers to predict where and when to fish, affecting their income and food security.

Locally, Candijay is a coastal town and home to a number of artisanal fisher folks who rely heavily on the ocean for their livelihood. However, in recent years, these fisher folks have been experiencing the effects of climate change on their daily lives. According to Vargas et al. (2020) in Candijay, as in many other coastal communities in the Philippines, typhoons and other extreme weather events have become more frequent and severe, causing damage to fishing boats and equipment and putting the lives of fisher folks at risk. The changing ocean currents and temperatures have also caused shifts in fish populations, with some species becoming scarce while others become more abundant, forcing fisher folks to adapt and find new fishing grounds (Vargas et al, 2020). The continued impact of climate change on the ocean and the livelihoods of artisanal fisher folks in Candijay and other coastal communities in the Philippines highlights the urgent need for climate action and support for vulnerable communities.

The pressing issue of climate change poses significant challenges for small-scale fishers worldwide. Thus, the purpose of this study is to explore the experiences of artisanal fisher folks regarding climate change, specifically how it affects their livelihoods, income, physical health, and well-being through a phenomenological inquiry. By adopting a phenomenological approach, this study seeks to gain an in-depth understanding of the subjective experiences of the participants, including their perceptions and interpretations of the changes they have witnessed that have impacted their everyday livelihood, income, and well-being. Numerous studies have noted how climate change is affecting marine capture fisheries. It is probably going to have a big impact on the food security and income of fishermen (Rahman et al., 2021). This study seeks to gain insights into how artisanal fisherfolk in a specific region perceive the effects of climate change on their daily fishing activities and overall economic well-being.

This study is crucial in highlighting the urgent need for effective measures to mitigate the impact of climate change on artisanal fisher folks' livelihoods and to promote sustainable practices that ensure the preservation of natural resources for future generations.

2. Theoretical basis

2.1. Impact of climate change on the fishing industry

According to Mendenhall et al. (2020), a number of intricate elements already influence the likelihood of fisheries disputes, and climate change is one of them. The following are acknowledged causes of fisheries conflict: diminishing or stagnating catches;

attempts to control illicit and unreported fishing; food shortages; and disputed maritime boundaries. Although climate change amplifies many of these processes, little is known about how climate change and maritime security concerns are related. Similarly, Ojea et al. (2020), the distribution patterns of marine species are changing due to climate change, which is also endangering food security and upsetting fishermen and fishing communities. Along the whole seafood supply chain, these changes have an impact on livelihoods, economies, and society. They also influence all types of fishing, from small-scale to industrial. Thiault et al. (2019) also mentioned that climate change has the potential to affect the factors that support food availability and production, which might have a domino effect on global economies and food security. On the other hand, Lam et al. (2020) explained that fish stocks and tropical marine habitats are susceptible to changes in the ocean's physical and biogeochemical composition brought on by an increase in greenhouse gas emissions. The United Nations Sustainable Development Goals are significantly impacted by these modifications to fish populations and the ensuing effects on fish productivity. As discussed by Cinner et al. (2022), agriculture and fisheries are two important food production industries that are predicted to be significantly impacted by climate change. But seldom are the possible effects of climate change on different sectors taken into account simultaneously, particularly at smaller national scales, which can conceal significant variations in the ways that communities will be impacted. In line with this, Gaines et al. (2023) stated that the distribution of ice, sea level, circulation, chemistry, and climate of the ocean are all being affected by climate change. The ecosystems, biological productivities, and species assemblages that support a large number of the sea's economic benefits are severely impacted by these system changes taken as a whole.

2.2. Lived experiences of artisanal fishers

In coastal communities of poor nations, where over 90% of the population depends on fishing for a living, artisanal fisheries are an essential economic and cultural activity that support local livelihoods, food security, and poverty reduction (Gamarra et al., 2023). Global worry is the increasing susceptibility of societies to climate change. Due to their frequent exposure to dangers, artisanal fishermen are extremely vulnerable, which has serious repercussions for their families and rural communities (Montejo-Damián et al., 2022). Truchet and Noceti (2021) explained that the introduction and expansion of invasive species, a growing threat of global warming, lead to significant impacts on the ecosystem structure, functioning, and biodiversity. Adisa et al. (2021) stressed that a significant amount of the fish that the teeming populace consumes is provided by artisanal fishermen. These fishermen rely on small boats, antiquated technology, and rudimentary gear to catch a variety of fish species. For Montes et al. (2019), many communities used fishing as a major source of food, income, and cultural identity. More than any other community, the small-scale artisanal fishers along the coast are at risk from climate change (Alam & Mallick, 2022). Thus, a weather forecast is very crucial to artisanal fishermen. However, Martin et al. (2022) found that fishermen do not always utilize the more precise and localized forecasts. One tool that artisanal fishermen use to control potential hazards and prepare for fishing in hazardous conditions is weather forecasts. They use it not only to decide whether to go to sea or not. Their choices are also influenced by their financial requirements and the availability of fish. Moreover, for Mabe and Asase (2020), it is clear that fishermen caught more fish per unit of man-hour when they employed more climate change adaptation techniques. Promoting climate change adaptation measures and sustainable fishing is a wise move for all parties involved. Close fishing seasons and aquaculture production are two examples of sustainable climate change adaptation measures that need to be prioritized more.

3. Methodology

This study used a Phenomenology Design, an approach in studying experiences wherein researchers identify the essence of human experiences about a phenomenon (Creswell, 2007). In this study, phenomenology uncovered the experiences and contexts of the lived experiences of eight fisher folks who experience the effect of climate change in their fishing livelihood.

The participants of this study were the ten (10) fisher folks from a Barangay in Candijay, Bohol. Following Polkinghorne's (1988) selection of participants, phenomenological researchers interviewed ten fisher folks who had experience the effect of climate change. Moreover, the participants were selected using the purposive sampling method wherein the researchers purposely selected individuals from the population based on the criteria to gather the experiences of the chosen participants that can supply the important information to meet the study's goals. The criteria used were: participants are not known by the researchers, recommended by local Barangay unit, knows the nature of the study, and are into fishing as livelihood and source of income. Ten participants were sufficient for this study because their responses reached data saturation, meaning no new information or themes emerged from additional interviews. In phenomenological research, this ensures that the gathered data provides a comprehensive understanding of the participants' lived experiences with climate change, fulfilling the study's objectives.

The researchers asked permission from the local Barangay captain to conduct an interview with the selected fisher folks in their barangay for legal permission. With the approval, the researchers started to gather the data through a personal interview with the participants. Before conducting the interview, the researchers gave a consent form to the participants of the study. Once the consent is granted, the researchers introduce the study to the participants. During the conduct of the study an in-depth interview was administered to gain more in-depth responses regarding their lived experiences in the occurrence of the climate change phenomenon. To protect the data of the participants, the recording of the collected responses that are stored digitally is deleted.

The research instrument used in this study is a self-made research protocol which are validated by experts in the field. The instrument included questions for interviews to further gain in-depth data about the lived experiences of the participants of the study. These questions include: 1) How do artisanal fisherfolk perceive the impact of climate change on their daily fishing practices and livelihoods? (Unsa may inyong masulti sap ag usab2x sa panahon ngadto sa inyong panagat?) 2) What challenges in livelihood, income, and well-being do the fisherfolk experience in their encounter with climate change? (Unsa inyong mga kalisdanan nga nasinati sa inyong trabaho, pangkwarta, ug panglawas isip mananagat kabahin sap ag usab usab sa panahon?) 3) What adaptive strategies are artisanal fisherfolk employing to cope with the challenges posed by climate change? (Unsay inyong mga gibuhat para maka salbar sa pang adlaw2 nga kalisdanan?).

Analysis of the responses was done using Creswell's (2007) simplified version of Moustakas's modification of the Stevick-Colaizzi-Keen Method of Analysis of Phenomenological Data. This analysis involved the following: description of experiences with the phenomenon, bracketing, listing of significant statements, coding and clustering of significant statements to form themes, producing textural descriptions of experiences, building of structural descriptions, and combining descriptions of essences. The analysis allows researchers to explore the respondents' experiences, perspectives, and opinions on code-switching.

To ensure the transparency of this research study, the Trustworthiness framework of Lincoln and Guba's Four-Dimensions Criteria (1985) that includes credibility, transferability, dependability, and confirmability was observed. For credibility, the researchers assure participants that the interview is solely conducted for research purposes and ensure a prolonged engagement to instill confidence that the findings based on participants' perspectives are accurate, reliable, and realistic. For transferability, the researchers see to it that the detailed descriptions of the participants' lived experiences and contexts of code-switching are captured. For dependability, the researchers ensure that the study's process is traceable, and thoroughly recorded. For confirmability, the researchers ensure that interpretations and findings are unmistakably drawn from the data, necessitating a justification for the researcher's conclusions and interpretations, and that data were double-checked during data collection and analysis and were returned to the participants for verification. An inter-coder, who is not part of this research, was asked to verify the results of the study.

4. Result and discussion

This part presents the findings based on the research objectives that investigate the perception of fisherfolks, challenges to livelihood, income, and well-being, and their coping strategies on the impact of climate change in their everyday fishing. The following themes were generated based on the responses of the key informants and analyzed through the coding process. Inter-coder validation was used as part of the verification of themes.

Theme 1: Decreasing fish abundance

The first research question of the study is "**How do artisanal fisherfolk perceive the impact of climate change on their daily fishing practices and livelihoods?**" The theme that emerges from this question's data set is "Decreasing Fish Abundance." The answers of the following key informants support the claim of this theme.

Informant 4 pointed out that:

K4. *"Gamay ray pakuha, di pareha sauna. Kung naa man gani igo ra e sud-an, di kabaligya"* **"Limited availability, not the same as in the past. If there's a catch, it's just a dish, not enough to sell".**

The claim shows a decline in the daily catch of fish. This is because of altered fish migration patterns, smaller breeding grounds, or the devastation of coral reefs - all of which are common effects of climate change. Here, the fishermen see a direct influence on their capacity to subsist due to a decline in fish availability, which they believe is the direct result of climate change. Likewise, the fisherman claims that there is "just a dish" worth of catch, hardly enough for personal use, and not enough to sell. This is a change from the dual livelihood model, in which fishermen catch enough fish to sell and eat, to one in which they must fight for subsistence. This illustrates how artisanal fishermen are facing fewer options for a living, which will lower their income and maybe put their families in financial trouble. They are forced by this circumstance to rely on additional or different sources of income, if any are available. Insufficient fish to sell also suggests a deterioration in one's financial stability. The disappointment of not being able to supplement their income from fishing is probably felt by the fisherman, and this affect their capacity to pay for essentials, maintain their home, or make improvements to their fishing gear and techniques. This demonstrates how their ability to fish and their general economic well-being are both directly threatened by climate change. As explained by Alam and Mallick (2022), more than any other community, the small-scale artisanal fishers along the coast are at risk from climate change.

Informant 5 specified that:

K5. *“Ang grasya sa dagat mag depende sa hanging habagat ug dumagsa. Kung Habagat, wa na kaayo’y pakuha, pero kung dumagsa, naa pero mag depende sa season. Sauna pag wa pay pag bago-bago sa panahon, kada dumagsa daghan jud na ug pakuha. Pero karon, lisud na makakuha ug isda, kung naa man gani igo ra pang sud-an”.*

“The grace of the sea depends on the wind, whether it be Southwest wind or Northeast wind. And also, it depends on the season. In southeast wind, there’s usually no bountiful catch, while with northeast wind, it’s always expected with a bountiful catch. Then, every time the northeast wind blew, there was always an abundant catch of seafood. Now, even though it’s fish season, it is difficult to catch a single fish, and if graced to catch one, it will always fall as a dish, not for selling”.

The accounts of these informants suggest that artisanal fisherfolks in the study area have observed a significant decline in fish abundance, which they attribute to the impacts of climate change on the marine ecosystem and their fishing practices. This finding is consistent with existing research that highlights the vulnerability of small-scale fisheries to the effects of climate change, such as shifts in fish species distribution and productivity (Allison et al., 2009; Omitoyin & Tosan, 2012). Effective fisheries management must then develop an understanding of social relationship responses to climate change and their consequences for managing the distribution of fisheries’ benefits (Elsler et al., 2021). This finding aligns with previous research on the impacts of climate change on coastal livelihoods, where low fish catch is attributed to rising temperatures and decreasing rainfall (Brehmer et al., 2024). Fisheries must adopt adaptive strategies, such as frequent monitoring and harvest control rules that vary with climate regime, to address these challenges posed by climate change.

The United Nations Sustainable Gaol in Climate Action emphasizes that all people are responsible for the climate crisis, as all people are affected by climate change. Significantly, the decline in fish stocks underscores the need for more focused ecological studies on the effects of climate change on marine biodiversity, particularly in coastal areas like Candijay. Future research that aligns with UN SDG 13 should explore the impact of the shifts in marine ecosystems and the sustainability of different fish species under changing environmental conditions.

Theme 2: Frequently without income

The second research question, **“What challenges in livelihood, income, and well-being do the fisherfolk face to climate change?”** led to the emergence of the theme “Frequently Without Income,” which encapsulates the informants’ overall response to the income challenges they encounter due to climate change. The testimonies highlight the data set from the key informants. The responses show how artisanal fishers perceive climate change as a threat not only to their primary source of income, fishing, but also to their overall economic stability. They are adapting by taking on various forms of manual labor and micro-enterprises, but these efforts often yield low income and reinforce their marginalization and highlighting the profound socioeconomic challenges climate change imposes on their livelihoods.

Informant 3 lamented that:

K3. *“Minus ang kwarta kay way pakuha, kapoy pa” “Lacking money due to the limited catch, and it’s tiring”.*

There's a clear link between declining fish availability and reduced earnings. This is a reality where environmental factors such as rising sea temperatures, changes in fish migration patterns, and possibly even damage to coral reefs due to climate change are making it more difficult for fishers to secure a sufficient catch. The experience of "lacking money" suggests that fishing trips are often unprofitable, with fewer opportunities to sell fish and generate income. In this scenario, the fishers struggle to meet basic needs like food, household expenses, and maintenance of fishing equipment, which creates economic instability. On the other hand, the mention of "it's tiring" shows the physical and mental toll that climate change is taking on artisanal fishers. As the availability of fish diminishes, fishers need to spend longer hours at sea, travel farther distances, or make multiple attempts to catch fish, all of which increase the physical effort required. The exhaustion described here is not just the demanding nature of fishing but also the psychological fatigue caused by the constant uncertainty of their livelihood. This creates feelings of frustration, helplessness, and anxiety about their future, as they face declining returns despite increased effort. Moreover, the phrase "frequently without income" encapsulates the unstable financial situation of the fisher. The challenges brought on by climate change make income irregular and unpredictable, leaving fisherfolk vulnerable to periods without earnings. In line with this, Gaines et al. (2023) stated that the distribution of ice, sea level, circulation, chemistry, and climate of the ocean are all being affected by climate change. The ecosystems, biological productivities, and species assemblages that support a large number of the sea's economic benefits are severely impacted by these system changes taken as a whole. This affects not only their ability to provide for themselves and their families but also their long-term financial planning. With the inability to rely on consistent fish catches, they may resort to alternative income sources, and lead to a shift in livelihood or increased debt.

Informant 9 also unfolded the experienced crisis that:

K9. *"Krisis. Wa pay kuha sa panagat, mahal pag pamalitonon tungod sa inflation"*
"Crisis. No catch, and the goods are pricey due to the rise of the inflation".

The testimonies of the informants in this study reveal the harsh realities these communities face. The fishing industry has long been a vital component of many coastal communities, providing a source of sustenance and income for those who rely on the bountiful waters for their livelihoods. However, the effects of climate change have become increasingly apparent, posing significant challenges for the fisherfolk who depend on the sea for survival (Ferrer et al., 2021). The study's finding suggests that climate change impacts on small-scale fisheries are multifaceted and severe. Disruptions to the fishing industry due to climate change, have had a far-reaching impact on the entire value chain, affecting not only the fisherfolk but also the broader network of businesses and individuals who rely on the industry for their livelihoods, including suppliers, traders, processors, transporters, financiers, and others (Ferrer et al., 2021; Omitoyin & Tosan, 2012). The study highlights that the uncertainty surrounding the precise impacts of climate change on particular fish stocks and fisheries is a source of concern, as it can lead to increased economic hardship or missed opportunities for development in countries heavily dependent on fisheries (Burden & Fujita, 2019). The compounding effects of these challenges underscore the urgent need for policymakers and stakeholders to address the vulnerability of these communities to the impacts of climate change. The informants' testimonies are evidence of the multifaceted challenges faced by fisherfolk in the face of climate change.

One of the key goals of the United Nations that aims to address the financial challenges of the poor is UN Sustainable Development Goal 1: No Poverty. This goal focuses on reducing poverty among marginalized communities. However, the slow economic growth within the context of fisherfolk, largely due to the effects of climate change, remains a significant issue that requires research attention. The financial instability of these communities highlights the need for in-depth studies on their socio-economic resilience. Such research could explore how social safety nets, access to credit, and alternative income sources affect the ability of fisherfolk to adapt to environmental changes. Comparative studies with other small-scale fishing communities worldwide could also offer valuable insights into best practices for building resilience.

Theme 3: Battling with physical exhaustion and sickness while fishing

The theme “Battling with Physical Exhaustion and Sickness while Fishing” emerged from the key informants’ responses to the research question, “What challenges in livelihood, income, and well-being do the fisherfolk face due to climate change?” This theme emphasizes the challenges related to well-being that the informants experience as a result of climate change. The testimonies of the key informants highlight the theme of the study. Climate change is a force that worsens their physical health, mental well-being, and economic security. The fisher’s account illustrates how the changing environment, unpredictable weather, and declining fish stocks push artisanal fisherfolk into a cycle of exhaustion, illness, and financial instability. These challenges not only affect their immediate livelihood but also threaten their long-term survival as coastal communities reliant on fishing.

Informant 1 stated that:

K1. “*Sakit sa kalawasan, wad-ag gana kay way pakuha, hilanat kay mauwanan ug kalit, way saktong income, di igo sa matag-adlaw kung ang dagat ray saligan*” **“Body pain, no desire to act because there’s no catch, colds and fevers due to sudden rainpours, no exact income, unable to provide the daily needs if we only depend with the sea”.**

“Body pain” and “colds and fevers due to sudden rainpours,” indicate the physical toll that fishing takes on their body. This physical strain is heightened by the worsening weather patterns brought about by climate change, such as unpredictable storms and rain. The fisher’s mention of “sudden rainpours” points to increased exposure to harsh and erratic weather conditions, which increases the risk of sickness while at sea. Additionally, the constant physical demands of fishing without sufficient rest or reward contribute to ongoing “body pain” and fatigue, a result of long and arduous work for minimal returns.

Likewise, the statement “no desire to act because there’s no catch” speaks to the psychological impact of climate change on the fisher’s motivation. The difficulty in catching fish due to environmental changes, such as warming waters and shifting fish populations, creates a sense of futility in their daily efforts. According to Mendenhall et al. (2020), a number of intricate elements already influence the likelihood of fisheries disputes, and climate change is one of them. This loss of motivation suggests that the fisher feels defeated by the continuous failure to secure a sufficient catch, leading to a growing sense of hopelessness. The mental strain is compounded by the physical fatigue and creates a cycle of exhaustion that negatively impacts their well-being.

The participant’s reference to “no exact income” is the unpredictability of their earnings due to the diminishing availability of fish. This lack of consistent income makes it difficult for

fisherfolk to plan for daily expenses and long-term financial needs. The phrase “unable to provide the daily needs if we only depend on the sea” shows their economic vulnerability, as their reliance on fishing is no longer enough to sustain their families. Climate change has disrupted their primary livelihood, pushing them into financial insecurity, where they struggle to meet basic necessities like food, healthcare, and other household expenses. Similarly, Ojea et al. (2020), the distribution patterns of marine species are changing due to climate change, which is also endangering food security and upsetting fishermen and fishing communities.

The fisherfolks acknowledged that solely depending on the sea is no longer viable. As discussed by Cinner et al. (2022), agriculture and fisheries are two important food production industries that are predicted to be significantly impacted by climate change. This is the overall instability of relying on traditional fishing practices in the face of climate change. Fisherfolk may be forced to seek alternative income sources, but these are often limited and low-paying in coastal communities. The unpredictability of the fishing industry, coupled with declining fish stocks, leaves fisherfolk in a vulnerable economic state, where their livelihood is no longer dependable.

Indeed, climate change-related factors such as unpredictable weather conditions and the physical demands of fishing are directly impacting the health of fisherfolk. Constant exposure to the elements and lack of adequate protection from sudden changes in weather lead to frequent illnesses like colds and fevers. This not only affects their ability to fish but also increases medical expenses, further straining their already limited resources. Lam et al. (2020) explained that fish stocks and tropical marine habitats are susceptible to changes in the ocean’s physical and biogeochemical composition brought on by an increase in greenhouse gas emissions.

The combination of physical exhaustion and the difficulty of catching fish takes a toll on the fisher’s mental health. The lack of motivation and growing sense of hopelessness reflect the psychological burden of continuously working with little reward. This mental fatigue affects decision-making, overall productivity, and the willingness to invest in their fishing practices, further reducing their chances of improving their livelihoods.

Contrarily, the irregular and often inadequate income from fishing makes it difficult for fisherfolk to provide for their daily needs. With climate change reducing their catch and disrupting traditional fishing patterns, their economic stability is threatened. They are unable to rely solely on the sea, leading to a search for supplemental or alternative sources of income, which are not always available or sufficient to cover basic expenses. Thiault et al. (2019) also mentioned that climate change has the potential to affect the factors that support food availability and production, which might have a domino effect on global economies and food security.

Informant 4 also mentioned that:

K4. *“Way igo sa pangwarta, usahay magsakit pa ang kalawasan, panuhoton kay kusog hangin”* **“Lacking money. Sometimes, the body hurts, flatulence due to strong winds”.**

Climate change has had a profound impact on the well-being of fisherfolks, as evidenced by the testimonies of the informants. The informants describe various ailments caused by the changing climate, such as body pain, loss of appetite, fever, and flatulence (Adelekan & Fregene, 2014; Allison et al., 2009; Johnson & Welch, 2009). These physical ailments not only impact the fisherfolks’ well-being but also their ability to earn a livelihood. The sudden changes in weather patterns, such as increased storm intensity and unpredictable rainfall, make fishing more challenging and dangerous, leading to reduced catches and

income. The testimonies of the informants highlight the dire consequences of climate change on the physical and economic well-being of fisherfolk. The finding underscores the urgent need for policymakers and stakeholders to develop comprehensive strategies to support fisherfolks in adapting to the changing climate. Strategies may include improving access to healthcare, providing financial assistance, and investing in climate-resilient fishing technologies and infrastructure.

UN Sustainable Development Goal 3 aims to address health and well-being issues, particularly among marginalized communities. This goal seeks to improve the health outcomes of vulnerable populations, including fisherfolk, who often face hunger due to their low income, which also contributes to their exhaustion from long hours of work. The physical strain of fishing underscores the need for future research into the occupational risks faced by artisanal fishing communities. Investigating the long-term health effects of climate change on fisherfolk could inform policy developments that improve access to healthcare and enhance occupational safety programs for these populations.

Theme 4: Engaging in manual labor with low income

The study's final research question, "What adaptive strategies are artisanal fisherfolk using to cope with the challenges posed by climate change?" led to the emergence of the theme "Engaging in Manual Labor with Low Income," which is supported by the informants' testimonies.

Informant 2 stated that:

K2. *"Mang montar ug pukot para makapalit bugas"* **"Make fishing nets to buy rice"**.

The strategy of "making fishing nets to buy rice" is a shift from direct fishing to fishing-related work as a means of survival. The production of fishing gear, such as nets, offers a way to generate income, albeit likely a modest one. This situation shows how fishers adapt by utilizing their skills in ways that do not rely on the unpredictable availability of fish. The need to sell these nets just to buy basic necessities, like rice, underlines their precarious financial situation, where even basic survival is tied to inconsistent income.

Informant 3 also mentioned that:

K3. *"Mo sideline, magpasuhol mamungay"* **"Groom neighbors' grass yard"**.

The participant describes how they "groom neighbors' grass yard" as a sideline job, underscoring the necessity of taking on manual labor outside of fishing. This is a further departure from traditional fishing practices, where the fisher must rely on offering labor to the community to make ends meet. The fact that this work is often low-paid and physically exhausting shows how climate change forces artisanal fishers to expand their activities beyond their expertise, yet still leaves them in a vulnerable financial state.

Informant 6 emphasized that:

K6. *"Nag tinda-tinda ko ug ginagmay"* **"I have a small sari-sari store"**.

Engagement in a small sari-sari store "I have a small sari-sari store" involves venturing into micro-entrepreneurship. While this might provide a steady but minimal income, the use of the term "small" implies that the earnings from this venture are limited. This shows resilience, as fishers look for alternative ways to sustain their households, but it also reflects the limited economic opportunities available to them due to their geographic and socio-economic conditions.

Informant 7 explained that:

K7. *“Usahay manginhas, usahay magpa labor kung unsay bakante nga trabaho sudlan” “Sometimes, I collect seashells and sell them, or sometimes apply as a construction worker. Any work that is available will do to provide the needs of my family’s daily life”.*

Artisanal fisherfolk, who rely on manual labor and often have low incomes, face significant challenges in adapting to the impacts of climate change. Low fish catch due to the impacts of climate change, such as rising temperatures and decreasing rainfall, has been a significant challenge (Ankrah, 2018). Additionally, research in Nigeria has shown that artisanal fisherfolk in coastal areas have been significantly affected by climate change, leading them to seek alternative sources of livelihood, such as engaging in agricultural production or other manual labor activities (Omitoyin & Tosan, 2012; Opele et al., 2022). The artisanal fisherfolk in this study have demonstrated their resilience and adaptability in the face of climate change challenges. By diversifying their income sources through manual labor and small-scale entrepreneurship, they can cope with the uncertainties and disruptions caused by the changing climate. This highlights the resilience and adaptability of these communities, who are often disproportionately affected by the impacts of climate change (Samah & Shaffril, 2018).

The diversification of livelihoods through manual labor and small-scale entrepreneurship is a key strategy employed by the artisanal fisherfolk to supplement their income from fishing. This suggests the importance of supporting the development of alternative livelihood opportunities and strengthening the overall resilience of these communities.

The study also underscores the need for policymakers and development organizations to take a holistic approach to supporting artisanal fisherfolk, addressing not only the direct impacts of climate change on their fishing activities, but also the broader socioeconomic and livelihood challenges they face.

The transition from relying solely on fishing to engaging in various forms of low-paying work. The fishers perceive climate change as having rendered their traditional livelihoods unreliable, forcing them to seek supplemental income through manual labor or small businesses. However, these activities are often insufficient to fully replace the lost income from fishing, leaving them trapped in a cycle of hard work with minimal financial gain. As explained by Montejo-Damián et al. (2022), climate change is a global worry that is the increasing susceptibility of societies to climate change. Due to their frequent exposure to dangers, artisanal fishermen are extremely vulnerable, which has serious repercussions for their families and rural communities.

There’s also a shift to alternative, often manual, forms of labor that reflects a loss of economic autonomy for these fishers. Instead of being self-sufficient through their fishing practices, they must now depend on other people (neighbors or community members) or small business ventures that are highly sensitive to local demand and competition. This economic shift indicates a deeper sense of vulnerability as their ability to control their livelihoods diminishes.

The strategies and the resilience of artisanal fisherfolk are evident even during the uncertainty of their situation. As climate change continues to disrupt their traditional livelihood, these fishers are forced into uncertain, low-paying roles that provide no guarantee of long-term stability. Their ability to adapt is admirable, but the low financial returns from these jobs reflect how climate change limits their capacity to thrive, making survival more challenging.

UN Sustainable Development Goal 8, focused on Decent Work and Economic Growth, aims to address the issue of low-income jobs to support global economic growth. Fisherfolk, whose livelihood often does not provide enough to meet their daily needs or contribute significantly to the country's economy, require urgent attention from policymakers. Research into how local knowledge systems and traditional fishing practices adapt to climate-related challenges would enhance the understanding of indigenous resilience. Future studies could explore how these knowledge systems can be incorporated into larger climate adaptation strategies.

5. Conclusions and recommendations

Artisanal fisherfolk, who rely on small-scale fishing for their livelihoods, are among the most vulnerable communities to the impacts of climate change. The vulnerability of these communities is exacerbated by their limited adaptive capacity, which is shaped by existing socio-economic status. The overall experiences and perceptions of the key informants on the effect of climate change imply the detrimental impact on their overall livelihoods, as they struggle to meet their basic needs and sustain their families. Addressing the socio-economic resilience of fisherfolk in relation to poverty (SDG 1) requires urgent research into their financial instability and adaptive strategies to climate change. The occupational health risks they face, particularly due to hunger and exhaustion (SDG 3), underscore the need for policies that improve access to healthcare and implement safety measures in their work environment. Additionally, investigating traditional fishing practices and integrating local knowledge systems into broader climate adaptation frameworks (SDG 8) will be crucial for enhancing the economic stability and sustainability of fisherfolk's livelihoods. Hence, policy-makers could implement microfinance programs or offer low-interest loans to support investments in more resilient fishing gear. Access to insurance programs that protect against climate-related risks could also alleviate economic pressures on these communities. Addressing also the health issues faced by fisherfolk, especially those caused by physically exhausting work conditions, is critical. Policies aimed at improving healthcare access in coastal areas and providing medical assistance for occupational injuries could enhance the overall well-being of these communities. Programs designed to reduce the physical strain of fishing, such as modernizing fishing equipment or offering alternative employment during low fishing seasons, should be considered. Lastly, policy-makers could implement community-based coastal management programs that include fisherfolk in decision-making processes. Strengthening community resilience through the protection and restoration of marine ecosystems, such as mangroves and coral reefs, can improve both environmental sustainability and the livelihoods of artisanal fisherfolk.

SCIENTIFIC CONTRIBUTION

The manuscript clearly identifies a research gap; the manuscript extends or refines existing theories; the manuscript proposes a new theoretical or analytical model; the manuscript introduces or improves research methods; the manuscript provides new datasets or empirical evidence; the manuscript presents statistically and practically significant findings; the manuscript offers policy/managerial/technological implications; the manuscript opens new directions for further research.

AUTHOR CONTRIBUTIONS

CRedit: **Armand Galupo Cuñado**: Conceptualization, Validation, Investigation, Data Curation, Writing - Review & Editing, Visualization, Project Administration; **Weena Mae Granada Ampo**: Methodology, Formal Analysis, Resources, Writing - Original Draft, Supervision.

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All authors declare that they have no conflict of interest.

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