

MICROPLASTICS ACCUMULATION OF COMMERCIALLY SOLD SHRIMPS (*Metapenaeus endeavouri*) IN PANGUIL BAY AREA

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ABSTRACT

Microplastics, defined as plastic particles smaller than 5 mm, have emerged as a global environmental concern due to their persistence, bioaccumulation potential, and associated health risks. With the Philippines identified as a major contributor of plastic waste to the ocean, this research aimed to assess the extent of microplastic contamination in a key aquaculture product consumed locally. A total of 300 shrimp samples were collected from local vendors and analyzed through dissection, chemical digestion using 6.25% sodium hypochlorite (NaClO) and 10% potassium hydroxide (KOH), and followed by microscopic identification. The study categorized microplastics by location, and morphology (fibers, microbeads, fragments, films, and pellets). Among the three locations, Macquilao shows the highest total number of microplastics present (2.64 ± 0.1), followed by Silanga (2.27 ± 0.11), and lastly, Migcanaway (1.41 ± 0.09). Larger shrimp may have greater feeding capacity and exposure, so these size distribution differences are relevant in microplastics analysis. This study confirmed the presence of microplastics in the Panguil Bay Area, Tangub City, with Macquilao exhibiting the highest accumulation, followed by Silanga and Migcanaway.

Keywords: *consumption, commercially sold shrimps, Metapeneaus endeavouri, microplastics, Panguil Bay Area*

DEDICATION

This research is dedicated to our Almighty God for providing us with wisdom, strength, guidance, and perseverance throughout the completion of this study.

We also dedicate this work to our parents and families for their endless love, encouragement, understanding, and unwavering support in all our academic endeavors.

Their sacrifices and motivation inspired us to continue despite the challenges encountered during the conduct of this research.

To our research adviser, panelists, and professors, we sincerely dedicate this study as a token of gratitude for sharing their knowledge, expertise, patience, and valuable guidance that greatly contributed to the success of this study.

Lastly, this research is dedicated to all future researchers and students who may benefit from this study and continue exploring knowledge for the advancement of science and the community.

Mary Mae, Christel, & Franz

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INTRODUCTION

Background of the Study

Plastic has become an emerging problem, with over 7 billion tons of plastic waste generated since the 1950s, and a significant portion of it ending up on the ocean floor. Plastics have had a significant impact on society due to their accessibility, flexibility, low cost, and versatility. Over two million tons of plastic are disposed of on the ocean floor each year (Ritchie et al., 2023). Inappropriate waste management and disposal of plastics can have a significant impact on the environment, especially on the marine environment. Once released into the environment, it will be broken down by several factors and pathways, including microbial activity, mechanical forces, and sunlight. These larger materials consequently decompose into microplastics, which can be readily consumed by marine life. This bioaccumulation and the potential transfer of toxic substances across trophic levels put ecosystem health and human food safety at risk (UNEP, 2025).

Microplastics have become part of the marine food web, and humans are now on the receiving end as consumers of microplastic-contaminated seafood. A study conducted by Lim et al. (2023) revealed that microplastics can easily penetrate the tissues and organs of marine life because they are so tiny. Microplastics are a global problem that may directly or indirectly endanger the lives and development of marine animals due to

their abundance, widespread presence, and physical characteristics (Keshavarzifard et al., 2021).

To mitigate microplastic pollution and lessen its impact on aquatic species, various technologies, including physical, chemical, and biological methods, are utilized. Removal techniques include chemical treatments, biological removal and ingestion, and physical sorption and filtration. One physical method involves the use of green algae, such as *Pseudokirchneriella*, *Subcapitata*, *Cladophora*, and *Fucus vesiculosus*, which help absorb microplastics (Padervand et al., 2020). Meanwhile, the risk of people consuming microplastics is not always decreased by gutting the fish. There is an unanticipated risk of microplastic exposure among consumers because small dried marine fish are typically eaten intact. However, fish from different places have varying levels of microplastics and polymer types (Piyawardhana et al., 2021).

Additionally, Tanaka and Takada (2016) examined microplastics in the digestive tracts of Japanese anchovies collected from Tokyo Bay; 49 fish (77%) of the 64 examined contained plastic particles, with an average of 2.3 pieces and a maximum of 15 per fish. Therefore, eating contaminated seafood will inevitably result in human consumption of microplastics. Although some estimates are available, there are currently no precise figures for the quantity of microplastics consumed by people through contaminated seafood. A study by Feng et al. (2020) showed that although little is known about the accumulation of microplastics (MPs) in fish from large fish farms and mariculture areas, microplastics (MPs) have been found embedded in the digestive tracts and other tissues of a wide range of marine organisms. This suggests that microplastics of any kind are not only confined to the guts of marine life but have also entered their tissues and organs.

Compared to global data, microplastic contamination of African aquatic environments is high. White, transparent, and black were the most common colors; fibers and fragments were the most common shapes; and polypropylene (PP), polystyrene (PS), and polyethylene terephthalate (PET) were the most readily available polymers. The greater the geographical distance between sites, the less comparable the microplastic polymers were. Polypropylene (PP), polyethylene terephthalate (PET), and PE were present in small proportions, were white, and were the main characteristics of microplastic contamination in African aquatic systems. This indicates that humans face a much higher risk of microplastic exposure when consuming seafood whole or eating the digestive organs. Consequently, there is a direct link between consuming whole marine animals and the amount of microplastics humans ingest.

Plastic pollution is a major issue in the Philippines. In 2019, the Philippines was the largest contributor to ocean-bound plastic waste, accounting for approximately 36.38% of global inputs. The country has seven of the ten most contaminated rivers, with the Pasig River sending more debris to the ocean than the Yangtze River in China (Ramos, 2023). For instance, Bucol et al. (202) found that nearly half of the rabbitfish samples sold in Philippine markets contained microplastic particles in their digestive systems. This finding underscores the growing prevalence of microplastic contamination in aquatic environments and highlights the potential risk it poses to both marine organisms and human consumers.

Quintero (2021) investigated microplastic contamination in 200 samples of *Litopenaeus vannamei* (white leg shrimp) from General Santos City, identifying 101 particles categorized as fibers, fragments, and films. Films emerged as the most prevalent

form, while Cabansag et al. (2021) further analyzed the chemical composition of these pollutants, detecting polypropylene (PP), polyethylene (PE), and polyethylene terephthalate (PET). PET was detected only in surface water samples from the Cañas River, whereas PP and PE were consistently present across all sampling sites. These polymers are thought to originate from the degradation of everyday materials such as fishing nets, ropes, straws, and textile fibers, which continuously contribute to microplastic pollution in aquatic ecosystems.

Microplastics can emit compounds such as Polybrominated Diphenyl Ethers (PBDEs), Bisphenol A (BPA), Nonylphenol (NP), and Octylphenol (OP), as well as other potentially harmful substances. They can serve as carriers of potentially harmful microbes (Alberghini et al., 2022). It has been detected in human blood, placenta, breast milk, and testicles, indicating widespread infiltration throughout the body and potentially leading to serious adverse effects. Li et al. (2024) reported detecting microplastics across a wide range of human tissues and fluids. Specifically, concentrations were measured at 1.6 $\mu\text{g/mL}$ in blood; 0-7.75 MP/g in heart tissue; 0-2.72 MP/g in breast milk; 4.6 MP/g in the liver; 1.1 MP/g in the spleen; and between 0.69 and 14.1 MP/g in the lungs. Additionally, bronchoalveolar lavage fluid contained 9.18 ± 2.45 MP per 100 mL.

Research on microplastics in shrimps remains limited. While Reble et al. (2025) documented the prevalence of microplastics in seaweed from the Panguil Bay area using FTIR-ATR (Attenuated Total Reflectance-Fourier Transform Infrared Spectroscopy), identifying several polymer types, this does not establish their presence in shrimps, thereby revealing a knowledge gap. Moreover, local consumers remain largely unaware of the potential impacts of microplastic accumulation in shrimps. To address this, the

present study investigated the occurrence and extent of microplastic contamination in shrimps harvested from Panguil Bay. It also aimed to generate baseline data on contamination levels in commercially sold shrimp, assess the distribution of microplastic particles across the collected samples, and provide insights that may support future environmental monitoring and public health awareness initiatives in the locality.

Objectives of the Study

The goal of this study was to determine the amount of microplastics present in commercially sold shrimps in the Panguil Bay Area. Specifically, this research was conducted as follows:

1. Identified the presence, type, and quantified the amount of microplastics present in the gastrointestinal tract of the shrimp;
2. Determined the possible relationship between weight and the location of the shrimp and the amount of microplastic present; and
3. Established baseline data about the presence of microplastics in commercially sold shrimp for human consumption harvested from the Panguil Bay Area.

Significance of the Study

Multiple sectors benefited from this study. This raised consumer awareness of the potential health risks associated with ingesting microplastics through shrimp consumption. For the local vendor, sufficient knowledge of microplastics and their impact on public health will influence sustainable fishing and market practices, ensuring food quality and safety. In addition, the results of this study informed public health

personnel and the local government in designing policies and interventions aimed at reducing plastic pollution in the city and coastal areas that eventually reach marine ecosystems. Moreover, this study contributed to microplastic awareness and its effects on the marine ecosystem. Also, it served as a scientific reference for future research that aimed at expanding the environmental and health risks of microplastics.

Scope and Delimitations

This study investigated microplastic contamination in commercially sold shrimp collected from selected areas within the Panguil Bay Area. Specifically, the study was limited to extracting, quantifying, and identifying microplastics in the gastrointestinal tract (GIT) of shrimp samples. Microplastics were characterized using measurable parameters, including abundance (number of particles), type, and physical characteristics observed during analysis. Sampling was conducted only within a designated collection period, representing a cross-sectional assessment of microplastic occurrence at the time of study.

The study did not include analysis of microplastic contamination in other shrimp tissues (e.g., muscle tissue or edible portions), nor did it evaluate the chemical composition, polymer classification, or potential contaminants adsorbed onto the microplastics. Additionally, the research was limited to shrimps and did not extend to other marine organisms, seafood products, water samples, or sediments within Panguil Bay.

Furthermore, this study did not assess the potential toxicological or health implications of human consumption of shrimp containing microplastics. Seasonal

variations, temporal trends, environmental factors influencing microplastic accumulation, and long-term monitoring of contamination levels were also beyond the scope of this research.

MATERIALS AND METHODS

Research Design

This study used a descriptive-qualitative research design to investigate the levels of microplastics found in shrimps sold in the Panguil Bay Area. The researchers investigated whether microplastics were present in commercially sold shrimp, identified the type of microplastic, and assessed its quantity. This research employed shrimp sampling, dissection, chemical digestion, and microscopic analysis. This allowed the researchers to directly detect and identify microplastics in shrimps under controlled conditions. Furthermore, this study went beyond simply quantifying and identifying microplastics by developing a comprehensive understanding of their environmental impact and the eventual risks to consumers.

Research Setting

This study was conducted at the laboratory of Misamis University, Natural Sciences Building, Main Campus, Ozamiz City. The laboratory was equipped, allowing the researchers to dissect and further examine the shrimp sample for microplastics.

The shrimp samples were procured from three local fishermen, from Barangays Macquillao, Migcanaway, and Silanga in Tangub City, who sourced their shrimp from Panguil Bay. These locations were chosen because they were an important source of livelihood for nearby communities and were also exposed to different human activities that may lead to microplastic pollution (Figure 1).

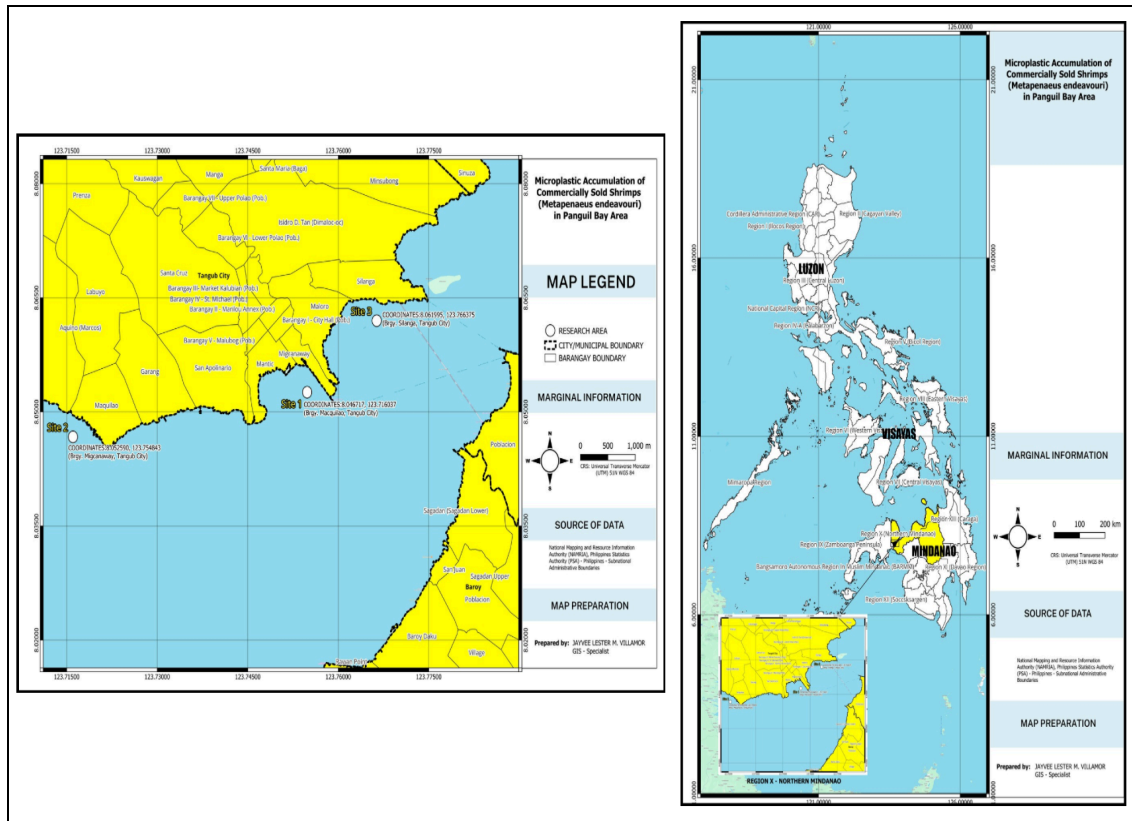


Figure 1. GIS Mapping of the three locations.(A. Barangay Migcanaway; B. Barangay Macquillao; C. Barangay Silanga)

Collection of Shrimp Samples

A total of six kilograms of commercially sold shrimp samples were collected from three selected coastal locations in the Panguil Bay Area (Figure 2). The number of shrimp samples obtained from each site depended on the quantity available from vendors at the time of collection. Immediately after collection, all samples were placed in chilled containers to preserve them, then grouped and labeled by the collection site for proper organization throughout the study.

Species Identification of Shrimp Samples

Prior to chemical processing and laboratory analysis, five shrimp samples from each collection site were submitted to the Bureau of Fisheries and Aquatic Resources - Region X (BFAR-X) for taxonomic identification to confirm the species of the collected shrimp samples. Species identification was conducted to ensure consistency and reliability of the samples included in the study.



Figure 2. Shrimp samples collected from Panguil Bay Area

Sample Treatment of Shrimp Samples

This study adapted the method of Curren et al. (2020), in which the whole shrimp was used. The samples were stored in a chilled container to preserve them prior to laboratory testing. The shrimp samples were classified by the area from which they were collected. The shrimp samples were chilled for 1 hour, then washed. The samples were drained of excess water and weighed using an analytical balance to record the exact weight. Shrimps were dissected and deshelled, then organized into three jars by collection site. For the analysis, their gastrointestinal tracts were removed and collected into these containers. To maintain a sterile environment and prevent contamination, researchers wore cotton lab coats and nitrile gloves throughout the procedures. All procedures were

performed inside the fume hood. Researchers wore gloves and laboratory coats, avoided synthetic clothing to prevent fiber or dust contamination, and ensured a controlled environment. While laminar flow cabinets were ideal for minimizing airborne contamination, fume hoods were commonly used when laminar flow was unavailable, as reported in microplastic studies (Noonan et al., 2023).

Dissection was performed on stainless-steel trays using metal scissors and forceps. Tools were rinsed with distilled water after every use to avoid cross-contamination. The gastrointestinal tract of each shrimp was carefully removed and placed into 100 mL glass jars for further processing. To reduce contamination from fibers or dust, the work was done inside a fume hood. Researchers wore gloves and laboratory coats and avoided synthetic clothing.

Density Separation

The dissected gastrointestinal tracts were digested by adding 6.25% sodium hypochlorite (NaClO) solution. About 50 mL of solution was placed in each jar, which was then covered with aluminum foil to prevent contamination and kept at room temperature (around 25 °C) for 48 hours. This process dissolved most of the soft tissues, leaving only resistant materials behind.

Sodium hypochlorite acts as a strong alkaline oxidant. It was reported that a 0.5% solution was used because of the compound's high reactivity and tendency to chemically degrade organic materials (Dakin, 1915). NaOCl is widely used for its ability to degrade organic tissue and provide effective disinfection (Haapasalo et al., 2014; Shen et al., 2012).

Organic waste in aquatic tissues can be effectively removed using sodium hypochlorite (NaClO). Monteiro et al. (2022) demonstrated that NaClO treatment at room temperature successfully digests aquatic tissues, achieving the desired level of ablation.

Leaving digested biological material at room temperature for prolonged periods can promote microbial growth and produce unpleasant odors. Comparable challenges have been noted in previous studies; however, these do not compromise the stability or identification of microplastics. (Cole et al., 2020; Masura et al., 2021).

Identification and Analysis of Microplastics

Samples of shrimp, which are frequently sold for human consumption in the coastal area of Panguil Bay, Philippines, were collected from fishermen. To remove any surface debris, filtered distilled water was used to rinse each shrimp. After being dissected with sterile stainless-steel tools, the gastrointestinal tracts were placed in glass containers that had been previously cleaned. Potassium hydroxide (KOH) is being studied as the most efficient method for removing microplastics from biotic samples in current microplastic research (Rochman et al., 2015; Dehaut et al., 2016). It is inexpensive, uses readily available chemicals, and needs a straightforward sample process. Other biological and ecological disciplines that may provide considerably more information on the health of organisms have not been included in prior studies, thereby limiting the interpretation of the findings (Lusher & Millian, 2018).

To keep the process as simple as possible in other circumstances where incubators are not available, the samples were dried at room temperature (Kühn et al., 2016). This modification was done because incubators may not always be available in some

laboratory settings. Drying the samples at room temperature still allowed moisture to evaporate before microplastic analysis, while keeping the procedure simple and cost-effective. In addition, using room temperature minimized the exposure of the samples to high heat, which could potentially alter or damage some microplastic particles. Through this modification, the study was still able to prepare the samples effectively for analysis while adapting to the available laboratory resources.

After soaking the digestive tract for at least 48 hours using the 10% potassium hydroxide (KOH), the supernatant was then removed, leaving only the digested gastrointestinal tract of the shrimp. After allowing the samples to settle for at least 48 hours, the supernatant, which might contain microplastics, was carefully collected and directly filtered through a glass fiber filter paper with a pore size of 0.47 μm , and the filtrate was subsequently placed onto the agar plates (Kato et al., 2020).

These filters were then transferred to agar plates and allowed to dry within covered petri dishes. Samples and filters were dried at room temperature in a clean, covered fume hood rather than in an incubator to minimize potential thermal degradation of microplastic particles. Previous studies on microplastic extraction from prawn digestive tracts reported successful overnight drying at room temperature (22–24°C) and recommended maintaining temperatures below 40°C to preserve polymer integrity (Li et al., 2022). Following the drying process, the samples were examined under an Olympus microscope at 40 $\times$ magnification, where suspected microplastics were identified and categorized by morphology—specifically as fibers, fragments, films, or pellets—according to standardized criteria (Cowger et al., 2020).

To ensure data integrity, extraction contamination was minimized by pre-filtering all chemical solutions before use, and all laboratory procedures were conducted in a strictly controlled, clean environment using glassware and metalware. Microplastics were quantified and characterized solely based on morphological features, including shape, size, and color, using visual assessment under a microscope (Curren et al., 2020).

Data Analysis

The collected data were analyzed using descriptive statistics to summarize the presence of microplastics in commercially sold shrimp samples from Migcanaway, Macquillao, and Silanga in the Panguil Bay Area.

After sample processing and microscopic examination, the identified microplastics were classified by type (fibers, microbeads, and fragments), counted, and recorded for each location. Shrimp weight was also measured to characterize the sample.

The results were organized using tables and descriptive summaries to identify patterns in the occurrence and distribution of microplastics among the three sampling locations.

Statistical Analysis

This study used descriptive statistics to summarize and present the collected data on microplastic contamination in commercially sold shrimps. The mean and standard deviation were used to describe the average number of microplastics and the variation of values across the three sampling locations. Frequency counts and percentages were also used to summarize the distribution of microplastic types identified in the shrimp samples.

The results were presented through tables and descriptive summaries to provide a clear interpretation of the occurrence, abundance, and distribution of microplastics. No inferential statistical tests were performed, as the study aimed only to describe the observed findings.

Ethical Consideration

This study adhered to established ethical research standards. Shrimps were obtained from local vendors, with their approval, to provide sufficient shrimp samples for the study, collected from their designated ocean stations. The collection process was performed responsibly to minimize unnecessary harm to the shrimps and to reduce environmental impact. All shrimps collected were used solely for academic purposes and were not wasted.

The researchers conducted the study with honesty and integrity, ensuring that all data gathered were accurate, reliable, and valid, free from any manipulation or falsification. All references and sources of information were properly acknowledged to avoid plagiarism. The identities of the vendors remained confidential, and the research findings were reported objectively and without bias. Throughout the study, the team strictly adhered to the institution's ethical guidelines to uphold respect, accountability, and academic integrity.

RESULTS AND DISCUSSION

Microscopic analysis of Commercially Sold Shrimps

Figure 3 illustrates the different types of microplastics observed under an Olympus CX23 microscope after being isolated from the gastrointestinal tracts of the shrimps. It shows the three most commonly isolated types of microplastics: (A) fibers, (B) microbeads, and (C) fragments. Fibers are commonly found in synthetic and cotton textiles. Wastewater discharge and domestic laundering activities are considered major sources of synthetic microfibers entering aquatic environments (Beaumont et al., 2019). It can also be found in fishing-related materials, suggesting both marine activities and household wastewater sources. Microbeads appear to be irregularly shaped and are usually associated with industrial products and personal hygiene materials, which also indicate contamination by residential and commercial pollutants. Fragments are usually the most common type of microplastic that can be found in marine samples. Fragments are irregularly shaped, resulting from the degradation of larger plastic debris and reflecting environmental breakdown processes such as photodegradation and mechanical abrasion. These findings are consistent with previous studies revealing that fibers, fragments, and beads are the most common microplastic morphotypes found in shrimp (Gurjar et al., 2021).

Numerous microplastics were found during examination and appeared to have glossy surfaces, sharp edges, and distinct geometrical patterns. These findings are consistent with previous studies reporting the occurrence of microplastics in marine

organisms intended for human consumption. Microplastics have been found in marine biota, including seafood, and seafood consumption has been identified as a major pathway of human exposure (Campanale et al., 2020). Most studies included in systematic reviews reported microplastic contamination in seafood species, including crustaceans such as shrimp (Danopoulos et al., 2020). Comparable findings were also reported by Gurjar et al. (2021), confirming the occurrence of microplastic contaminants in shrimp.

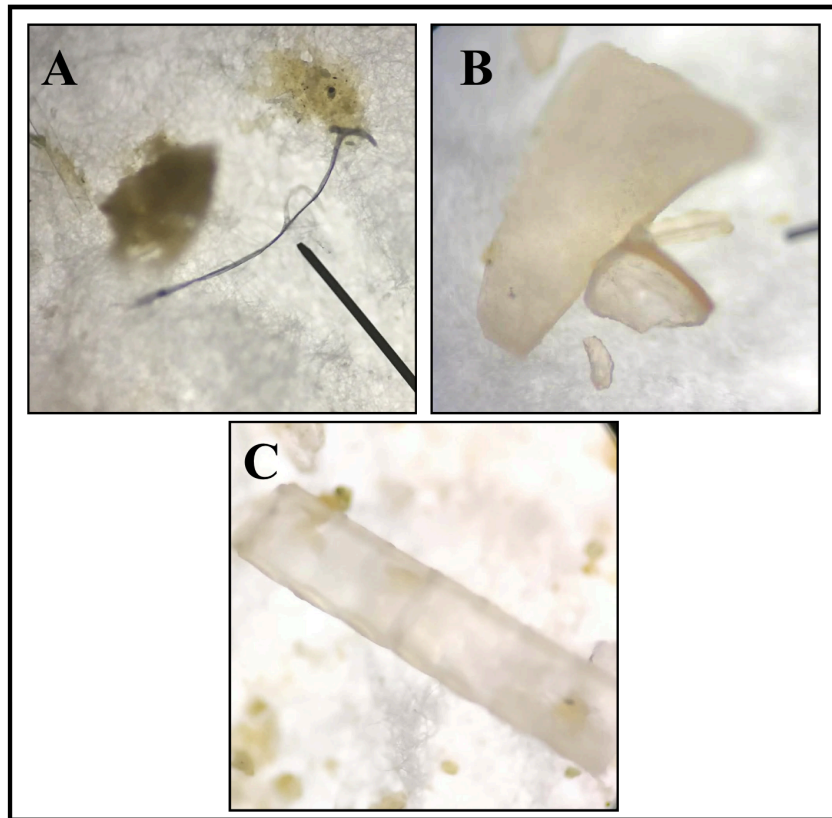


Figure 3. Microscopic identification of microplastics using Olympus CX23 Microscope (A. Fiber, B. Microbeads, C. Fragment)

Microplastics in shrimp are often found in various shapes, including fibers, fragments, films, pellets, and spheres, reflecting the diverse sources and degradation pathways of plastic pollution in aquatic environments. Fibers are reported to be the most

abundant morphotype detected in shrimp samples (Severini et al., 2020). Fiber-type microplastics are consistently identified as the most abundant morphotype in shrimp and other marine organisms due to the widespread release of textile fibers and fishing-related materials into aquatic ecosystems (Savoca et al., 2021).

Residents living near Panguil Bay are known for improper waste disposal, and heavy daily traffic and activity on the bridge contribute to plastic waste. Coastal communities with intensive human activities and inadequate waste management systems are recognized contributors to microplastic pollution in marine environments (Molenda et al., 2021). Over time, these plastics degrade into smaller particles, increasing the likelihood of ingestion by marine animals. These findings align with recent research, which highlights that coastal zones near urban and transport infrastructure tend to have significantly higher microplastic loads due to continuous inputs from land-based pollution sources (Kim & An, 2026). MPs are everywhere and can accumulate harmful pollutants, posing a significant threat to marine life. MPs could exacerbate heavy metal-induced oxidative stress and DNA damage in polychaetes. MPs can transfer pollutants and pathogens to organisms, potentially detrimental to biota and humans (Morris et al., 2025).

Primary microplastics are directly released into the environment as small particles, including synthetic fibers typically released via washing machine runoff and plastic microbeads used as scrubbing agents or for other purposes, found in personal care products and cosmetics. Secondary microplastics originate from the breakdown of larger plastic items; this usually occurs when larger plastics undergo weathering through exposure to, for instance, wave action, wind abrasion, and UV radiation from sunlight

(Baalkhuyur et al., 2020). They are often found in marine and freshwater environments, are brightly colored rather than shiny, and are often in long strands because they are made with industrial dyes and synthetic polymers designed to be durable and flexible. Their resistance to biodegradation allows them to persist in the environment for long periods, either suspended in water or settling into sediments, where they serve as feeding grounds for aquatic organisms such as shrimp. Notably, artificial fibers are prevalent in nature due to human activities, which often exhibit vivid colors, dull sides, and a string-like appearance (Mercy & Alam, 2024). This explains why colored, thread-like microplastic fibers are commonly detected in shrimp tissues and gastrointestinal tracts in polluted aquatic environments. Due to the direct and indirect routes of MP accumulation from water and sediments, and through their diet, shrimp can be used to monitor environmental pollutants (Keshavarzifard et al., 2021).

Understanding the extent of MP contamination in shrimp and their environment, including feed, water, and sediment, is essential for assessing potential risks to human health (Naidu et al., 2024). Due to their minute size, microplastics are easily mistaken for food by marine animals, leading to ingestion and accumulation within the gut, which can result in mechanical damage and other toxicological effects. Oxidative stress, intestinal colony composition changes, and immune system damage (Zhou et al., 2022).

Table 1 shows the distribution, type, and abundance of microplastics (MPs) found in shrimp samples collected from three different locations: Migcanaway, Macquilao, and Silanga. Among the three locations, Macquilao shows the highest total number of microplastics (2.64 ± 0.1), followed by Silanga (2.27 ± 0.11) and, lastly, Migcanaway

(1.41 ± 0.09). This clearly suggests that shrimps from Macquillao are exposed to and ingest microplastics more than those from other areas.

Table 1. Descriptive Analysis of Microplastics in each Location

Location	No. of MPs	Type of MP	Total No. of MPs	Standard Deviation	Mean MPs per shrimp
Migcanaway	5	Fiber	141	0.09	1.41
	90	Microbead			
	46	Fragment			
Macquillao	150	Microbead	264	0.1	2.64
	4	Fiber			
	110	Fragment			
Silanga	94	Fragment	227	0.11	2.27
	8	Fiber			
	125	Microbead			

Note: MPs: Microplastics

Distribution Weight of the Shrimp Samples from Three Different Locations

A 2025 systematic review from Asia also reported that organisms in areas with higher anthropogenic pressure consistently exhibit higher levels of microplastic ingestion, particularly in coastal ecosystems (Adim et al., 2025). Recent studies confirm that variations in microplastics abundance among aquatic organisms are strongly influenced by local human activities, including urban runoff, fishing operations, and waste mismanagement (Bulannga & Schmidt, 2024). Numerous factors affect the distribution of MPs across different pond habitats, including air, silt, and pond biota such as shrimp. The airflow transporting plastic trash, the deterioration of pond nets, and the pathways through which microorganisms and particles might get into the environment (Guo et al., 2024).

In terms of the types of microplastic distribution, microbeads were the most commonly found type of microplastics isolated in shrimps. This could indicate that the sources of microplastic accumulation may differ. Microbeads could indicate waste from domestic or commercial products, while fragments often result from the breakdown of larger plastic debris. Recent marine pollution literature also confirms that microfibers, fragments, and beads originate from wastewater discharge, textile shedding, and degradation of plastic waste, and are now dominant in marine food webs (Kim & An, 2026).

Distribution Weight of the Shrimp Samples from Three Different Locations

Table 2 presents the comparison of the weight of the shrimps procured from Migcanaway, Macquilao, and Silanga in Tangub City. With an equal size of 100 pieces per location to ensure comparability among locations. The variation in shrimp weight across the three locations suggests differences in environmental conditions, including habitat, nutrient availability, and other ecological factors that could affect growth. Larger shrimp may have greater feeding capacity and exposure, so these size-distribution differences are relevant to microplastic analysis. Small and medium-sized shrimp did not show a significant difference in microplastic levels, whereas microplastic levels increased in large shrimp (Yoon et al., 2022). Microplastic ingestion by marine organisms can be direct (feeds on MPs) or indirect (feeds on organisms that consume MPs). It can occur depending on the organism's diet, habitat, or size, as MPs have been found in biota across the benthic, pelagic, and neritic zones (Valencia-Castañeda et al., 2024).

Table 2. Total and Mean weight analysis of each shrimp from different locations

Location	No. of Shrimp Samples	Total Weight (g)	Mean Weight (g)
Migcanaway	100 pcs	386.13g	3.86g
Macquillao	100 pcs	421.66g	4.22g
Silanga	100 pcs	400.5g	4.0g

Baseline Microplastic Contamination in Commercially Sold Shrimp from Panguil Bay

Microplastics enter the stomach with the food and are further transferred to the small intestine, where they remain for a relatively longer time (Murray & Cowie, 2011). Certain zooplankton are affected by ingested microplastics in terms of feeding, growth, and fecundity (Cole et al., 2015). For instance, the pelagic copepod *Calanus helgolandicus*'s feeding ability can be considerably altered by ingestion of 20 μm polystyrene beads, and prolonged exposure to microplastics dramatically reduces reproductive output (Cole et al., 2015). These differences may also influence exposure to microplastics, as previous studies on marine shrimp have reported that environmental conditions and local pollution sources affect the presence and composition of microplastics (Mercy& Adam, 2024).

The analysis of commercially sold shrimps from Panguil Bay established baseline evidence of microplastic contamination within the gastrointestinal tract. The observed particles exhibited characteristics such as irregular shapes, glossy appearances, and distinct appearances, which could also be used to identify the microplastics present. This finding is significant because it provides localized evidence that microplastics have already entered the human food chain through the ingestion of shrimp.

Quantitative baseline measurements show spatial variation in microplastics, with shrimps procured from Barangay Macquillao showing the highest number per shrimp (2.64 ± 0.10), followed by Silanga (2.27 ± 0.11) and Migcanaway (1.41 ± 0.09). These differences suggest that variations influence microplastic accumulation in site-specific anthropogenic activities, such as coastal urbanization, improper waste disposal practices, and traffic activity in the area. Recent studies also highlight that coastal zones near urban and transport infrastructure tend to have significantly higher microplastic loads due to ongoing inputs from land-based pollution sources (Kim & An, 2026).

In terms of the morphology of the microplastics, three types of microplastics, mainly microbeads, fiber, and fragments, are the most dominant microplastics isolated from each shrimp. The type and source of microplastics also affect how they accumulate. Microbeads are typically found in personal care and hygiene products, while fragments come from larger plastic debris. Fibers are commonly linked to textiles, cotton, and fishing materials. This suggests that the presence of different types of microplastics at each location indicates that pollution sources may also vary, which can influence how much and what kinds of microplastics are ingested by the shrimp.

Microplastics can act as vectors for pathogens by providing surfaces where microorganisms attach, survive, and multiply, forming a "plastisphere." These contaminated particles can then transport and release pathogens across aquatic environments, facilitating their spread and potential entry into food and water systems (Timilsina et al., 2023). This suggests that water contaminated with microplastics is more likely to cause health problems for both marine life and humans because it has become more conducive to the spread of pathogens.

From a baseline point of view, the findings are consistent with these three key points: (1) microplastics are already present in shrimp sold for human consumption, (2) their abundance varies across locations, indicating different human activities and environmental exposure, and (3) multiple microplastic types isolated suggest the diverse sources of pollution from each location. This baseline data is important for future comparative studies, monitoring programs, and risk assessments.

Overall, the findings are consistent with both regional and international research, indicating that microplastic contamination of seafood is a common environmental problem rather than a singular occurrence. The establishment of this baseline in the Panguil Bay area provides an essential reference for understanding the extent of contamination and its potential effects on the integrity of the marine ecosystem and public health.

CONCLUSION AND RECOMMENDATION

This study confirmed the presence of microplastic contamination in commercially sold shrimps (*Metapenaeus endeavouri*) collected from the three sampling sites in Panguil Bay Area, Tangub City, with three morphologies identified: microbeads, fibers, and fragments. Macquillao recorded the highest mean microplastic abundance (2.64 ± 0.10 particles per shrimp), followed by Silangan (2.27 ± 0.11 particles per shrimp), while Migcanaway recorded the lowest abundance (1.41 ± 0.09 particles per shrimp). These findings establish baseline data on microplastic contamination in commercially sold shrimps from Panguil Bay.

Based on the findings of this study, the following are recommended: continuous environmental monitoring of Panguil Bay and surrounding waters to track microplastic levels over time; implementing of improved solid waste management practices in coastal communities of Tangub to reduce plastic pollution entering the marine environment; conduct of further studies to determine statistical relationships between shrimp weight and microplastic accumulation; investigation of other commercially important marine species in Panguil Bay for microplastic contamination; assessment of potential health risks to consumers associated with microplastic ingestion through seafood consumption; and engagement of local government units, fisherfolk, and stakeholders in awareness campaigns and policy development aimed at reducing plastic pollution Panguil Bay and its surrounding areas

DECLARATION OF THE USE OF AI TOOLS

The researchers would like to acknowledge the use of Grammarly in reviewing the manuscript for grammar, spelling, punctuation, sentence construction, and overall clarity during the final stage of writing.

The suggestions generated were carefully reviewed and utilized by the researchers to refine the structure, readability, and correctness of the manuscript. All final revisions and decisions remained under the discretion of the researchers.

The researchers would also like to acknowledge the use of ChatGPT [<https://chatgpt.com/>] in assisting with idea generation, paraphrasing, and organization of concepts related to the study.

The following prompts were used:

“Generate ideas and related concepts about microplastics contamination in marine organisms”

“Paraphrase sentences to improve clarity and coherence”

“Provide existing studies to support microplastics in marine organisms for further studies”

The outputs generated by the AI tools served only as supplementary assistance and starting references for developing the manuscript. The researchers reviewed, revised, and validated all information included in the study to ensure accuracy, to avoid plagiarism, and to also ensure academic integrity.

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APPENDICES

APPENDIX A. Permits

Request Letter to the College of Arts and Sciences for the Use of Laboratory Equipment, Rooms, and Reagents



Misamis University

Ozamiz City

COLLEGE OF MEDICAL TECHNOLOGY



CERTIFIED: ISO 21001: 2018 Educational Organizations Management System by DNV
ACCREDITED: Philippine Association of Colleges and Universities Commission on Accreditation (PACUCOA)

Date: January 20, 2026

DR. HAYDEE D. VILLANUEVA

Dean, College of Arts and Sciences
Misamis University

Subject: *Request for Permission to Use Laboratory Equipment, Rooms, and Reagents for Research Data Gathering*

Dear Dean Villanueva,

We, the undersigned undergraduate researchers from the College of Medical Technology, respectfully seek permission from your good office to **use selected laboratory equipment, laboratory rooms, and reagents located at the Natural Sciences Building** under the College of Arts and Sciences. This request is in line with our ongoing research data gathering for our research paper entitled:

“Microplastics Accumulation of Commercially Sold Shrimps in Panguil Bay Area.”

The experimental procedures of our study are scheduled to be conducted from **February to April 2026**. The facilities and resources available at the National Science Building are essential for the successful completion of specific laboratory components of our research.

We give our full assurance that all laboratory work will be carried out **in accordance with university rules and regulations**, under proper supervision, and with utmost care for laboratory safety, cleanliness, and responsible use of equipment and reagents. We likewise commit to restoring all facilities to their proper condition after use.

Furthermore, all information and data obtained will be utilized **exclusively for academic research purposes**, and due acknowledgment will be given to the College of Arts and Sciences and the National Science Building in all research outputs.

We humbly request your approval and support for this academic endeavor. Your favorable response will greatly aid us in completing our research requirements.

Thank you very much for your time and kind consideration.

APPENDIX A. Cont'd



Misamis University

Ozamiz City

COLLEGE OF MEDICAL TECHNOLOGY



CERTIFIED: ISO 21001: 2018 Educational Organizations Management System by DNV
ACCREDITED: Philippine Association of Colleges and Universities Commission on Accreditation (PACUCOA)

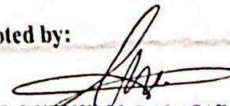
Respectfully yours,

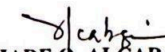

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Noted by:


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Research Adviser


ARJADE O. ALCABAZA RChT
Laboratory In-Charge

Recommending Approval:


DR. NELFAD. CANINI
Chairperson, Department of Natural Sciences

Approved by:


DR. HAYDEE D. VILLANUEVA
Dean, College of Arts and Sciences

APPENDIX A. Cont'd

Request Letter to the College of Medical Technology for the Use of Laboratory Equipment and Laboratory Room



Misamis University

Ozamiz City

COLLEGE OF MEDICAL TECHNOLOGY



CERTIFIED: ISO 21001: 2018 Educational Organizations Management System by DNV
ACCREDITED: Philippine Association of Colleges and Universities Commission on Accreditation (PACUCOA)

Date: March 9, 2026

MS. EVANGELINE M. SEÑEDO, RMT, MATMRS

Dean, College of Medical Technology

Misamis University

Subject: *Request for Permission to Use Laboratory Equipment, and Rooms for Research Data Gathering*

Dear Dean Señedo,

Good day.

We, the undersigned undergraduate researchers from the **College of Medical Technology**, respectfully request permission to use the following equipment and facility of the College of Medical Technology for the purpose of **research data gathering** of our approved research study entitled **"Microplastic Accumulation of Commonly Sold Shrimps in Panguil Bay Area"** during the following time and dates:

- 3 Olympus Microscope
- Room M104 (March 9, 2026 1:00-4:00 pm)

This study aims to investigate the presence and/or characteristics of **microplastics**, contributing to the growing body of scientific knowledge on environmental and public health concerns.

We assure your good office that all laboratory activities will be conducted **strictly under the supervision of authorized faculty or laboratory personnel**, and that we will observe proper **laboratory safety protocols, equipment handling procedures, and waste disposal guidelines**. We also commit to the responsible and economical use of all reagents and materials entrusted to us.

Rest assured that any data gathered will be used **solely for academic and research purposes**, and proper acknowledgment will be given to the College of Medical Technology in all related outputs, reports, and presentations.

We sincerely hope for your kind consideration and approval of this request. Your support will greatly contribute to the successful completion of our research.

Thank you very much for your time and consideration.

Respectfully yours,

APPENDIX A. Cont'd



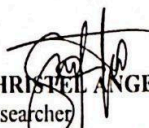
Misamis University

Ozamiz City

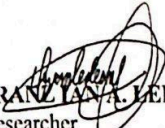
COLLEGE OF MEDICAL TECHNOLOGY



CERTIFIED: ISO 21001: 2018 Educational Organizations Management System by DNV
ACCREDITED: Philippine Association of Colleges and Universities Commission on Accreditation (PACUCOA)


CHRISTEL ANGELIE G. DE LEON
Researcher
BS-Medtech Year 3

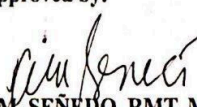

MARY MAE G. BAÑEZ
Researcher
BS-Medtech Year 3


FRANZ IAN A. LEDESMA
Researcher
BS-Medtech Year 3

Noted by:


MS. RUTHIE M. BALASABAS, RMT, MBA-HHA, AMT
Research Adviser

Approved by:


MS. EVANGELINE M. SENEDO, RMT, MATMRS
Dean, College of Medical Technology

APPENDIX B. Approved Letters of Consent

Letter for Thesis/Research Data Gathering Approval Form



Misamis University

Ozamiz City



MISAMIS UNIVERSITY RESEARCH CENTER

CERTIFIED: ISO 21001: 2018 Educational Organizations Management System by DNV

ACCREDITED: Philippine Association of Colleges and Universities Commission on Accreditation (PACUCOA)

MU-RC-042/13 November 2024

Thesis/Research Data Gathering Approval Form

Date: 01-21-26

Name of Authors: Boñez, Mary Mae ; De Leon, Christel Angelie ; Ledesma, Franz Ian
College/Department: College of Medical Technology
Research Title: Microplastics Analysis of Commercially Sold Shrimps in Pangasinan Bay Area

Data Gathering Procedure:

a. Type of Research: (Kindly check)

☐ Quantitative	☒ Qualitative	☒ Experimental
☐ Approved Research Title & Problem/Objectives	☐ Approved Data Gathering Procedure	☐ Approved Data Gathering Instrument/Data Sheets

b. Respondents/Participants/Subject/Samples to be Collected: Commercially Sold Shrimps

c. Procedure:

☐ Survey	☐ Interview	☒ Experimentation	☐ Laboratory Testing
---------------------------------	------------------------------------	---	---

d. Place of Implementation/Study Area: Misamis University - Natural Sciences Building

If to be conducted outside the school campus, indicate the nature of transportation to be used:

☐ Own private vehicle	☐ public utility vehicle	☐ rental	☐ Others, please indicate _____
--	---	---------------------------------	--

e. Date/s of Implementation/Sampling: February 2026

Attachments:

☐ Approved Letter of Consent from the designated authority in the area/place where the study is to be conducted
☐ Signed Parents' Consent

The thesis proposal mentioned above is hereby recommended for the commencement of data gathering implementation.

Recommended by:

Ruthie M. Bernaldo, EdD, MEd, MA, AMT
Thesis/Research Adviser

Nelfa Conin, PhD
Thesis/Research Instructor

Approved by:

Emelina M. Sereno, RMT, MATMS
College Dean

CONTROLLED DOCUMENT

APPENDIX B. Cont'd



MISAMIS UNIVERSITY
Ozamiz City
Department of Student Affairs & Services

MU-DSAS-006/02/June2023

PARENT'S CONSENT

College of Medical Technology
Sponsoring Group/Organization

I am allowing my son/daughter/ward, Christel Angelic G. de Leon, to join the Collection of samples (activity) to be held on February 2026 at Pangul Bay Area in Tangub under the supervision of Ms. Ruthie M. Palacios, RMT, MEd-THA, AMT (Adviser/Faculty).

I understand that Misamis University exercises the necessary safety precautions in this activity.

In consideration of the benefits to be derived from the above activity, I expressly waive any and all claims against the administration or any member of the faculty and staff of the Misamis University on account of any unforeseen accident or injury that my son/daughter/ward might incur in connection with the aforementioned activity.

Wendell C. de Leon
Signature over printed name of
Parent/Guardian

January 15, 2026
Date

Christel Angelic G. de Leon
Signature over printed name of
Student

January 15, 2026
Date

Important: This form shall be submitted to the DSAS Office at least two (2) days before the conduct of the activity.

SUBSCRIBED AND SWORN to before me, this 21 JAN 2025 day of JAN at Ozamiz City, Philippines, that the herein affiant personally came and appeared with his/her _____, as evidence of his/her personal identity.

Doc. No. 433
Page No. 68
Book No. 14
Series of 20 24

ATTY. REY A. BINAG, RMT
Notarial Commission No. 2025-18
Notary Public for Ozamiz City and Clarin
City Hall Drive, Bernad Subdivision, Aguada, Ozamiz City
PTR No. 6507751; 01/05/2026; Ozamiz City
IBP O.F. No. 576100; 12/29/2025; Pasig City
Attorney's Roll No. 70648
MCLE Compliance No. WH-0314127; Valid until 04/14/2028

Notary Public
Until _____
PTR No. _____
IBP No. _____
TIN No. _____
Roll No. _____

(For DSAS Personnel only)

Attested by:

RODEL L. BALDADO, MHist, MAEd
OIC, Department of Student Affairs & Services

Date: 37



APPENDIX B. Cont'd



MISAMIS UNIVERSITY
Ozamiz City
Department of Student Affairs & Services

MU-DSAS-006/02June2023

PARENT'S CONSENT

College of Medical Technology
Sponsoring Group/Organization

I am allowing my son/daughter/ward, Mary Mae G. Bana, to join the Collection of Vampires (activity) to be held on FEBRUARY 2026 at Pangasinan Bay Area in Pangasinan under the supervision of Ms. Rumié M. Balasabas, RMT, MA-AMA (Adviser Faculty).

I understand that Misamis University exercises the necessary safety precautions in this activity.

In consideration of the benefits to be derived from the above activity, I expressly waive any and all claims against the administration or any member of the faculty and staff of the Misamis University on account of any unforeseen accident or injury that my son/daughter/ward might incur in connection with the aforementioned activity.

Mary Mae G. Bana
Signature over printed name of
Parent/Guardian

January 18, 2026
Date

Mary Mae G. Bana
Signature over printed name of
Student

January 18, 2026
Date

Important: This form shall be submitted to the DSAS Office at least two (2) days before the conduct of the activity.

SUBSCRIBED AND SWORN to before me, this 12 day of JAN 2026 at Ozamiz City Philippines, that the herein affiant personally came and appeared with his/her _____, as evidence of his/her personal identity.

Doc. No. 332
Page No. 68
Book No. 17
Series of 20 24

ATTY. REYES S. DINAG, RMT
Notarial Commission No. 2025-18
Notary Public for Ozamiz City and Clarin
City Hall Drive, Bernad Subdivision, Aguada, Ozamiz City
PTR No. 6007751; 01/05/2026; Ozamiz City
IBP C.R. No. 576185; 12/29/2025; Pasig City
Attorney's Roll No. 70648
MCLE Compliance No. VIII-0014127; Valid until 04/14/2028

Notary Public
Until _____
PTR No. _____
IBP No. _____
TIN No. _____
Roll No. _____

(For DSAS Personnel only)

Attested by:

RODEL L. BALDADO, MEd, MAEd
OIC, Department of Student Affairs & Services

Date: _____



APPENDIX B. Cont'd



MISAMIS UNIVERSITY
Ozamiz City
Department of Student Affairs & Services

MU-DSAS-006/02 June 2023

PARENT'S CONSENT

College of Medical Technology
Sponsoring Group/Organization

I am allowing my son/daughter/ward, FRANZ JAN A. LEDESMA, to join the Collection of Samples (activity) to be held on February 2026 at Baygail Bay Area in Lingsub under the supervision of Mt. Ruthie M. Balasabas, RMT, MBA-HMA, AMT. (Adviser/Faculty).

I understand that Misamis University exercises the necessary safety precautions in this activity.

In consideration of the benefits to be derived from the above activity, I expressly waive any and all claims against the administration or any member of the faculty and staff of the Misamis University on account of any unforeseen accident or injury that my son/daughter/ward might incur in connection with the aforementioned activity.

Stanley Laure Ledesma
Signature over printed name of
Parent/Guardian

11/20/26
Date

FRANZ JAN A. LEDESMA
Signature over printed name of
Student

11/20/26
Date

Important: This form shall be submitted to the DSAS Office at least two (2) days before the conduct of the activity.

SUBSCRIBED AND SWORN to before me, this 26 JAN 2025 at Ozamiz City, Philippines, that the herein affiant personally came and appeared with his/her _____, as evidence of his/her personal identity.

Doc. No. 431
Page No. 68
Book No. 14
Series of 20 66

ATTY. REX E. BINAG, RMT
Notarial Commission No. 2025-18
Notary Public for Ozamiz City and Clarin
City Hall Drive, Bernad Subdivision, Aguada, Ozamiz City
PTR No. 6007751; 01/05/2026; Ozamiz City
IBP O.R. No. 576165; 12/29/2025; Pasig City
Attorney's Roll No. 70648
MCLE Compliance No. VIII-0014127; Valid until 04/14/2028

Notary Public
Until _____
PTR No. _____
IBP No. _____
TIN No. _____
Roll No. _____

(For DSAS Personnel only)

Attested by:

RODEL L. BALDADO, MHist, MAEd
OIC, Department of Student Affairs & Services

Date: _____



Scanned with CamScanner

APPENDIX C. Computation

Number and Types of Microplastics (MPs) Identified per Sampling Location (Migcanaway, Macquilao, and Silanga) with Corresponding Total Microplastic Count

Location	No. of MPs	Type of MPs	Total No. of MPs
Migcanaway	5	Fiber	141 MPs
	90	Microbead	
	46	Fragment	
Macquilao	150	Microbead	264
	4	Fiber	
	110	Fragment	
Silanga	94	Fragment	227
	8	Fiber	
	125	Microbead	

APPENDIX C. Cont'd

Raw Data on the Weight of Each Shrimp (100 pcs.) Collected from Migcanaway

Location	Weight of each Shrimp (100pcs.)					
Migcanaway	3.82	3.87	3.78	3.8	3.95	
	3.95	3.79	3.95	3.87	3.79	
	3.74	3.96	3.82	3.96	3.86	
	4.01	3.83	3.89	3.84	3.92	
	3.89	3.68	3.7	3.68	3.74	
	3.67	4.04	3.97	3.92	3.88	
	3.91	3.77	3.85	3.78	4.02	
	4.05	3.9	3.76	3.89	3.83	
	3.78	3.94	4.03	4.01	3.97	
	3.84	3.86	3.83	3.77	3.8	
	3.69	3.71	3.9	3.91	3.89	
	3.97	3.98	3.88	3.85	3.75	
	3.88	3.75	3.79	3.73	3.91	
	3.76	3.92	3.94	3.98	3.84	
	4.02	3.8	3.81	3.82	3.78	
	3.81	3.88	3.72	3.94	3.93	
	3.93	3.73	3.99	3.88	3.87	
	3.85	4	3.86	3.76	3.99	
	3.72	3.84	3.75	3.9	3.82	
	3.99	3.91	3.93	3.81	3.9	

APPENDIX C. Cont'd

Raw Data on the Weight of Each Shrimp (100 pcs.) Collected from Macquillao

Location		Weight of each Shrimp (100pcs.)				
Macquillao		4.12	4.34	4.14	4.16	4.06
		4.25	4.18	4.26	4.38	4.25
		4.08	4.24	4.11	4.12	4.1
		4.33	4.13	4.39	4.24	4.29
		4.19	4.4	4.2	4.19	4.13
		4.05	4.21	4.08	4.35	4.34
		4.28	4.1	4.33	4.07	4.22
		4.14	4.27	4.17	4.28	4.08
		4.36	4.35	4.25	4.23	4.36
		4.22	4.16	4.36	4.11	4.2
		4.09	4.23	4.13	4.3	4.27
		4.31	4.06	4.21	4.17	4.11
		4.17	4.32	4.29	4.33	4.15
		4.26	4.19	4.1	4.14	4.38
		4.11	4.28	4.34	4.26	4.19
		4.38	4.12	4.18	4.09	4.23
		4.2	4.37	4.27	4.21	4.31
		4.15	4.22	4.05	4.37	4.07
		4.29	4.09	4.31	4.18	4.28
		4.07	4.3	4.22	4.32	4.14

APPENDIX C. Cont'd

Raw Data on the Weight of Each Shrimp (100 pcs.) Collected from Silanga

Location		Weight of each Shrimp (100pcs.)				
Silanga		3.95	3.87	3.84	3.89	3.99
		4.12	4.09	4.12	4.02	4.03
		3.88	3.94	3.97	3.96	3.86
		4.05	4.13	4.06	4.13	4.12
		3.97	3.82	3.92	3.91	3.9
		4.2	4.17	4.15	4.05	4.15
		3.83	3.98	3.86	3.85	3.94
		4.1	4.02	4.08	4.17	4.07
		3.91	3.89	3.99	3.98	3.87
		4.08	4.14	4.03	4.09	4.11
		3.86	3.93	3.9	3.93	3.95
		4.15	4.07	4.1	4.14	4.16
		3.99	3.85	3.83	3.88	3.82
		4.03	4.16	4.18	4.06	4.09
		3.92	3.96	3.95	3.97	3.98
		4.18	4.01	4.07	4.01	4.04
		3.84	3.88	3.87	3.92	3.89
		4.06	4.19	4.11	4.19	4.18
		3.9	3.91	3.94	3.84	3.91
		4.11	4.04	4.16	4.08	4.06

APPENDIX D. Documentation

Collection of Fresh Shrimps from Fisherman



D1. Shrimp collection

Dissection of Shrimps for Analysis



D2. Shrimp dissection

APPENDIX D. Cont'd

Tissue specimens were dried and ready to be viewed



D3. Post-digestion sample

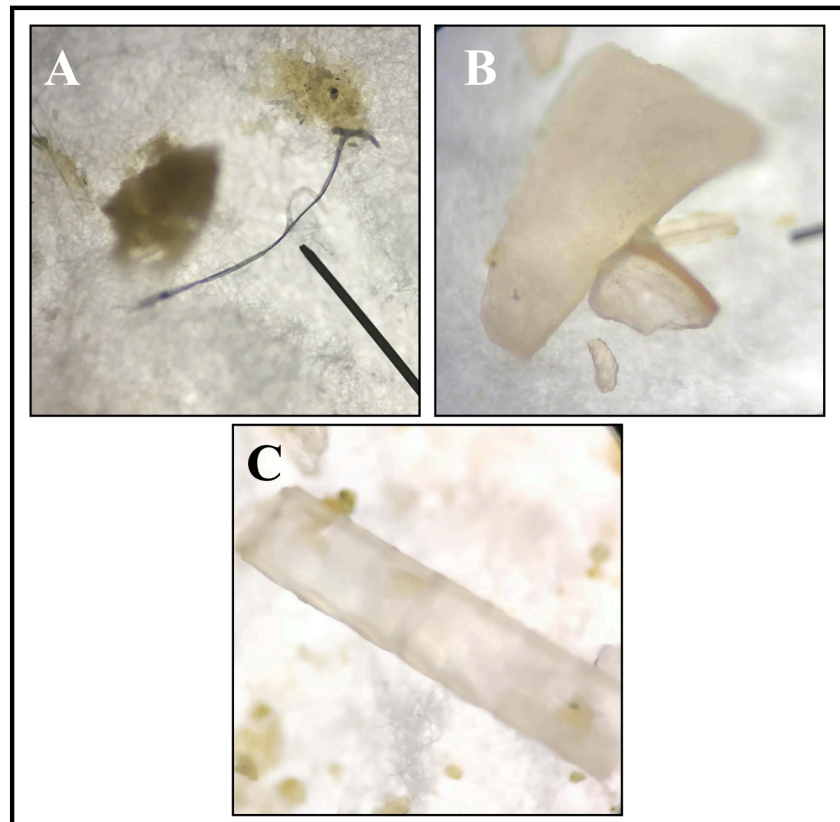
Specimens were being viewed and analyzed under the microscope



D4. Microscopic examination setup

APPENDIX D. Cont'd

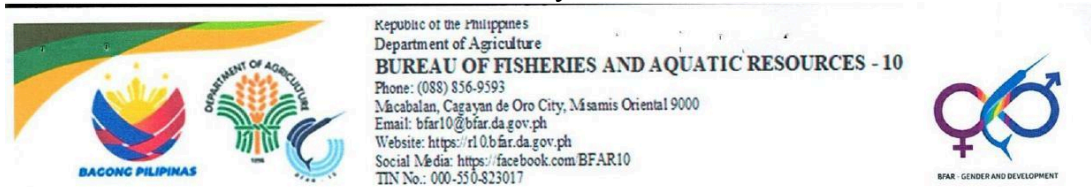
The images below were the different types of microplastics being recovered from the gastrointestinal tract of our shrimps



D5. Microplastic under microscope

APPENDIX E. Species Identification Result

Species Identification Result from the Bureau of Fisheries and Aquatic Resources-Region (BFAR-10) Confirming All Shrimp Specimens Collected from Migcanaway, Macquilao, and Silanga as *Metapenaeus endeavouri* (Schmitt, 1926) through Morphological Analysis.

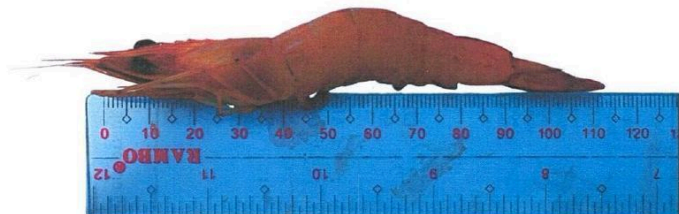


RESULTS OF ANALYSIS

Source of Specimen : Migcanaway, Tangub City
Submitted by : Christel Angelie G. De Leon et., al.
Address : Misamis Occidental
Date Submitted : April 16, 2026
Date of Completion of Analysis : April 21, 2026
Examination : Morphological Analysis
Kingdom : Animalia
Phylum : Arthropoda
Class : Malacostraca
Order : Decapoda
Family : Penaeidae
Genus : *Metapenaeus*
Species : *Metapenaeus endeavouri* (Schmitt, 1926)
Common Name : Endeavour shrimp

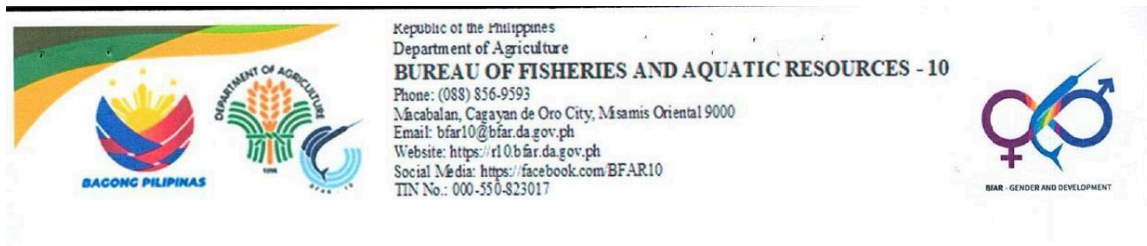


Sample 1. Specimen for morphological analysis of *Metapenaeus endeavouri* (Schmitt, 1926)



Sample 2. Specimen for morphological analysis of *Metapenaeus endeavouri* (Schmitt, 1926)

APPENDIX E. Cont'd

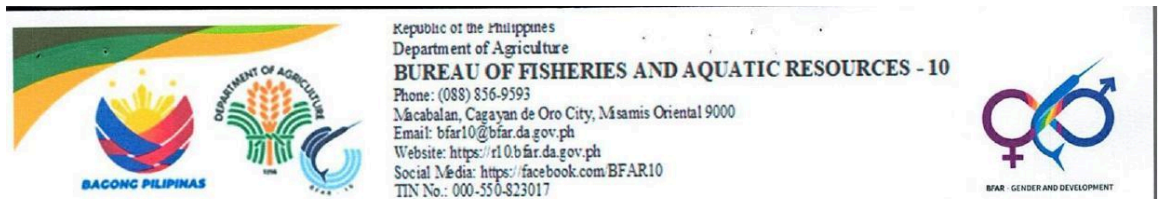


Sample 3. Specimen for morphological analysis of *Metapenaeus endeavouri* (Schmitt, 1926)

References:

- DecaNet eds. (2026). *Metapenaeus endeavouri* (Schmitt, 1926). In DecaNet. Retrieved March 25, 2026, from <https://www.marinespecies.org/aphia.php?p=taxdetails&id=241292>
- Integrated Taxonomic Information System (ITIS). (n.d.). *Taxonomic information for TSN 95813*. Retrieved March 25, 2026, from https://www.itis.gov/servlet/SingleRpt/SingleRpt?search_topic=TSN&search_value=95813

APPENDIX E. Cont'd



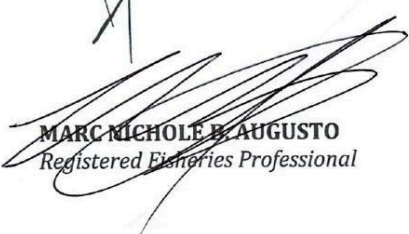
CERTIFICATION

This is to certify that the samples submitted by **CHRISTEL ANGELIE G. DE LEON** and received by **BFAR-10** on **April 16, 2026**, were subjected to morphological analysis and were identified as the scientifically recognized species *Metapenaeus endeavouri* (Schmitt, 1926) commonly known as the "Endeavour shrimp".

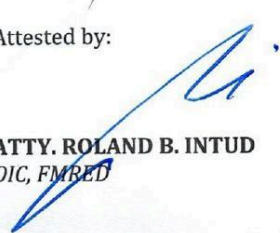
This certification is issued on the **21st of April 2026** at BFAR Regional Office, Cagayan de Oro City.

Certified by:

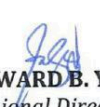

PRINCESS MAE T. CENA
Marine Biologist/PARLC Member


MARC NICHOLE B. AUGUSTO
Registered Fisheries Professional

Attested by:


ATTY. ROLAND B. INTUD
OIC, FMRED

Approved:


EDWARD B. YASAY
Regional Director

Page | 3

APPENDIX E. Cont'd

	Department of Agriculture BUREAU OF FISHERIES AND AQUATIC RESOURCES 10 PROVINCIAL FISHERIES OFFICE-MISAMIS OCCIDENTAL City Hall Compound, Agaña, Ozamiz City, Misamis Occidental Phone: +63 (088) 856 9593 +63 (088) 564 0690 E-mail: bfa10@bfa.da.gov.ph phomissoc10@bfa.da.gov.ph Website: https://region10.bfa.da.gov.ph/ Social Media: https://www.facebook.com/BFAR10/multextid-ff TIN No. 000 550 023-017	  In receiving pls cite this code RD02260432
April 16, 2026		
FOR	: EDWARD B. YASAY Regional Director	
FROM	: FELIX L. MEJOS OIC, PFO Misamis Occidental	
SUBJECT	: ENDORSEMENT OF REQUEST FOR SPECIES VERIFICATION (Shrimp Samples)	

Respectfully submitted and endorsed herewith is the request from the students of Misamis University – Medical Technology Department for the species verification of shrimp samples in support of their research study entitled: “Microplastic Accumulation of Commercially Sold Shrimps in Panguil Bay Area.”

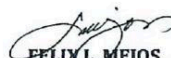
Based on the students' initial interview and identification, the samples were presumed to be *Litopenaeus vannamei*. However, according to the records of the National Stock Assessment Program (NSAP) enumerators deployed in Tangub City, which part of the Panguil Bay area, the shrimp species commonly recorded in the locality are *Metapenaeus endeavouri* and *Metapenaeus ensis*.

It is further noted that the shrimp samples subject for verification was collected from Migcanaway, Tangub City.

In this connection, species verification is respectfully requested to properly determine the exact identification of the collected samples to support the accuracy and validity of the students' research study.

Attached herewith is the students' request letter for your reference and appropriate action.

ACTION REQUESTED: For information and approval


FELIX L. MEJOS
OIC, PFO Misamis Occidental

OK & Endo 2404140 PFO ROC X
Masaganang Agrikultura, Maunlad na Ekonomiya



APPENDIX E. Cont'd



Misamis University

Ozamiz City

COLLEGE OF MEDICAL TECHNOLOGY



CERTIFIED: ISO 21001: 2018 Educational Organizations Management System by DNV
ACCREDITED: Philippine Association of Colleges and Universities Commission on Accreditation (PACUCOA)

Date: April 15, 2026

EDWARD B. YASAY

Regional Director

Bureau of Fisheries and Aquatic Resources, Region 10

Macabalan, Cagayan de Oro City

Subject: *Request for Species Identification for the Purpose of Research*

Dear Sir Yasay,

Good day.

We, the undersigned undergraduate researchers from **Misamis University-College of Medical Technology**, respectfully write to you regarding our research study entitled: **"Microplastic Accumulation of Commercially Sold Shrimps in Panguil Bay Area"**.

The purpose of this letter is to formally request assistance in the species identification of these commercially sold shrimp samples collected for our research study, as accurate identification is essential to the validity of our research.

This study is conducted solely for academic and research purposes, and all sample collection was carried out ethically and in accordance with established scientific standards. Should the Bureau of Fisheries and Aquatic Resources (BFAR) require a live specimen for proper identification, we would be willing to coordinate accordingly and may be contacted at your convenience.

Your favorable consideration of this request will be highly appreciated. Thank you very much.

0951-841-4927

Alanta
4/15/26

APPENDIX E. Cont'd



Misamis University

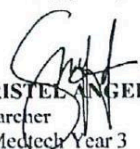
Ozamiz City

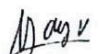
COLLEGE OF MEDICAL TECHNOLOGY

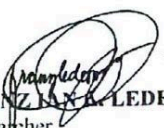


CERTIFIED: ISO 21001: 2018 Educational Organizations Management System by DNV
ACCREDITED: Philippine Association of Colleges and Universities Commission on Accreditation (PACUOCA)

Respectfully yours,


CHRISTEL ANGELIE G. DE LEON
Researcher
BS-Medtech Year 3


MARY MAE G. BAÑEZ
Researcher
BS-Medtech Year 3


FRANZ MAX R. LEDESMA
Researcher
BS-Medtech Year 3


RUTHIE M. BALASABAS, RMT, MBA-HHA, AMT
Research Adviser

Noted by:


MS. EVANGELINE M. SEÑEDO, RMT, MATMRS
Dean, College of Medical Technology

APPENDIX F. Grammarly report, and Turnitin results



Page 2 of 46 - Integrity Overview

Submission ID: trn:oid::28447:144145952

25% Overall Similarity

The combined total of all matches, including overlapping sources, for each database.

Filtered from the Report

- Bibliography

Match Groups



103 Not Cited or Quoted 18%

Matches with neither in-text citation nor quotation marks



37 Missing Quotations 7%

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Top Sources

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Integrity Flags

0 Integrity Flags for Review

No suspicious text manipulations found.

Our system's algorithms look deeply at a document for any inconsistencies that would set it apart from a normal submission. If we notice something strange, we flag it for you to review.

A Flag is not necessarily an indicator of a problem. However, we'd recommend you focus your attention there for further review.

53

APPENDIX F. Cont'd

General metrics

37,303	5,220	277	20 min 52 sec	40 min 9 sec
characters	words	sentences	reading time	speaking time

Score



This text scores better than 99%
of all texts checked by Grammarly

Writing Issues

4
Issues left


Critical

4
Advanced

Plagiarism

This text hasn't been checked for plagiarism

CURRICULUM VITAE

I. PERSONAL DATA

NAME : Mary Mae G. Bañez
BIRTHDATE : May 29, 2004
BIRTHPLACE : Oroqueta City, Misamis Occidental
ADDRESS : Purok 4, Talairon, Oroquieta City
CONTACT DETAILS : 09082646026
marymaebanez9@gmail.com

II. EDUCATIONAL BACKGROUND

PRIMARY EDUCATION : Talairon Central School
Talairon, Oroqueta City, Misamis Occidental
SECONDARY EDUCATION : Misamis Occidental National High School
Poblacion 1, Oroquieta City
TERTIARY EDUCATION : Misamis University
Aguada, Ozamiz City, Misamis Occidental

CURRICULUM VITAE

I. PERSONAL DATA

NAME : Christel Angelie G. de Leon
BIRTHDATE : December 26, 2004
BIRTHPLACE : Manolo Fortich, Bukidnon
ADDRESS : P2, Sto. Niño, Manolo Fortich Bukidnon
CONTACT DETAILS : 09518414927
chrstlangelie04@gmail.com

II. EDUCATIONAL BACKGROUND

PRIMARY EDUCATION : Manolo Fortich Central Elementary School
Tankulan, Manolo Fortich Bukidnon
SECONDARY EDUCATION : Gusa Regional Science High School - X
Gusa, Cagayan de Oro City
TERTIARY EDUCATION : Misamis University
Aguada, Ozamiz City, Misamis Occidental

CURRICULUM VITAE

I. PERSONAL DATA

NAME : Franz Ian A. Ledesma
BIRTHDATE : August 13, 2004
BIRTHPLACE : Oroqueta City, Misamis Occidental
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II. EDUCATIONAL BACKGROUND

PRIMARY EDUCATION : Victorious Christian School
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