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Immediate Socioeconomic Impacts of Mindoro Oil Spill on Fisherfolk of Naujan, Philippines

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Abstract: In February 2023, an oil tanker carrying 5660 bbl of industrial fuel oil sank off Naujan in the Philippines, causing an oil spill in the waters of Oriental Mindoro and nearby provinces. The disaster affected fishing communities as well as marine ecosystems including the Verde Island Passage, which is at the "center of the world's marine biodiversity". This study assessed the immediate social and economic impacts of this oil spill on various communities of the Naujan coast. We conducted semi-structured interviews and employed a narrative analysis to explore the lived experiences of fisherfolk after the oil spill and to understand the socioeconomic impacts. With the prohibition of fishing and other aquatic activities, the participants lost up to USD 1300 of income per week from fishing. The participants had no other source of income due to the lack of other skills or an opportunity for an alternative livelihood in the community. While the government provided food packs and financial assistance, the participants found these insufficient to sustain their basic family needs including food, utilities, education, and health. Traces of oil were also found in the sources of potable water affecting their daily household activities. The fisherfolk, who live in communities that are vulnerable to natural and human-made hazards, had their subsistence, food security, and human well-being highly compromised. The findings provided recommendations for government interventions to mitigate the impacts of an oil spill and other future disasters, considering social, economic, and human ecological perspectives.

Keywords: resource management; water resources; socioeconomic impacts; fisherfolk; oil spill

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1. Introduction

While there has been a remarkable decline in oil spillage into the sea [1] due to the stricter measures set by the International Convention for the Prevention of Pollution from Ships in 1973, as modified by the Protocol of 1978 or "MARPOL 73/78" [2], the marine pollution hazards of tankers and pipelines, carrying hundreds of thousands of tons of oil, remain. In the last five years, the most notable oil spills include those in China in 2018 [3,4], Russia in 2020 [5,6], Mauritius in 2020 [7,8], Venezuela in 2020 [9,10], Peru in 2022 [11,12], and, most recently, in the Philippines in 2023 [13,14]. Despite the numerous studies conducted to evaluate the socioeconomic and environmental impacts of oil spills, a comprehensive analysis of the immediate and long-term effects from a human ecological perspective remains challenging.

Oil spill disasters affect various components of human ecological systems. Lingering oil can cause adverse impacts on the environment and natural resources, particularly in sheltered areas like estuaries, deltas, fine-grained wetlands, and coastal ecosystems [15]. Sensitive habitats such as coral reefs, mangroves, and salt marshes could be at great

risk of oil contamination [16]. For instance, crude oils, heavy fuel oils, lubricating oils, and heavier grades of marine diesel oil are most likely persistent and toxic, affecting biodiversity, ecological succession, and bioaccumulation [15]. The polycyclic aromatic hydrocarbons (PAH) in oils affect multiple biological systems in fishes including cardiac function, cholesterol biosynthesis, peripheral and central nervous system function, the stress response, and osmoregulatory and acid–base balance processes [17].

From a socioeconomic perspective, economic impacts include the cost of clean-up, compensation, and damages to agricultural lands in deltas, fisheries, and wildlife, while social impacts include community conflicts, violence, frustration leading to militancy and protests against oil companies and the state, a reduction in the tourism and hospitality industries, prostitution, and decreasing cultural values [18]. Moreover, Abert et al. [19] reported that 9343 oil spill incidents in 10 years in Nigeria resulted in losses of jobs from tourism such as local feasting, swimming, and fishing festivals. People were physically, mentally, and emotionally frustrated, leading to segregation, enmity, and a lack of trust and transparency between communities and oil multinational corporations, which greatly influenced restiveness [19]. In another study, De Oliveira Estevo et al. [20] found that, although fish catches did not decline during the period of an oil spill in Brazil, fish sales were strongly affected due to the concerns of consumers about ingesting contaminated fish. Ribeiro et al. [21] estimated losses of 0.77% for food services production, along with a 0.66% reduction in accommodation services and a 0.90% loss in fishing. In the case of the Prestige Oil Spill, Garza et al. [22] estimated losses of EUR 1390 million for the fishing industry and EUR 187.9 million for recreation and tourism. Ferreira et al. [23] supported these claims and found a reduction in revenue and income in the lodging and food sectors, while more striking impacts were identified on artisanal fishing and beach vendors, who are known to be more socially vulnerable. In terms of health, Bruederle and Hodler [24] identified the causal effect of exposure to hydrocarbons from oil spills and the risks to fetal development by comparing siblings born to the same mother who were conceived before and after a nearby oil spill. Their study found that nearby oil spills that occur before conception increase neonatal mortality by 38.3 deaths per 1000 live births, corresponding to a 100% increase in the sample mean across girls and boys, socioeconomic backgrounds, and locations [24]. All these studies established that oil spill disasters could, directly and indirectly, affect several communities, societies, and ecological systems in different ways.

On 28 February 2023, an oil tanker, MT Princess Empress, carrying 5660 bbl of industrial fuel oil, sank off Naujan, Oriental Mindoro, while en route to Iloilo from Bataan Province, after its engine overheated. The tanker submerged about 389 m below the surface [14]. As shown in Figure 1, this accident resulted in an oil spillage in multiple areas and on shorelines in the waters of the Province of Oriental Mindoro and nearby provinces. The disaster affected fishing communities, marine protected areas, and ecological sanctuaries [25]. Along this area lies the Verde Island Passage, which is a global center of marine biodiversity [26].

As of 17 April 2023, the oil spill had affected 178,306 individuals from 37,871 families with 208 confirmed casualties (e.g., abdominal pain, dizziness, difficulty in breathing, chest pain, skin rashes/allergies, loose bowel movement, eye irritation, headache, cough, colds, vomiting, and sore throat) according to the National Disaster Risk Reduction and Management Council (NDRRMC) [27]. It affected not only those directly involved in fishing but also those who indirectly depend on marine resources, such as wholesalers, vendors, and tourism operators. There were 16,930 affected fisherfolk and farmers amounting to USD 5.27 million in agricultural damages to livestock, poultry, and fisheries [27]. Various government agencies, such as the Philippine Coast Guard (PCG), the Department of Environment and Natural Resources (DENR), the Department of Social Welfare and Development (DSWD), the Philippine National Police (PNP), and the Philippine Army, have been continuously working to monitor and control the spillage, while providing various kinds of assistance to the affected communities. According to the NDRRMC [27], the cost of the provided assistance is estimated at USD 4.28 million, as of 8 April 2023.

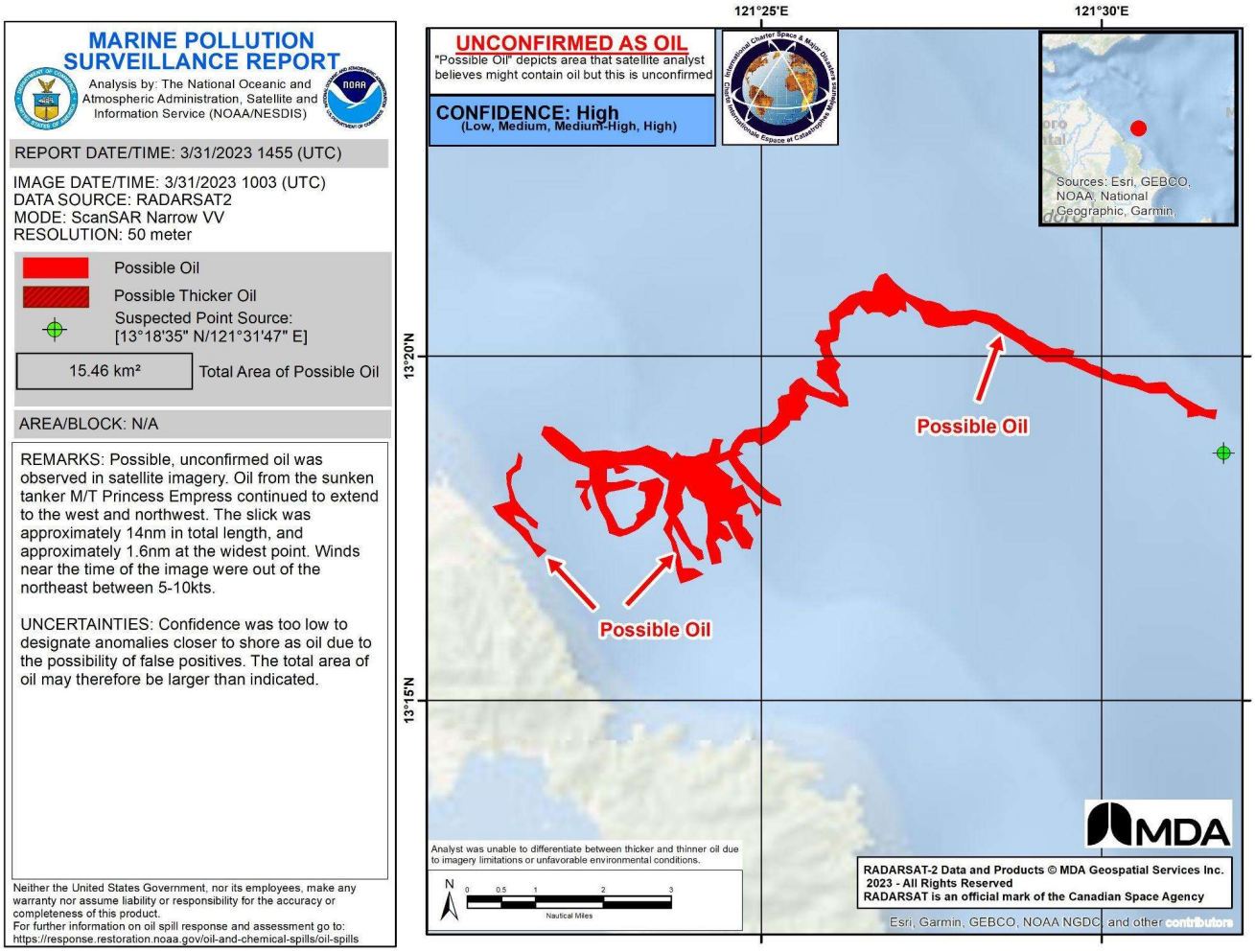

Figure 1. Possible unconfirmed oil from MT Princess Empress off the northeast coast of Mindoro in the Philippines as of 28 March 2023. Source: U.S. National Oceanic and Atmospheric Administration (NOAA) and National Environmental Satellite, Data, and Information Service (NESDIS).

The immediate socioeconomic impacts of the oil spill on fishing communities have not yet been studied. This study aimed to bridge this gap by exploring the experiences of fisherfolk during the oil spill disaster and analyzing the social and economic impacts. Specifically, this study conducted semi-structured interviews with fisherfolk in various coastal communities in Naujan. A narrative analysis was applied to interpret the participants' experiences during the disaster, and the results were synthesized to analyze the immediate social and economic impacts of the oil spill. This study further investigated the participants' experiences from the disaster, which would serve as the basis for government recommendations to mitigate the impacts of the oil spill, while providing better social services that are needed by the particularly vulnerable communities.

Socioeconomic and Physical Profile of the Study Area

Naujan is a first class municipality and the largest municipality in the Province of Oriental Mindoro, Philippines. According to the 2020 census, it has a population of 109,587 people inhabiting a total land area of 52,804.15 hectares and has significant geological, environmental, historical, and cultural features. It comprises 70 barangays, with 33 barangays having households that are engaged in fishing, accounting for 3.5% of the total household population.

Naujan is situated along the Verde Island Passage, which is the center of marine shore fish biodiversity. This area is part of the Coral Triangle, a roughly triangular area

in the tropical waters around the Philippines, Indonesia, Malaysia, Papua New Guinea, the Solomon Islands, and Timor-Leste, which is considered a rich spawning ground for diverse fish species. As seen in Figure 2, Naujan's coastline spans about 25 km, which is almost 7.3% of the total coastline of the Province of Oriental Mindoro. These areas have a bay—Buloc-buloc Bay, which is commonly utilized for various recreational activities such as bathing, swimming, diving, family outings, game fishing, etc. Along these areas are the three (3) marine protected areas (MPAs) of Naujan—the 30 ha. Tujod MPA in Herrera, 16 ha. Masaguing MPA, and the 72 ha. Buloc-buloc Cove MPA in Montemayor, as shown in Figure 3.

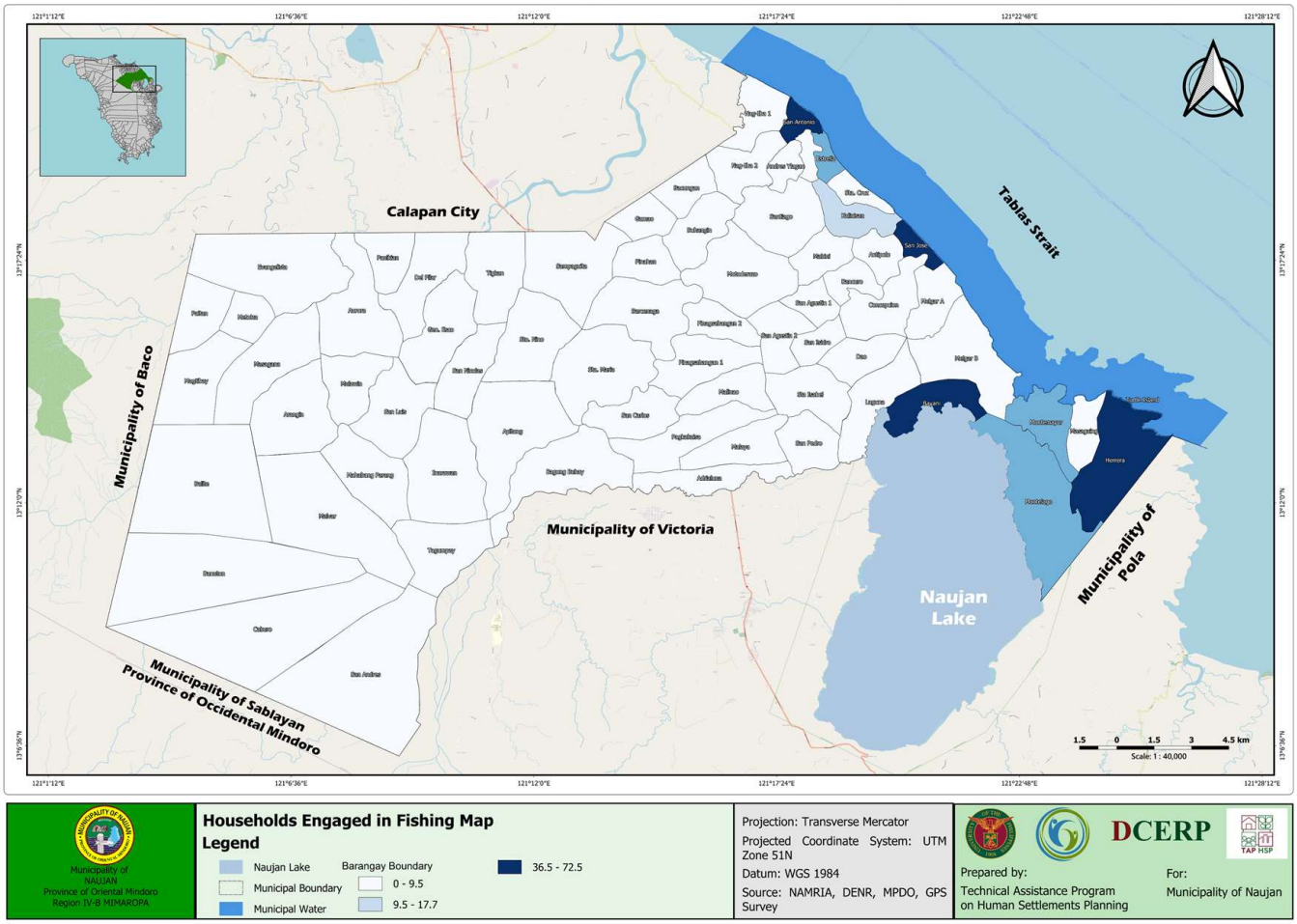

Figure 2. Map of households engaged in fishing activities in Naujan. Source: Naujan Comprehensive Development Plan 2023–2028, Vol. 1A: Socio-economic and Physical Profile, with permission from the Municipality of Naujan [25].

The coastal areas are fringed by mangrove forests, marshes, seagrass beds, coral reefs, beach ridges, and fishpond areas. According to the State of the Coasts of Oriental Mindoro (SoCOM) [28], three species of mangroves can be found in Naujan including Rhizophora apiculata or bakhaw lalaki, Rhizophora mucronata or bakhaw babae, and Sonneratia alba or pagatpat. These provide homes for a large variety of fish, crab, shrimp, and mollusk species, as well as nurseries for many fish species, including coral reef fishes [29]. Beside a stand of Rhizophora mangroves are the seagrass meadows of Barangay Herrera, which serve as nursery habitats and food for some fishes like rabbit fishes, mammals like dragon fishes, reptiles like green turtles, and invertebrates like sea urchins. The SoCOM [28] also assessed the coral reef and reef fish communities, wherein Masaguing and Montemayor were included. It was reported that Naujan has a live hard coral cover of more than 50%, which is considered to be in a good status according to the parameters used. Faviidae or

solitary corals are found in Naujan along with Pocillopovidae, Poritidae, and Acroporidae. Meanwhile, several coral predators are found in the area such as Acanthaster planci or crown-of-thorns starfishes and Drupella snails, which feed on coral polyps, causing them to bleach and eventually die. Naujan also has an abundance of reef fishes including the families of Pomacentridae, Scaridae, Siganidae, Lethrinidae, and Acarithuridae that can be found both outside and inside the MPAs.

Figure 3. Map of marine protected areas (MPAs) in Naujan. Source: Naujan Comprehensive Development Plan 2023–2028, Vol. 1A: Socio-economic and Physical Profile, with permission from the Municipality of Naujan [25].

The coastal areas of Naujan comprise 11 barangays with a population of 12,260 [29]. From these barangays, about 778 out of 3051 households are engaged in fishing. The most common species caught were mackerel, tuna, anchovies, sardines, grouper, roundscad, kitang, mullet, and other similar fish species [29]. During the last decade, the average annual fish catch has ranged between 163 and 220 thousand mt. In 2022, total fish production was 147,963.59 mt, which is 9.48% lower than 2021 production [25]. This decreasing production was attributed to illegal fishing activities like electrofishing and dynamite fishing, the entering of large fishing vessels from other areas to areas covered by the municipal water, the destruction of spawning grounds for fishery resources due to mangrove deforestation or degradation, deforestation-induced soil erosion that damages estuarine and marine organisms as well as coastal coral reefs and aquatic vegetation, and water pollution caused by improper waste disposal by structures and settlements along the coastal zone and river banks [25,29,30].

Another challenge hit the municipality when MT Princess Empress sank off its coast on 28 February 2023, causing the spillage of 5660 bbl of industrial fuel oil. The oil spill affected

marine ecosystems and the livelihoods of fisherfolk in Naujan and nearby municipalities and provinces. According to the Bureau of Fisheries and Aquatic Resources (BFAR), seaweed and fish samples collected from selected areas in Oriental Mindoro and Antique on 9–10 March showed low-level contamination of PAH, which are harmful to humans and other living organisms as they accumulate over time [31]. Several local government units (LGUs) prohibited all aquatic activities including fishing, swimming, and bathing, among other activities, in the affected areas. This greatly affected fisherfolk whose daily subsistence depends on fishing. According to the BFAR, the fishing sector loses nearly PHP 19 million daily as the Mindoro Oil Spill drags on. Meanwhile, the national government conducted integrated interventions to address the effects of the oil spill, categorized into four clusters, namely, the logistics cluster led by the Office of the Civil Defense (OCD), food and non-food items by the Department of Social Welfare Development (DSWD), health by the Department of Health (DOH), and search, rescue, and retrieval by the Armed Forces of the Philippines [32]. Additionally, various countries such as Japan, France, the United Kingdom, the United States, and South Korea also provided technical assistance and supplies for containing the oil spill [13].

2. Materials and Methods

2.1. Research Design

This study used a qualitative research design, seeking to explore the lived experiences of fisherfolk affected by the oil spill and the socioeconomic impacts. Qualitative research seeks to contextualize the nature of phenomena and is appropriate to answer questions about why something is observed or not observed, analyze complex interventions, and focus on intervention improvement [33]. Compared with quantitative research, qualitative research does not reduce its material to numbers and variables [34] but aims to understand phenomena, explain behavior and beliefs, identify processes, and understand the contexts of the participants' experiences [35]. In this study, we referred to our respondents as "participants", as they participated in the research by sharing their lived experiences in an in-depth interview. We only selected a few participants to achieve the depth of information rather than statistical representativeness.

2.2. Participants and Data Collection

The participants in this study were fisherfolk, who were affected by the recent Mindoro Oil Spill in February 2023. The data were collected using semi-structured interviews with fisherfolk from various coastal areas in the Municipality of Naujan in the Philippines. The interviews were conducted from 1 to 7 April, a month after the oil spill disaster. The selection of participants was accomplished using snowball sampling according to the following inclusion criteria: (a) fisherfolk with a primary source of income from fishing or selling fish, (b) livelihood was affected by the oil spill, (c) voluntary participation in the study, and (d) completeness of the reports following two main survey questions and instructions.

This study followed "data saturation" as defined by Kyngäs [36], which refers to the point when the obtained information from participants became repetitive, and the researchers would not gain any new information from further data collection. Data saturation was reached after interviewing nine (9) participants from three coastal barangays of Naujan: San Jose, Estrella, and Melgar B.

All materials and methods were performed in accordance with the Helsinki Declaration and were approved by the research committee of the Center for Human Development (CHD) of the University of Science and Technology of Southern Philippines. The survey questionnaire included details of the study such as the purpose, anonymity of responses, the confidentiality of the data, and informed consent; personal information of the participants; and five open-ended questions. The questions were validated by the CHD before the interviews. Free, prior, and informed consent (FPIC) was sought from the participants,

which included explaining to them the intent of the study, their voluntary participation in the study, and how the collected data would be used.

Participants were asked to describe their living conditions before the disaster, their lived experiences during the disaster and its socioeconomic impacts, government and private institutions' responses, their skills and alternative livelihood, and recommended government interventions. Specifically, the questionnaire contained the following questions: (1) Before the oil spill disaster, what was your primary source of living, and how much did you earn?; (2) What is your experience in the oil spill? What are the immediate impacts on your livelihood, health, environment, mental health, and others?; (3) How did the government and other organizations respond to control the oil spill and mitigate its impacts?; (4) How do you cope with the impacts? What are your alternative sources of income?; (5) Besides fishing, what other skills do you possess and what else do you want to acquire?; (6) What suggestions can you recommend to address the oil spill and other future disasters in terms of social and economic aspects? The survey form incorporated encryption codes to anonymize the participants. After analyzing the transcripts, participants were offered the opportunity to review and approve their shared information and experiences. They also received the coded data output for their final verification of the responses.

2.3. Data Analysis

This study applied a narrative analysis to explore participants' lived experiences of the oil spill disaster, its socioeconomic impacts, alternative livelihood or coping strategies, and learnings from the disaster. Narrative analysis was used to interpret richly detailed lived experiences obtained from interviews or written documents, which go beyond the description of the text by contextualizing each participant in social and historical terms [37]. Its analytic framework searches for patterns of meaning in the narratives and reflects on the role of the interpreter, referred to in this study as researchers, in co-constructing the meanings. Therefore, the narrative analysis contains a dual layer of interpretation: first, the participants interpret their own lived experiences; and second, the researchers interpret the participants' narratives [35]. Here, the researchers played a crucial role in deciding which stories provide answers to the research question, rather than attempting to consider everything that each participant narrates. Hence, different researchers produced different analyses [38]. In this study, the researchers closely collaborated to analyze the narrative reflections. The narrative analysis of participants' lived experiences focused on "the story itself" and sought to preserve the integrity of their personal experiences that cannot adequately be understood in terms of their discrete elements. After the analysis, the results were synthesized according to the social impacts, economic impacts, and government interventions to mitigate the impacts of the oil spill.

3. Results

3.1. Neljay: "Immediate Action from the National Government Is Highly Needed"

Neljay, a 32-year-old fisherfolk from San Jose, is the sole breadwinner of a family with three children. In addition to fishing, he also sells his day catch in the neighborhood and nearby communities. From day and night fishing, he can catch between 50 and 100 kg of fish per week, which can yield up to USD 600 per week during peak seasons.

When the oil spill reached his community, he was deeply bothered about the possible consequences of the disaster to his family. The local government immediately prohibited local fishing as well as swimming and other activities on the affected coastlines. Subsequently, he lost his only source of income and became worried about how to sustain his family. As various offices from the national and local government units provided financial and relief support to the affected families, Neljay received USD 7/day of "cash for work" financial assistance as well as food packs from the Department of Social Welfare and Development. However, he noted that this amount was not enough to sustain his family's needs including payments for utilities, basic needs, and the daily education of his three children.

The local government unit (LGU) and the community tried to address the challenges brought about by the oil spill. The BFAR continuously monitored the water quality and impacts of oil on aquatic resources. The LGU and other non-governmental organizations provided supplies of personal protective equipment (PPE) as well as materials for making spill booms such as ropes, nets, hay, and buoys. About 139 members of the fisherfolk organization, with the supervision and support of the barangay government and the BFAR, constructed and installed spill booms along the seashore to control the spread of the oil spill.

Currently, Neljay has no other source of income. He does not have enough skills for the jobs available in the community. Yet, he is willing to undergo any training that the government may offer such as welding and other vocational courses. Meanwhile, he is hoping for an immediate response from the national government to control the spread of the oil spill so he can return to fishing. Further, he believes that the financial assistance should also include subsidies, particularly to families with school children.

3.2. Matt: "Capacitate Local Communities for Disaster Response and Management"

Matt, 43, is a father of three children. He works as a councilor in the barangay of Melgar B. He does occasional fishing when he is free from the responsibilities of being a barangay councilor. With a minimum catch of 5–10 kg, he only earns USD 10–15 per catch.

When the oil spill reached the coastline, he was saddened for his family and the fellow fisherfolk who lost their livelihoods. He expected that this disaster would have a long-term impact on the environment and eventually affect their source of income and daily sustenance. For instance, he was worried about how to provide for the needs of his family, especially for his two children studying in college. In terms of health, Matt mentioned that the Municipal Disaster Risk Reduction and Management Office (MDRRMO) identified traces of oil in the water from well pumps (on 7 March 7, the provincial governor confirmed this and ordered the suspension of drinking water fetched underground in the affected barangays, though this was lifted on 26 April after a negative test for the presence of benzene and other compounds due to the oil spill). This disaster affected other household activities such as washing clothes, cleaning dishes, and backyard gardening. For other households, this posed a greater problem, as some of them obtain their drinking water from well pumps.

As a barangay official, he was well aware of the assistance provided by different governmental and non-governmental organizations to the communities. For instance, the DSWD distributed weekly food packs, the Department of Labor Employment (DOLE) provided USD 7.1/day financial assistance for 15 days, and a national official gave USD 40 to 500 fisherfolk. One of the uses for this cash assistance was to create spill booms and install them along the coastline. Other non-governmental organizations and private companies also donated food packs, rice, medicines, and toiletries. In terms of disaster response, the PCG monitored any development of the oil spill along the coastline, while the PNP guarded the shoreline against any activities such as fishing, swimming, and eating fish from the sea. The BFAR monitored the effects on fisheries and other aquatic resources. Concerning alternative livelihood activities, the Department of Agriculture provided vegetable seedlings for backyard gardening to all affected communities.

In addition to fishing, Matt possesses other skills that he used as alternative sources of income, such as basic carpentry and copra making. If given a chance, he hopes to learn driving, welding, and house tiling from the training courses given by the government. In the meantime, he only asks the government to capacitate local communities to respond to and manage disasters such as an oil spill. This includes providing equipment to control an oil spill and other disasters and natural hazards, capacity development training, as well as alternative livelihood activities.

3.3. Reagan: "Alternative Livelihood over Financial and Relief Support"

Reagan, 29, lives with his partner and two children in Estrella. His only source of income is fishing, from which he earns between USD 20 and USD 100 per week depending

on the situation in the sea. When the oil spill reached their community, the local government immediately banned all aquatic activities such as bathing, swimming, fishing, and eating anything from the sea. He became depressed and worried, as this would result in great losses to his livelihood.

To control the worsening situation, the barangay initiated the making of spill barriers/adsorbent with the help of the LGU. Reagan mentioned that materials were delivered to their community such as hay, buoys, and ropes. The fisherfolk community worked together to create and install spill booms along their coastline.

Meanwhile, Reagan had no other sources of income. While the government provided various kinds of assistance, he described that these would not sustain his family's daily needs in the long run, as long as the fishing ban was in place. Hence, he pointed out that the government should provide alternative livelihood activities for affected fisherfolk on top of food and financial assistance. Reagan mentioned that he has no other skills besides fishing. Therefore, if given a chance, he wants to take vocational courses or training to be an electrical lineman as an alternative livelihood and additional source of income.

3.4. Marjay: "Skilled but No Other Opportunities in the Community"

Marjay is a 39-year-old fisherfolk and vendor with five school-aged children. Before the oil spill, he disclosed that he could catch an average of 60 kg of fish in a day, with a maximum of 150 kg. He spent about 1 to 1.5 h on the sea in the morning and afternoon and took his fresh catch to the market, earning about USD 216 on a good day and about USD 80 almost daily.

The day after he heard about the incident, the provincial government issued a fishing ban. He immediately felt anxious and thought of his children. The DWSD took two weeks to respond. The agency sent relief packages to his barangay and assured him they would send these food packages every three days. The first two packages were delivered on time; however, the third and fourth batches took more than a week to arrive.

With the help of the DOLE's TUPAD program (a community-based package of assistance that provides emergency employment for displaced workers, underemployed people, and seasonal workers), affected fisherfolk like Marjay received cash for work amounting to USD 7 per day in exchange for constructing improvised spill booms and joining the clean-up drive. This helped his family to buy food and other daily expenses but was not sufficient for the monthly utility expenses. From his perspective as a fisherfolk for 23 years, this oil spill has truly affected his livelihood. While he understood why fishing was banned, he continues to express his concern or worry for the well-being of his children.

Besides fishing, he has other skills like welding, masonry, and carpentry. However, there are no opportunities for this kind of work nearby. For now, he is trying to buy and sell milkfish and tilapia, yet he only earns USD 8 for every 20 kg he buys from pond owners. Yet, Marjay is optimistic that the provincial government can address the impacts of the oil spill and is hoping that they can expedite the process so fisherfolk can return to fishing.

3.5. Noel: "The Lack of Stable Income Makes Life Arduous"

Noel, 57, is a father of six children. Originally from Pola, Oriental Mindoro, he migrated to Melgar B, Naujan, when he married a fish vendor more than 20 years ago. With their youngest child still in college, the couple experienced financial problems after the oil spill reached their barangay's shore and the provincial government issued a fishing ban.

Losing his primary source of livelihood meant a great deal to Noel as the provider of the family. Before, he earned an average of USD 40 for 20 kg of fish caught daily. While the response team from the Provincial Disaster Risk Reduction and Management (PDRRM) arrived a week after the incident, together with other government agencies like BFAR, DSWD, and DOLE, he felt that the food packages and USD 7 cash assistance were not enough to sustain the needs of his family. Although he was grateful for the presence and constant reassurance of the local government, it still pained him not to be able provide enough for his family: "The lack of steady income makes life arduous." he said.

Another reason for Noel's distress was the lack of alternative sources of income. He knew carpentry but doubted that someone would hire him because of his age. Thus, he was hoping that the government could provide livelihood programs like animal husbandry or crop growing. He was uncertain when the fish ban would end; hence, he was willing to undergo skills training for any livelihood program of the government.

In addition to all these concerns, the family now pays an additional USD 0.60 per gallon of potable water from refilling stations, as the municipal government issued an advisory that water from artesian wells was no longer safe for drinking due to traces of benzene. This advisory was given after the Department of Health and ChemPro Analytical Services Laboratories Inc. conducted water testing in the barangays affected by the oil spill.

Despite all these challenges, Noel was thankful that there were no recorded cases of oil-spill-related illnesses in his area. He mentioned that the immediate response of the provincial and municipal governments on banning fishing, drinking from wells, and going near the shore made a significant impact on the avoidance of diseases. However, he was hoping that the administration, while waiting to lift the fishing ban, could provide an alternative livelihood as a source of income to the people of Naujan.

3.6. Fred: "Hasten the Mitigation Measures"

Fred is a 35-year-old fisherfolk from Estrella, Naujan, who lives with his three other siblings. Although single, he is the household's breadwinner after being orphaned a few years ago. Before the oil spill, Fred took home an average of USD 400 a week. He used this to support his family's daily and monthly expenses, including food and utilities.

He felt that the oil spill rendered him financially incapacitated, as this was his only means of living. While he appreciated the immediate response of the local government and other agencies such as the DSWD, DOLE, PDRRM, and BFAR, he thought that the food supply and the financial assistance worth USD 7 were insufficient to keep his family afloat, especially when this crisis lasts longer. He added that they are now purchasing purified water from refilling stations in a neighboring barangay because their artesian well is already contaminated with benzene. Fortunately, according to him, no one from his family or anyone from his barangay contracted any oil-spill-related diseases that could further worsen their situation.

While Fred has skills in construction and welding, he has been unsuccessful in finding employment opportunities at this time. Hence, he pleads with the government to hasten the mitigation measures and support his family's daily needs during these trying times.

3.7. Alex: "Consider the Elders"

Alex is a 53-year-old widower from Estrella with four children, of whom three are still studying. According to Alex, the best harvest season for him comes from February to half of November. During a good harvest season, he can trade his fish for USD 55 per week; otherwise, he can earn USD 20.

Due to the fishing ban because of the oil spill, he lost hope because fishing was his primary source of income. Before, he was able to secure his family's daily needs and cover the education of his three children He found himself a burden to his eldest child, who is currently supporting him. He has not been able to find another job because of a lack of skills in addition to his old age.

As the founder of a fishermen's group in his area, he also observed a dramatic change in the standard of living of his colleagues. In addition, some sources of potable freshwater were temporarily closed due to the detection of toxic chemicals. There were also sightings of dead fish on shore that added to his distress.

Two weeks after the oil spill, help and assistance came from different agencies ranging from national to local governments. The assistance from the DOLE for the cash for work program and the construction of spill booms gave him temporary income. While the DSWD, the Provincial Government of Oriental Mindoro, and the LGU of Naujan extended their help by giving food packages.

Alex was uncertain when this disaster would end; however, he was positive that everything would be okay again. He was willing to learn entrepreneurship skills that would fit his age. He also mentioned that there must be immediate action by the government to mitigate and eliminate the problems brought about by the oil spill, so people can return to their normal ways of life.

3.8. Rollie: "Additional Skills Provide More Opportunities"

Rollie, a husband and the father of a child, is a 54-year-old fisherman from San Jose, Naujan. He is part of a group that uses the surface gill net method, locally called largarete. His income commonly depends on the condition of the sea, which determines the peak (February–November) and off-peak (November–January) harvest seasons each year. Aside from largarete, he is an irregular member of a scoop net fishing crew, locally known as gayad. On average, his income ranges around USD 1300 per week during the peak season and USD 130 per week during the off-peak season. Though there is a big difference in his income between these harvest seasons, he can decently provide for the needs of his small family.

Rollie felt sadness and mental worry the moment the oil spill reached the shoreline. He knew that this would momentously affect his foremost source of income. He did not know how to manage his little earnings from trading banana fruit and rice farming. Rollie thanked the government, specifically the DSWD and the LGU of Naujan, for reaching out and giving food packs. He also thanked some private individuals, mostly former residents, from his barangay who also lent help by giving the same kinds of goods. In addition to food packs and similar goods, monetary assistance was provided through a senator and a cash for work program by the Provincial Government of Oriental Mindoro.

Rollie's task for the cash for work program was to build spill booms to block and redirect oil from coming to the shoreline. But, in his observation, spill booms cannot withstand the waves, resulting in additional rice straw waste. The oil that reached the shoreline was collected in drums, which the local government promised to collect, yet no personnel from the municipal government collected it.

In addition to his anguish over budgetary constraints, he was also worried because of observable fish kills on the shoreline. He was hoping that the government would immediately resolve the problem. As an alternative, he was focused on increasing his income by doing manual labor (mowing land and construction helper), but he knew that these opportunities were not regular. He wished that the government could also teach more skills for him to provide more services and labor.

3.9. Richard: "Solidarity and Moving Forward Is the Key"

Richard, 27, is a young fisherman and barangay police officer from Melgar B, Naujan. He is living with his partner and a 7-year-old child. On average, he earns USD 90 per week from fishing plus his honorarium as a member of the barangay police, which is around USD 40 per month. Combining these sources of income, he can provide necessities for his family including food, bills, and education for his child.

After the decision of the authorities to temporarily ban fishing activities in Oriental Mindoro, he immediately looked for alternative sources of income. These included rice farming, drying portions of coconut meat, and trading banana fruit. He found it very difficult to generate an income equal to what he was earning before the oil spill disaster, because he was not used to performing his current job.

The government reached out a week after the disaster. Richard received food packs from both the DSWD and the LGU of Naujan. Meanwhile, the DOLE provided him an opportunity to earn USD 90 for providing 15 days of manual labor to create spill booms. Originally, this was a 46-day program, and Richard did not know when this cash for work program would resume.

Richard, with or without the cash for work program, is more than willing to serve his community by helping to remove spills from the coastline. As a public servant, he is also

bothered by observable fish kills. In response, he takes part in the voluntary monitoring of spills, using small boats that most of the time are financed, for fuel expenses, from people's own pockets. This may be too difficult for him, since almost 80% of his income was lost due to the fishing ban, but, for him, solidarity is one key to solving the problem.

He hopes that the government will intensify its programs, teach people valuable skills in poultry management, and introduce people to transportation services to generate a decent income. Being weary is not an option for Richard, and this is also his advice to others who are affected. He also suggests that people must learn how to adapt and move forward on their own with or without help from the government.

4. Discussion

4.1. Perceived Socioeconomic Impacts of Oil Spill to Fisherfolk

The recent Mindoro Oil Spill in February 2023 poses potential long-term impacts to several sectors of society. Within a month after the ship sank, the oil spread across the coastline of Oriental Mindoro and nearby provinces, damaging marine protected areas, ecological sanctuaries, tourism destinations, and numerous areas where socially vulnerable communities strongly rely on subsistence. Focusing on the Municipality of Naujan, where MT Princess Empress sank, and on fisherfolk who were directly affected by the disaster, we demonstrate the socioeconomic impacts of the oil spill on the targeted participants. The summary of the themes generated from interviews with fisherfolk is summarized in Table 1.

Table 1. Summary of immediate socioeconomic impacts of oil spill on fisherfolk.

Socioeconomic Aspect	Impact
Livelihood	Loss of income
Mental Health	Anxiety and depression
Health	Contamination of sources of potable water; contamination of marine resources and decreased food source
Education	Threat of discontinued education for schoolchildren
Recreation	Restrictions on swimming, fishing, and other aquatic activities

Fisherfolk reported their income loss as the main effect of the oil spill. Before the incident, the participants earned between USD 10 and USD 1300 per week, depending on the type of net fishing (along the shore, with a small boat, or with a commercial boat), frequency (once or twice a day), and season (peak from February to November or off-peak from November to January). When the vessel sank on 28 February 2023, the government prohibited all types of aquatic activities along the coastline. This implied the loss of livelihood of fisherfolk, whose only source of income is fishing. This result supports previous claims that oil spills cause fish kills as well as the loss of viable areas for fishing activities, leading to the loss of livelihood of fisherfolk [39,40]. Moreover, our study found that the participants rarely had an extra source of income and had limited job opportunities in their communities; hence, the banning of fishing resulted in a total loss of income.

The participants explained that the loss of livelihood had several consequences. At first, the participants described their anxiety toward the incident. They were worried about their families and communities and about how they could sustain their daily living without any source of income. This result supports previous studies reporting increased symptoms of anxiety, depression, and post-traumatic stress from the Gulf Oil Spill [41–43]. While the government provided monetary assistance in the form of "cash for work", the participants complained that this was not enough, especially for families with school children. Additionally, utility bills were piling up, including electricity and water bills. These factors were also observed in a previous study: the lack of monetary resources due to a decrease in fish sales from an oil spill resulted in restrictions on feeding native families; difficulties in buying basic commodities such as rice, beans, noodles, coffee, etc.; and delays or defaults on payments for energy, clothes, and appliances [44]. Moreover, the incident made the participants realize the need for skills training to have an alternative source of

income in times of disaster, when fishing is not allowed. However, Alvernia et al. [45] showed that a livelihood shift of fishermen to meet their daily needs was still not sufficient or was less than what they earned from fishing before an oil spill. Therefore, the solutions required to overcome the impacts of an oil spill are through the distribution of financial subsidies, the protection and care of those impacted by the oil spill, and the involvement of those affected people [45].

Meanwhile, the contamination of the potable sources of water and their food sources affected the participants' daily living activities. With contaminated water well pumps, fisherfolk tried to find another source of water for drinking, washing clothes and dishes, and backyard gardening. This implied an additional cost (for drinking water) for the family or extra effort to find a nearer source of water for general use. Moreover, a contaminated ocean implied an additional cost for the food budget, which was free from fishing activities before the oil spill. Oil compounds such as PAH do not pose a direct health risk to human health but do via seafood consumption, as they bioaccumulate in living organisms and may become more concentrated along the food chain [46]. At present, there were no reported incidences of health-related casualties from the interviewed communities. This is contrary to several studies showing the elevated risks of heart disease, neonatal mortality, and infant diarrhea [24,47,48]. Fisherfolk attributed the zero-to-low casualty rate from the recent oil spill to the rapid response of the government to prohibit the consumption and sale of seafood as well as aquatic activities in the affected communities.

4.2. Government Response and Local Reactions to Oil Spill

The Philippines is no stranger to oil spill disasters. Between 2000 and 2021, there were 14 major oil spills, of which only 10 were found in the PCG database, while the other 4 were retrieved from the NDRRMC. Among the most notable oil spills were those in Guimaras in 2006, Manila Bay in 2013, Semirara in 2005, Iloilo in 2013 and 2020, Cebu in 2013, and Davao in 2005 [49]. When MT Princess Empress sank off the coast of Naujan, the national government conducted integrated interventions to address the effects of the oil spill involving the logistics, food and non-food, health, and search, rescue, and retrieval clusters [13].

According to the survey participants, they were actively involved in controlling the oil spill. Various government agencies, international institutions, and private organizations provided the materials and expertise, while the community of fisherfolk helped create spill booms made from hay, straw, coconut palm, nets, and floaters and installed them with the guidance and strict supervision of the PCG and BFAR. Sorbent booms are considered a "first line of defense technology used for containing and minimizing the impacts of oil spills" [50]. Natural sorbent materials from waste agricultural products like hay, feathers, corncobs, bark, peat, cotton, kapok, cork, chicken feathers, wool, sawdust, and straw are generally abundantly available in nature, very low in cost or available for free, biodegradable, and non-toxic; hence, these are all considered environmentally friendly materials available for the remediation of oil [51].

In terms of support, the participants enumerated both the financial and material support they received from different government agencies, political personalities, and non-governmental organizations. Providing indirect or direct subsidies to affected families is one of the strategies of various governments to minimize the socioeconomic impacts of oil spills in coastal-dependent communities [44]. However, the participants revealed that these subsidies were still not enough to sustain their living in the long run. Fisherfolk were expecting a quick government response and quick management of the oil spill, as it not only affected their livelihood but might have a greater effect on marine life, which would ultimately affect their future catch both in the quantity and quality of the fish. The government needs to ensure well-coordinated and efficient measures to mitigate the impacts of such disasters, including assistance programs that can directly address the economic impact on the affected communities, and ensure the quick removal of oil slicks from affected areas [20].

4.3. Implications of Oil Spill on Resources Management and Disaster Risk Reduction

The results of the narrative analysis of the participants' lived experiences and the lessons learned from the oil spill provide several implications for oil transport policy, resources management, and disaster risk reduction. As reported in a previous study, various factors contribute to oil spill disasters, with human factors playing a major part structurally [3]. The implementation of more efficient risk management should be considered by a complete incident sequence, from the causations to the consequences of marine oil spill accidents [52]. In terms of maritime traffic safety management, government institutions and water transport operators should place great importance on the navigation safety of oil transportation and prioritize human resource management over the management of ships [3].

With the increase in marine traffic across the archipelago, the government and oil industries should have policies and regulations in place that would prepare and empower stakeholders to cope with an oil spill disaster. This should comprise LGUs, civil society organizations, the academe, and the private sector following the bottom-up and whole-of-government or whole-of-society approaches. In the case of the Mindoro Oil Spill, the Philippine government is applying a whole-of-government approach with the collaborative efforts of different government agencies like the OCD, the PCG, the DENR, the DSWD, and LGUs; the academe; and international experts from several countries such as Japan, France, the United Kingdom, the United States, and South Korea [53].

Furthermore, there is a need to capacitate local governments and affected communities to immediately respond to natural and human-made disasters such as an oil spill, without waiting for national government actions. For instance, an effective monitoring system for oil spills is essential for avoiding damage to shorelines, timely oil containment, and the decision to strategize cleanup techniques and select suitable recovery equipment [16]. Additionally, the use of digital mapping with building vulnerability indices is a step forward in the development of measures to increase coastal community resilience while decreasing the susceptibility to any kind of disaster [54]. Of course, it is always a question of whether the government and industry are ready to commit substantial financial resources to a sparsely populated area, if such investments would lead to a significant increase in employment opportunities and economic benefits for the local population [55].

5. Conclusions

Despite technological advancements and stricter regulations in maritime transport, oil spills still happen and often impact water resources, marine wildlife, and coastal communities. The recent shipping accident in the Philippines resulted in an oil spill affecting marine ecosystems as well as the livelihoods of fisherfolk, vendors, and tourist establishments in Oriental Mindoro and nearby provinces. This study provided an initial analysis of the immediate socioeconomic effects of the oil spill from the perspective of fisherfolk in the affected communities. Applying narrative analysis, this study explored the lived experiences of fisherfolk during the oil spill disaster and the social and economic impacts.

The results showed that with the prohibition of fishing and other aquatic activities, the participants lost up to USD 1300 of income per week from fishing. This eventually resulted in stress, anxiety, and depression, as the fisherfolk were uncertain how to continue their daily living if the prohibitions were prolonged. Most of the interviewed participants had no other skills than fishing, while the rest had other skills, but no alternative jobs were available for them in the community. The government and private organizations provided various kinds of financial and food assistance, but the participants found these insufficient to sustain their basic family needs including food expenses, utility bills, the education of school children, and health maintenance. The traces of oil found in the sources of potable water and the ocean implied additional costs for drinking water and food expenses, while the participants fish for free. There were no reported negative health impacts, as the participants believed that the government took an immediate response to contain the oil spill. However, the participants expected the government to expedite interventions to

enable them to return to fishing. These fisherfolk, who are members of communities that are vulnerable to natural and human-made hazards, had their subsistence, food security, and human well-being highly compromised.

Given these findings, this study presented the implications of providing better social services and support for the affected communities for policymakers.

- Provide alternative livelihoods and other sources of income to the affected communities.
- Conduct capacity building and training courses for technical–vocational skills, financial literacy, and disaster preparedness and response.

The current study had several limitations. First, the study used a snowball sampling with nine participants, which lacked the representativeness of all the fisherfolk communities affected by the oil spill. The narrative analysis focused on the depth of the participants' lived experiences of the oil spill and the immediate socioeconomic impacts. Hence, the findings should not be used to make generalizations about entire fisherfolk communities, and the results from across the province and from nearby island provinces, different livelihood activities, and the economic status of fisherfolk should be compared. Quantitative research is needed to complement this study with more tailored questionnaires and a considerable number of randomly sampled respondents. For a more holistic approach to the government response to this type of disaster, the perspectives of various stakeholders should be taken into account, including government officials, private organizations, and the rest of the community. Lastly, this study only focused on the immediate socioeconomic impacts of the oil spill. Future studies should include the long-term impacts and other aspects including the environmental impacts on water quality and biodiversity, maritime transport policy and governance, and disaster response and management to better capture a broader perspective of the short- and long-term effects of an oil spill.

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