

**BIOACCUMULATION OF CADMIUM (Cd)
IN PHILIPPINE OYSTERS *Crassostrea iredalei* AND *Magallana
bilineata* SOLD IN THE STREETS OF TUDELA, MISAMIS
OCCIDENTAL**

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BACHELOR OF SCIENCE IN MEDICAL TECHNOLOGY

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Misamis University
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COLLEGE OF MEDICAL TECHNOLOGY
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CERTIFICATE OF PANEL APPROVAL

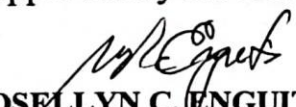
The research paper attached hereto, entitled “**BIOACCUMULATION OF CADMIUM (Cd) IN PHILIPPINE OYSTERS *Crassostrea iredalei* AND *Magallana bilineata* SOLD IN THE STREETS OF TUDELA, MISAMIS OCCIDENTAL**”, prepared and submitted by **SHANNERY NICOLE R. INDOC, DAPHNE JAYCE D. LAURETE, DANNAH GRACE R. SEPE AND JUDECAEL KALIL D. ZAMBRA** in partial fulfillment of the requirements for the degree of **BACHELOR OF SCIENCE IN MEDICAL TECHNOLOGY**, is hereby recommended for approval.


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ABSTRACT

Heavy Metals can enter the environment through natural processes and human activities such as farming, manufacturing, and waste dumping; they can be toxic even in small amounts. This research examines cadmium (Cd) levels in oysters sold on the streets of Tudela, Misamis Occidental. Oysters are popular in this area and are often eaten raw, raising health concerns about heavy metal contamination. While several studies have examined the bioaccumulation of heavy metals, such as cadmium (Cd), in oysters from different regions of the Philippines and abroad, there is no scientific research that specifically examines oysters marketed on the streets of Tudela for potential heavy metal contamination. Addressing this gap is necessary because increased oyster consumption in the area may pose health hazards if oysters are contaminated. The study used a quantitative, descriptive research approach; the researchers collected three oysters from two species (*Crassostrea iredalei* and *Magallana bilineata*) from two street vendors in Tudela. A certified laboratory analyzed the oysters to measure cadmium levels. The results showed that the overall mean for cadmium concentration in *Crassostrea iredalei* was 0.0664 mg/kg, and 0.0819 mg/kg for *Magallana bilineata*. The results are compared to food safety guidelines set by the Bureau of Fisheries and Aquatic Resources (BFAR) and Food and Agriculture Organization (FAO), and the values from the analyzed oyster samples were below the maximum allowable limit of 0.50 mg/kg, indicating that the oysters were safe for consumption. However, continuous and frequent consumption of oysters containing cadmium, even at low concentrations, may lead to bioaccumulation in the human body over time and potentially cause adverse effects. Therefore, regular monitoring of cadmium levels in oysters sold in the area is recommended to ensure consumer safety.

Keywords: *Bioaccumulation, Cadmium, Oyster, Atomic Absorption Spectrophotometry*

DEDICATION

This research is humbly and respectfully dedicated to the individuals whose unwavering support, guidance, and encouragement have been instrumental in completing this study. To our beloved parents, thank you for your unwavering support, whether moral or financial. We appreciate everything that you do; thank you for your unconditional love, patience, and sacrifices. Your constant prayers, encouragement, and faith in our abilities have been our strongest foundation.

Shannery, Daphne, Dannah, and Judecael

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This study would not have been possible without the individuals who continuously provided support and direction to the researchers, sustaining their enthusiasm and dedication to quality throughout the investigation. To express our appreciation for their time, effort, and generosity in completing the study, the researchers are pleased to recognize them.

First and foremost, we extend our deepest gratitude to our research adviser, **Ms. Shaira Guaman**, for her unwavering guidance, valuable insights, patience, and continuous support throughout the entire research process. Her expertise, constructive suggestions, and encouragement greatly contributed to the improvement and completion of this study. We are truly grateful for the time and effort she dedicated to help us achieve our research goals. We would also like to express our sincere appreciation to our esteemed panel members, **Ms. Marie Rosellyn C. Enguito, MSc. Bio**, **Ms. Meliza Parba, PhD**, and **Mr. Karl Maxel O. Lao, RMT, MSc. MLS**, for their valuable comments, insightful recommendations, and professional expertise. Their thoughtful evaluation and constructive criticisms helped strengthen the quality, accuracy, and credibility of this research. Their guidance challenged us to improve our work and broaden our understanding of the subject matter.

Special thanks are also extended to our Research Instructor, **Ms. Nelfa D. Canini, PhD**, whose dedication to teaching and commitment to academic excellence have provided us with a strong foundation for conducting this research. We are deeply

thankful for her patience in addressing our questions and for motivating us to persevere despite the challenges encountered in completing this study.

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To the researchers for their sustained enthusiasm, perseverance, and dedication throughout the completion of this study. Their commitment in maintaining quality and accuracy in every stage of the research contributed significantly to its success. Through their hard work and determination, this study was carried out with integrity and excellence. To everyone who contributed, directly or indirectly, to the completion of this study, we extend our sincere thanks. Your support and generosity will always be remembered and greatly appreciated.

Shannery, Daphne, Dannah, and Judecael

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INTRODUCTION

Background of the Study

The growth of the industry has made human life easier due to progressing technologies and enormous scientific development. Despite this major contribution, this growth posed new challenges for environmental protection and was frequently linked to heavy metal accumulation (Rahman et al., 2020). The discharge of harmful metallic elements from industrial byproducts has resulted in notable environmental and public health risks (Adelaja et al., 2024).

Heavy metals are sometimes defined as metals with a density at least five times that of water. The human body's metabolism depends on key metals such as copper, which is necessary for hemoglobin synthesis, and iron, which is necessary for digestion. However, excessive concentrations of these metals can harm cells (Bharti et. al., 2022). These are dangerous and cause toxic effects even at low concentrations, since they cannot be removed from the environment (Malik et al., 2006). Heavy metals such as cadmium are toxic, pollute aquatic environments, and bioaccumulate in living organisms (Shaari et al., 2016).

According to Zaynab et al. (2022), the increasing concentration of heavy metals is a major global concern. It causes physiological, histological, and metabolic changes in marine species by altering their enzymes and various metabolites. This causes a serious threat to public health because consumption of these species is a source of stress

in the cell and contributes to the development of diverse human pathologies, including cancer.

Cadmium is found in water and the terrestrial environment. Consumption of cadmium-contaminated food poses a health hazard and may lead to serious health problems, even when the amount present is minimal. Human exposures to cadmium can come from fossil fuels, the manufacturing of iron and steel, cement, the manufacture of nonferrous metals, the burning of trash, fertilizers, smoking, etc. (Sharma et al., 2015). With a lifespan of 10 to 35 years, cadmium can accumulate in the kidneys, lungs, and liver and interfere with normal bodily functions (World Health Organization, 2008).

Heavy metals, being toxic, non-degradable, and persistent, can accumulate in marine organisms through the food chain and pollute seawater and sediments (Shenai-Tirodkar et al., 2016). Accordingly, it is well known that bivalve organisms can survive in the intertidal zone, despite being exposed to large volumes of sediment, frequent dry spells, and fluctuations in salinity and temperature (Silva et al., 2005). In this vein, it is suggested that bivalves and other marine organisms that thrive in the intertidal zone are more likely to experience heavy metal exposure and accumulation.

Oysters are filter-feeding bivalves that are common in marine environments. Because of their ability to accumulate heavy metals, these creatures are frequently used as bioindicators to monitor heavy metal levels in marine environments. In addition, because this bivalve is frequently eaten raw, it may carry harmful substances that humans could absorb (Liu et al., 2021). In the Philippines, the most significant cultivated bivalves that provide Filipino homes with high-quality protein and nutrients

are oysters and mussels (FAO, 2016). In Northern Mindanao, oyster farming is a major source of income for the local community and economy. Some oysters are sold in local markets, while others are sold on the streets, just like in Tudela, Misamis Occidental.

Oysters contaminated with heavy metals pose a health risk to consumers; therefore, information on heavy metal presence in bivalves is necessary. There is a growing number of oyster vendors along the streets of Tudela, Misamis Occidental, indicating strong local demand for this delicacy. However, there is no research that specifically examines oysters marketed on the streets of Tudela for potential heavy metal contamination. Addressing this gap is necessary because increased oyster consumption in the area may pose health hazards if oysters are contaminated.

Objectives of the Study

This study aimed to determine cadmium (Cd) levels in oysters sold in Tudela, Misamis Occidental, and to evaluate their potential health risks to consumers. Specifically, this study aimed to:

1. Analyze the concentrations of Cadmium (Cd) in oyster tissues sold in Tudela:
 - a. *Crassostrea iredalei*
 - b. *Magallana bilineata*
2. Compare the measured levels of Cadmium (Cd) against the food safety standards set by the Bureau of Fisheries and Aquatic Resources Rules and Regulations.

Significance of the Study

This study investigated the bioaccumulation of cadmium (Cd) in oysters sold in the streets of Tudela, Misamis Occidental. Considering the persistence, non-degradability, and toxicity of these heavy metals, this investigation contributed to understanding the potential health risks associated with consuming oysters contaminated with Cd. By determining the extent of heavy metal accumulation, this study provides baseline information and valuable data on seafood safety and public health protection, particularly for communities that rely on oysters as a regular source of nutrition. Furthermore, this research emphasized the importance of food safety monitoring and supported policies and regulations that ensured consumer protection from heavy metal contamination. The findings were expected to benefit not only consumers but also local oyster vendors. For consumers, this study raised awareness of potential hazards; for farmers and local sellers, it provided information that could guide safer aquaculture practices.

Scope and Delimitation

The study primarily focused on the evaluation of heavy metals (Pb) in the Philippine oyster, *Crassostrea iredalei* (slipper oyster), and *Magallana bilineata*. The researchers used these species because they were among the most popular and widely marketed oysters in the Philippines, particularly in local markets and roadside stalls like those in Tudela. This research was conducted in Nailon, Tudela, due to the emerging oyster vendors along its streets. Likewise, the research focused on only one place, Nailon, Tudela, Misamis Occidental. It cannot present the case of oysters in other

locations of Misamis Occidental or in the Philippines in general. Despite these limitations, the research offers useful data on the safety of oysters sold in Nailon, Tudela, and underscores the need for monitoring heavy metals in commonly consumed shellfish.

MATERIALS AND METHODS

Research Design

A quantitative and descriptive research design was utilized for this study, as it would permit objective measurement and systematic description of Cadmium (Cd) levels in oysters marketed in Tudela, Misamis Occidental. The quantitative approach provided accurate numerical calculation of heavy metal levels, which was crucial for comparing the findings with established food safety standards. In contrast, the descriptive element provides a vivid picture of the current level of contamination without altering any variables, thereby making it best suited for this observational study. By measuring and describing the bioaccumulation of these metals, the study evaluated potential consumer health hazards, thereby facilitating informed decision-making in public health and food safety.

Research Setting

This study took place in the streets of Nailon, Tudela, Misamis Occidental, at coordinates 8°13'45.7"N 123°50'59.5"E, where there was an overwhelming increase in oyster vendors, indicating strong local demand for this delicacy (Figure 1). It was also where the Philippine Oyster (*Crassostrea iradelei*) and *Magallan bilineata* were collected. The testing for cadmium was conducted in F. A. S. T. Laboratory at Cagayan De Oro City. The chosen laboratory featured sterile workstations and instruments, ensuring precise, controlled testing.

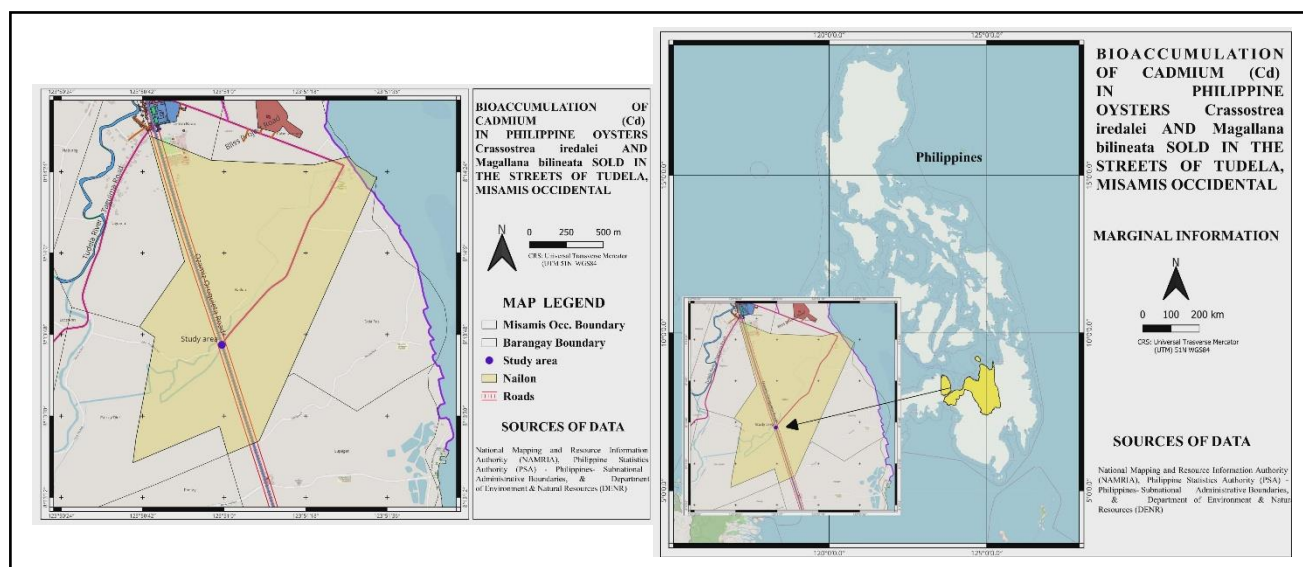


Figure 1. Location of the selected oyster vendors along the streets of Nailon, Tudela ,Misamis Occidental.

Data Gathering Procedure

Oyster Sample Collection

A total of twelve (12) oyster samples were collected from oysters sold by two different vendors in the streets of Nailon, Tudela, and the researchers collected 3 kg per oyster species from each street vendor. The oyster species obtained were *Crassostrea iredalei* (slipper oyster) and *Magallana bilineata* (cupped oyster), which were among the most commonly traded oysters in the area, based on the results of the Species Identification conducted by the researcher with the assistance of the Bureau of Fisheries and Aquatic Resources (BFAR). All the samples were placed in sterile plastic jars, properly labeled, and transported in a cooler with ice packs to maintain their quality and prevent deterioration. A total of twelve (12) oyster samples were collected, consisting of three samples of *Crassostrea iredalei* and three samples of *Magallana bilineata*, each from the two vendors. Prior to heavy metal analysis, the collected samples were randomized and consolidated into three samples per species, with 100 g per container to provide a more general assessment of cadmium contamination in

oysters from the study area. This approach was employed to represent the overall heavy-metal burden of the collected oysters rather than variations attributable to individual vendors, thereby providing a broader evaluation of cadmium presence in the sampled oyster population.

Preparation for Heavy Metal Testing

Upon arrival at the laboratory, the oyster shells were opened with sterile tools, rinsed with sterile water, and placed in an ice pack for preservation until further testing. These procedures were performed to preserve sample integrity and minimize potential contamination before heavy metal determination. The prepared samples were then sent to the F.A.S.T. Laboratory in Cagayan de Oro City for heavy metal testing for Cadmium (Cd). Heavy metal determination was conducted using Atomic Absorption Spectroscopy, following the analytical principles described in the Official Methods of Analysis of AOAC International, 21st Edition (2019) and the operational guidelines specified in the Shimadzu AA-7000 Atomic Absorption Spectrophotometer Manual (Latimer et al., 2023). Atomic Absorption Spectroscopy is a widely accepted analytical technique for determining trace metal concentrations in biological and environmental samples. The method is based on the absorption of element-specific electromagnetic radiation by free atoms in the gaseous state, with the amount absorbed directly proportional to the concentration of the target analyte in the sample. Prior to instrumental analysis, the oyster tissue underwent laboratory preparation and treatment in accordance with the referenced AOAC methodology to ensure that cadmium present within the sample matrix was converted into a measurable form suitable for atomic absorption determination. Quantification was achieved through calibration against

appropriate analytical standards, and the resulting absorbance values were used to determine cadmium concentrations in the oyster samples. Quality assurance procedures, including instrument calibration and analytical verification, were performed by the testing laboratory in accordance with established laboratory protocols and AOAC-referenced procedures.

Data Analysis

A descriptive analysis was conducted to assess Cadmium (Cd) levels in Philippine Oysters (*Crassostrea iredalei*) and *Magallana bilineata* from street vendors in Tudela, suspected of heavy metal contamination. A motorcab was rented to facilitate the collection of oysters from the street vendors. The research team was accompanied by a local individual to the designated area to collect the oyster samples. After collection, the team returned to Misamis University, Ozamiz City, to pack the samples in plastic jars with ice packs to keep them cool but not frozen, in accordance with the guidelines provided by the F.A.S.T laboratory, and sent them to Cagayan de Oro City. Numerous studies have found that the bivalve hepatopancreas is a key target organ for heavy metal accumulation (Kouba et al., 2010). That is why this part of the oyster was used for the analysis. A total of 6 samples, each containing 100 g of oyster flesh per jar, were sent to the F.A.S.T laboratory in Cagayan de Oro City for heavy metal testing. To ensure reliability and accuracy of the results, three (3) biological replicates were conducted by the F.A.S.T laboratory for each sample during analysis.

Statistical Analysis

The concentrations of Cadmium in oyster tissues were determined and expressed in milligrams per kilogram (mg/kg) of dry weight (US EPA, 2000). The measured concentrations were compared against the food safety limits set by the Food and Agriculture Organization (FAO) and Bureau of Fisheries and Aquatic Resources (BFAR). Descriptive statistics were used to analyze lead and cadmium concentrations and provide a clear summary of the levels of heavy metals present. Through descriptive statistical analysis, the study determined cadmium and lead levels and assessed the overall quality and safety of the oyster samples.

RESULTS AND DISCUSSION

Concentration of Cadmium in Crassostrea iredelai

The results in Table 1 showed that the concentration of cadmium was <0.50 mg/kg; this indicates that the heavy metal was present but did not exceed the accepted amount considered harmful to consumers, based on guidelines from BFAR and FAO. With mean values of 0.0663 mg/kg, 0.0682 mg/kg, and 0.0649 mg/kg for Samples 1, 2, and 3, respectively, the cadmium amounts found in the oyster samples varied from 0.0649 to 0.0682 mg/kg. The results indicate only slight variations among the samples, suggesting relatively uniform distribution of cadmium in the oyster collected.

All detected cadmium concentrations were considerably lower than the maximum permissible limit of 0.50 mg/kg. Heavy Metals undetectable or in low values were most likely to be bound in sediments; therefore, they might not be bioavailable (Atkinson et al., 2024). This suggests that even when sediments are heavily contaminated, the metals may not be in a bioavailable form that oysters can readily absorb (Costa et al., 2024). Research by Grizzle et al. (2001) shows that pre-ingestive sorting of oysters reduces the intake of mineral-bound metals, thereby lowering the "bioavailable" dose relative to the "total" environmental concentration.

Heavy metals in aquatic environments may accumulate through both waterborne and sediment-associated pathways, with sediments serving as important reservoirs of metal contaminants (Redeker et al., 2004). Since oysters are filter-feeding organisms, the reduced bioavailability of dissolved Cadmium in the surrounding water may contribute

to the lower concentrations detected in the tissues of *Crassostrea iredalei*.

Furthermore, environmental factors such as water quality, sediment composition, salinity, and anthropogenic activities may influence the degree of heavy metal accumulation in marine organisms (Shenai-Tirodkar et al., 2016). The findings of this study may indicate that the oyster-harvesting areas were not heavily contaminated with Cadmium at the time of sampling. Nevertheless, continuous monitoring of heavy metal concentration in oysters remains important, as oysters are known bioaccumulators and may reflect changes in environmental pollution over time.

Table 1. Cadmium test result for *Crassostrea iredalei*

Heavy Metals	Unit	Trial 1	Trial 2	Trial 3
Cadmium	mg/kg	0.0677	0.0648	0.0663
Cadmium	mg/kg	0.0689	0.0674	
Cadmium	mg/kg	0.0641	0.0657	

Concentration of Cadmium in Magallana bilineata

The cadmium (Cd) concentration for *Magallana bilineata* was less than 0.50 mg/kg, according to the results shown in Table 2, but it also exhibited the highest heavy metal concentration, with recorded values of 0.0822, 0.0812, and 0.0817 mg/kg, respectively. According to Chan et al. (2020), *Magallana bilineata* exhibits active filter-feeding behavior, allowing the species to continuously filter large volumes of water to obtain food particles such as plankton and organic matter. Because of this filtration activity, oysters can also accumulate trace elements and heavy metals present in their surrounding environment. Despite being the highest detected concentration among the analyzed samples, the value still did not exceed the permissible limits established by the Bureau of Fisheries and Aquatic Resources (BFAR) and the Food and Agriculture Organization (FAO) for seafood intended for human consumption. The cadmium concentration detected in the oyster samples ranged from 0.0808 to 0.0831 mg/kg, with mean values of 0.0817, 0.0831, and 0.0808 mg/kg for samples 1, 2, and 3,

respectively. The results indicate minimal variation among the samples, suggesting relatively uniform accumulation of cadmium within the oysters collected from the sampling site.

The overall mean for cadmium concentration across all analyzed samples was 0.0819 mg/kg; the detected cadmium concentration was substantially lower than the maximum permissible limit of 0.50 mg/kg established by BFAR and FAO. This indicates that the oysters analyzed in the present study remain within the acceptable safety standards, and are therefore not considered harmful for human consumption. The low levels of cadmium observed in the samples suggest that the oysters were collected from an environment with relatively low cadmium contamination and limited exposure to significant sources of heavy metal pollution. Factors such as lower dissolved cadmium concentrations in seawater, reduced sediment contamination, favorable salinity conditions, and limited anthropogenic inputs may have contributed to the low cadmium concentrations detected in the analyzed oysters (Lekhi et al., 2008). Moreover, seasonal variations and biological factors such as oyster size, growth rate, and physiological activity have also been reported to influence cadmium uptake and accumulation (Lekhi et al., 2008).

The findings of the present study therefore suggest that the oysters sold on the streets of Nailon, Tudela, Misamis Occidental were relatively free of cadmium contamination. Moreover, there are currently no published data on heavy metal concentrations in oysters sold on the streets of Nailon, Tudela, Misamis Occidental, making this study an important baseline reference for future monitoring and food safety assessments in the area.

Table 2. Cadmium test result for *Magallana bilineata*

Heavy Metals	Unit	Trial 1	Trial 2	Trial 3
Cadmium	mg/kg	0.0822	0.0812	0.0817
Cadmium	mg/kg	0.0837	0.0825	
Cadmium	mg/kg	0.0802	0.0814	

Comparison of Detected Cadmium Levels with BFAR and FAO Food Safety Guidelines

Table 3 presents a comparison of the detected heavy metal concentrations in *Magallana bilineata* and *Crassostrea iredalei* with the established food safety standards set by the Bureau of Fisheries and Aquatic Resources (BFAR) and the Food and Agriculture Organization (FAO). The measured concentrations of cadmium (Cd) obtained from the analyzed oyster samples were evaluated to determine whether they fall within the permissible limits for safe human consumption. Comparing the detected heavy metal levels with these regulatory guidelines is essential for assessing the potential health risks associated with oyster consumption and determining the overall safety and quality of oyster samples collected from Nailon, Tudela, Misamis Occidental.

The overall mean cadmium concentration detected in *Crassostrea iredalei* was 0.0664 mg/kg, whereas in *Magallana bilineata* it was 0.0819 mg/kg. Although *Magallana bilineata* accumulated more cadmium than *Crassostrea iredalei*, both species contained cadmium levels that were substantially lower than the established maximum permissible limit of 0.50. This revealed that, although the oyster samples contained cadmium, the levels were still below the acceptable safety range and are therefore not considered dangerous for human consumption. Furthermore, the relatively low cadmium levels may indicate that the oysters were not exposed to hazardous waters or sediments in the sample location.

The higher cadmium level observed in *Magallana bilineata* may be attributed to species-specific differences in filtration rate, feeding behavior, growth characteristics, and metal uptake efficiency (Chan et al., 2020). Although these values were slightly higher than those found in *Crassostrea iredalei*, they were still well below the BFAR and FAO-established permissible limit of 0.50 mg/kg. This implies that, in terms of cadmium contamination, the oyster samples examined in this study were still safe to eat. Overall, the findings of the present study demonstrated that both *Crassostrea iredalei* and *Magallana bilineata* had cadmium concentrations well within the established permissible limits. These results indicate that the oysters collected from

Nailon, Tudela, Misamis Occidental are relatively safe for human consumption with respect to cadmium contamination.

The low cadmium levels observed may be attributed to favorable environmental conditions, low dissolved metal concentrations in the surrounding waters, and the absence of major anthropogenic sources of pollution (Lekhi et al., 2008). The findings are also consistent with reports from the Food and Agriculture Organization that shellfish, such as oysters, harvested from areas with limited industrial and agricultural contamination generally exhibit lower levels of heavy-metal contamination and pose minimal risks to consumers (FAO, 2003).

Therefore, the present study provides valuable baseline information on the heavy metal status of oysters sold in the streets of Nailon, Tudela, Misamis Occidental, and may serve as a reference for future environmental monitoring, seafood quality assessments, and public health protection programs.

Table 3. Comparison of Cadmium Levels in *Crassostrea iredalei* and *Magallana bilineata* with BFAR and FAO food safety guidelines

Species	Heavy Metal	Trial 1 (mg/kg)	Trial 2 (mg/kg)	Trial 3 (mg/kg)	BFAR FAO 210s 2001
<i>Crassostrea iredalei</i>	Cadmium	0.0677	0.0648	0.0663	0.50
	Cadmium	0.0689	0.0674		0.50
	Cadmium	0.0641	0.0657		0.50
<i>Magallana bilineata</i>	Cadmium	0.0822	0.0812	0.0817	0.50
	Cadmium	0.0837	0.0825		0.50
	Cadmium	0.0802	0.0814		0.50

CONCLUSION AND RECOMMENDATIONS

In conclusion, the current investigation found that both *Crassostrea iredalei* and *Magallana bilineata* had measurable cadmium (Cd) levels. Cadmium levels in both oyster species were consistently within the maximum permissible level of 0.50 mg/kg established by the Food and Agriculture Organization (FAO) and the Bureau of Fisheries and Aquatic Resources (BFAR), demonstrating adherence to food safety regulations.

Despite having slightly higher Cd readings than those of *Crassostrea iredalei*, *Magallana bilineata*'s results were all below safe consumption limits and posed no serious health hazards. The oysters' overall safety is supported by the absence of lead, which further suggests little environmental pollution at the harvest site.

Continuous monitoring of heavy metals, particularly cadmium (Cd) from their specific sources and the oysters sold in Nailon, Tudela, Misamis Occidental, is recommended to ensure consumer safety and maintain seafood quality. Bivalves, such as oysters, are filter-feeding and can accumulate pollutants over time; they can serve as bioindicators of maritime pollution, necessitating regular monitoring. Future studies should include more oyster samples, additional species, physicochemical properties, seasonal assessments, and analyses of other heavy metals for a more comprehensive evaluation of oysters. Local health and regulatory authorities are also encouraged to strengthen routine inspection and monitoring of seafood products sold in local stalls and markets.

Finally, this study offers baseline information for upcoming evaluations of food safety and the environment in Nailon, Tudela, Misamis Occidental. Policymakers, academics, and local health authorities should use these findings to guide the implementation of monitoring systems and ensure the ongoing safety of seafood products in the province.

DECLARATION OF THE USE OF AI TOOLS

In the preparation of this research manuscript, the researchers utilized selected artificial intelligence (AI) tools as supplementary aids during the writing and development process. Grammarly was employed to assist in proofreading the manuscript by identifying and correcting grammatical errors, punctuation, inconsistencies, spelling mistakes and issues related to sentence structure and readability. The recommendations provided by the software were carefully evaluated, and only appropriate suggestions were incorporated into the final manuscript.

The researchers also used ChatGPT to support the conceptualization and organization of ideas relevant to our study. The AI tool was utilized to assist in generating research-related ideas, improving the clarity of written content, paraphrasing selected passages, and identifying possible literature and concepts associated with cadmium contamination and bioaccumulation in oysters. All outputs generated by this AI tools were reviewed, verified, and revised by the researchers prior to inclusion in the manuscript. The researchers take full responsibility for the accuracy, originality, interpretation, and integrity of the content presented in this study. AI-generated outputs served solely as supportive resources and did not replace the researchers critical analysis, scientific judgement or authorship.

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APPENDICES

APPENDIX A: Informed Consent 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: 01-11-26

Name of Authors: Lauvete, Daphne Jayce Indoc, Shannery Nicole R. Zambra, Judecael Kalil D.
College/Department: College of Medical Technology
Research Title: Bioaccumulation of Cadmium (Cd) and Lead (Pb) in oyster sold in the streets of Tudela, Misamis Occidental.

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: _____

c. Procedure:

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

d. Place of Implementation/Study Area: Nailon, Tudela, Misamis Occidental

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: January to 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.

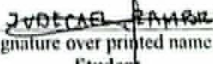
Recommended by:

<u>MS. SHAIRA U. GULAMAN</u> Thesis/Research Adviser	<u>MS. NEIDA D. CAMM, PhD</u> Thesis/Research Instructor
---	---

Approved by: [Signature]
MS. EVANGELINE M. MENED, RMT, MATMRS
College Dean

CONTROLLED DOCUMENT

APPENDIX B: Approved Letter of Consent

	MISAMIS UNIVERSITY <i>Ozamiz City</i> Department of Student Affairs & Services
MU-DSAS-006/02 June 2021	
PARENT'S CONSENT	
<u>College of Medical Technology</u> Sponsoring Group/Organization	
I am allowing my son/daughter/ward, <u>Zambra, Judecel Kalil D.</u>, to join the <u>Research Data gathering/Collecting of sample</u> (activity) to be held on <u>January 22, 2016</u> at <u>Tudela Misamis Occidental</u> under the supervision of <u>Mr. Jovita U. Guzman</u> (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.	
 Signature over printed name of Parent/Guardian	<u>01-10-16</u> Date
 Signature over printed name of Student	<u>01-10-16</u> 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 _____ day of _____ at _____, Philippines, that the herein affiant personally came and appeared with his/her _____, as evidence of his/her personal identity.	
Doc. No. <u>225</u> Page No. <u>40</u> Book No. <u>19</u> Series of 20 <u>26</u>	 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	

APPENDIX B Cont'd

	MISAMIS UNIVERSITY <i>Ozamiz City</i> Department of Student Affairs & Services
---	--

MU-DSAS-006/02 June 2023

PARENT'S CONSENT

COLLEGE OF MEDICAL TECHNOLOGY
Sponsoring Group/Organization

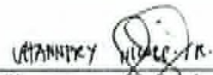
I am allowing my son/daughter/ward, INDIG, HANNEY NICOLE R., to join the RESEARCH DATA GATHERING / CREATING OF SAMPLE (activity) to be held on JANUARY 22, 2026 at TUPELA, MISAMIS OCCIDENTAL under the supervision of Mr. Jovita U. Guzman (Adviser/Faculty).

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.


 Signature over printed name of
Parent/Guardian

JAN. 16, 2026
 Date

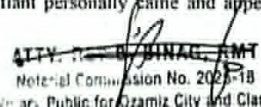

 Signature over printed name of
Student

JAN. 16, 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 _____ day of _____ at _____, Philippines, that the herein affiant personally came and appeared with his/her _____, as evidence of his/her personal identity.

Doc. No. 224
 Page No. 40
 Book No. 40
 Series of 20 24


ATTY. R. BALDADO, JMT
 Notarial Commission No. 2023-18
 Notary Public for Ozamiz City and Clarin
 City Hall Bldg., Parnad Subdivision, Aguada, Ozamiz City
 PTR No. CCL-101, 1/05/2025, Ozamiz City
 IEP C.I. No. 376165, 12/29/2025, Pasig City
 Attorney's Roll No. 70648
 MCLE Compliance No. VII-0014127, Valid until 04/14/2028

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

(For DSAS Personnel only)

Attested by:


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

APPENDIX B Cont'd



MISAMIS UNIVERSITY
Ozamiz City
Department of Student Affairs & Services

MU-DSAS-006/03 June 2023

PARENT'S CONSENT

COLLEGE OF MEDICAL TECHNOLOGY
Sponsoring Group/Organization

I am allowing my son/daughter/ward, LAURETE, DAPHNE JAYUS D., to join the Research Data Gathering / Collecting of VAMPIRE (activity) to be held on January 28, 2024 at TUDELA, MISAMIS OCCIDENTAL under the supervision of Ms. Uchira Alaina U. Guimaran (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.

WILSON F. LAURETE
Signature over printed name of
Parent/Guardian

01 / 19 / 24
Date

DAPHNE JAYUS D. LAURETE
Signature over printed name of
Student

01 / 20 / 24
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 ____ day of ____ at _____, Philippines, that the herein affiant personally came and appeared with his/her _____, as evidence of his/her personal identity.

Doc. No. 223
Page No. 40
Book No. 1P
Series of 2024

ATTY. REY O. BIRAS, BMT
Notarial Commission No. 2025-18
Notary Public for Ozamiz City and Clarin
City Hall Bldg., Bernal Subdivision, Aguada, Ozamiz City
PTR No. 4007751; 01/05/2025; Ozamiz City
ISP O.R. No. 576185; 12/20/2025; Pasig City
Attorney's Roll No. 70848
MCE Compliance No. VII-CU1412, Valid until 04/14/2023

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 _____

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, DANNAH GRACE R. VEPE, to join the CAMPUS GATHERING OF RESEARCH STUDY (activity) to be held on JANUARY TO APRIL 2024 at OZAMIZ CITY PORT & ANNEX under the supervision of Mr. KATH MAXELL O. LAO (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.

DANNAH GRACE R. VEPE
Signature over printed name of
Parent/Guardian

1/21/24
Date

DANNAH GRACE R. VEPE
Signature over printed name of
Student

1/21/24
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 day of JAN 2024 at Ozamiz City, Philippines, that the herein affiant personally came and appeared with his/her _____, as evidence of his/her personal identity.

Doc. No. 201
Page No. 42
Book No. 16
Series of 20 24
Notary Public for Ozamiz City and Clarin
PTR No. 6207751; C1/05/2026; Ozamiz City
IBP O.R. No. SA 165; 12/29/2025; Pasig City
Notary's Roll No. 73648
MCLT Compliance No. N-1-0014127; 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: _____

APPENDIX C: Letter for Species Identification



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 26, 2026

EDWARD B. YASAY

Regional Director,
Bureau of Fisheries and Aquatic Resources, Region 10
Macaban, Cagayan de Oro City

Thru: FELIX L. MEJOS

OIC-PFO MOC
BFAR 10, Ozamiz City

Subject: Request for species Identification for the Purpose of Thesis

Dear Sir Yasay:

We, the undersigned 3rd Year Bachelor in Science in Medical Technology students from the College of Medical Technology, Misamis University, respectfully write to you regarding our research study entitles "**Bioaccumulation of Lead (Pb) and Cadmium (Cd) in Oysters sold in the Streets of Tudela Misamis Occidental.**"

The purpose of this letter is to formally request assistance in the specie identification of the oyster sample collected for our scientific 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.

Respectfully yours,

JUDECAEL KAHIL D. ZAMBRA
Researcher

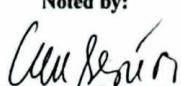
DAPHNE JAYCE D. LAURETE
Researcher

SHANNER V. INDOC
Researcher

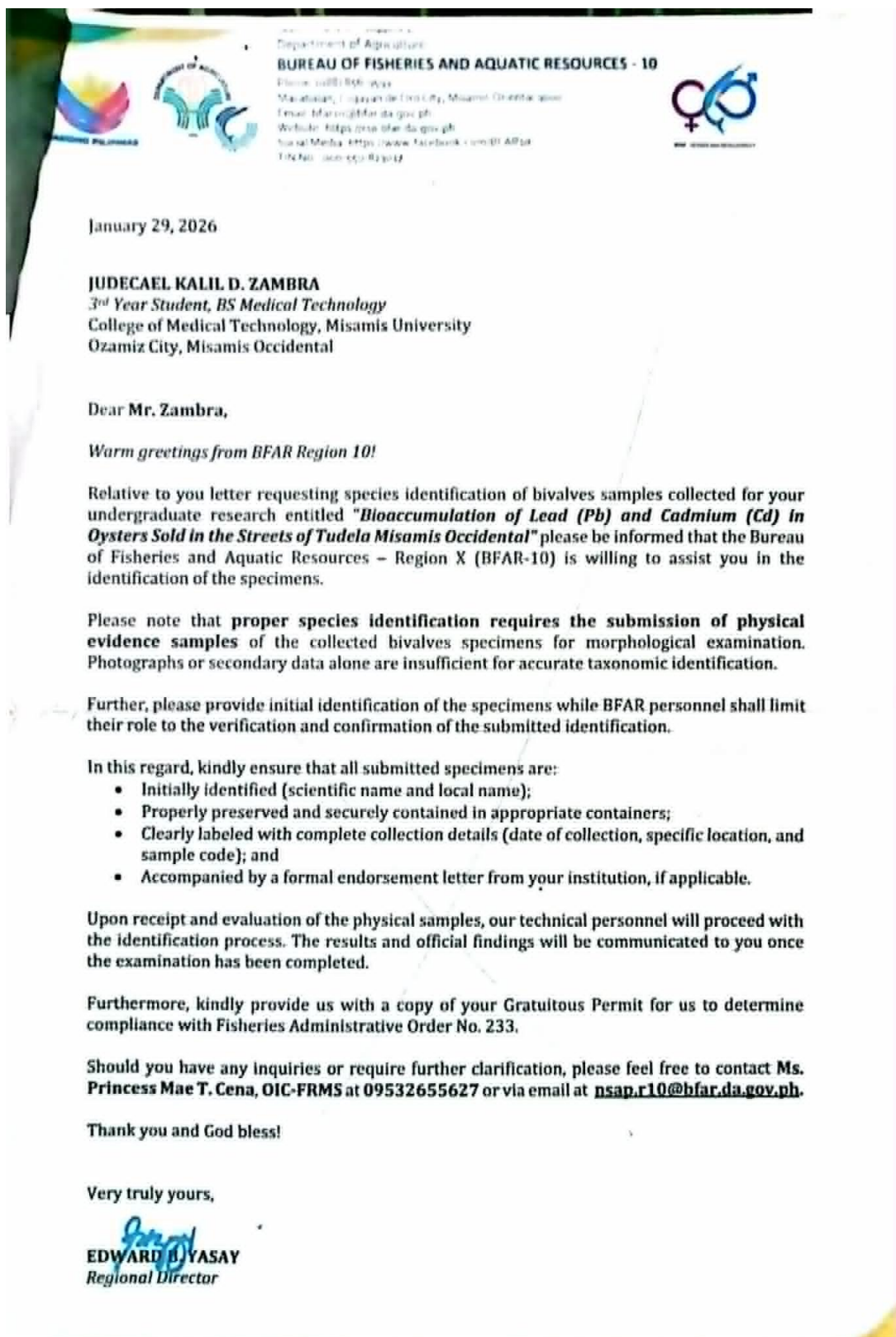
SPB.

*affon h
1/27/26*

APPENDIX C Cont'd

	Misamis University <i>Ozamiz City</i>	
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)		
 <u>MS. NELFA D. CANINI, PHD</u> Research Instructor		
Noted by:  <u>MS. EVANGELINE M. SENEDO, RMT, MATMRS</u> Dean, College of Medical Technology		

APPENDIX C Cont'd



APPENDIX D: Result for Species Identification

 **Department of Agriculture**
BUREAU OF FISHERIES AND AQUATIC RESOURCES - 10
Phone: (091) 856-9093
Marabulan, Cagayan de Oro City, Misamis Oriental 9006
Email: bfar10@dar.gov.ph
Website: https://icb.de.dar.gov.ph
Social Media: https://facebook.com/BFAR10
TIN No.: 000-855-823037



RESULTS OF ANALYSIS

Source of Specimen : Ozamis City, Misamis Occidental
Submitted by : Judecael Kalil D. Zambra
Address : Ozamis City, Misamis Occidental
Date Submitted : February 12, 2026
Date of Completion of Analysis : February 16, 2026
Examination : Morphological Analysis
Kingdom : Animalia
Phylum : Mollusca
Class : Bivalvia
Order : Ostreida
Family : Ostreidae
Genus : *Magallana*
Species : *Magallana bilineata* (Röding, 1798)
Local name : Talaba



Figure 1. Specimen for morphological analysis of *Magallana bilineata* (Röding, 1798)

References:
Del Norte-Campos, A. G. C., Burgos, L. A., & Sanchez, K. A. S. (2020). *A field guide to the commercially important mollusks of Panay, Philippines*. University of the Philippines Visayas.
World Register of Marine Species. (n.d.). *Magallana bilineata* (Röding, 1798).

Page | 1

Maunipang Agrikultura, Maunipang Ekonomiya

APPENDIX D Cont'd



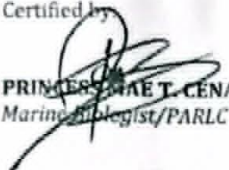
Department of Agriculture
BUREAU OF FISHERIES AND AQUATIC RESOURCES - 10
Phone: (099) 816-8793
Makabayan, Cagayan de Oro City, Marikina General 9000
Email: bfa10@bfa.gov.ph
Website: <http://bfa10.gov.ph>
Social Media: <https://facebook.com/BFA10>
TIN No. 006-315-42101

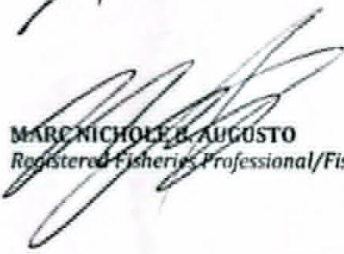
CERTIFICATION

This is to certify that the samples submitted by Judecael Kalil D. Zambra and received by BFAR-10 last February 12, 2026, are species of scientifically known as *Magallana bilineata* (Roding, 1798) or locally known as "Talaba".

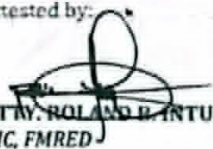
This certification is issued on the 16th of February 2026 at BFAR Regional Office, Cagayan de Oro City.

Certified by:


PRINCESS MAE T. CENA
Marine Biologist/PARLC Member


MARC NICHOLAS B. AUGUSTO
Registered Fisheries Professional/Fish Examiner

Attested by:


ATTY. ROLAND B. INTUD
OIC, FMRED

Approved:


EDWARD B. YASAY
Regional Director

Page | 2

Maunipang Agrikultura, Maunipang Ekonomiya

APPENDIX E: Result for Heavy Metal Testing



FOCUS ON EXCELLENCE • ADAPTABILITY TO CHANGE • SOCIAL RESPONSIBILITY • TEAMWORK • LEARNING AND GROWTH • ACCOUNTABILITY • BALANCED

F.A.S.T. Laboratories - CDO

Reference No. CD2604-2094

Lapasan Hi-way corner Camp Alagar Road CDO City

Page 2 of 2

TEST REPORT

CUSTOMER : JUDECAEL KALIL ZAMBRA
 ADDRESS : P1 Lapasan, Clarin, Misamis Occidental
 CONTACT PERSON : Judecael Kalil Zambra
 CONTACT DETAILS : judecaelkalilzambra@gmail.com
 SAMPLE(S) SUBMITTED : OYSTER FLESH – 2 (In Plastic Jar) (*Magallana bilineata*)
 SAMPLE CODE : CD2604-2094-02
 SAMPLED BY : Customer
 SAMPLING LOCATION : Nailon, Tudela, Misamis Occidental
 DATE / TIME RECEIVED : 10 April 2026 / 10:21 AM
 DATE ANALYZED : 20 April – 04 May 2026
 ANALYZED BY : S.S. PAHILAN J.A. CANATOY
 DATE REPORTED : 07 MAY 2026

Parameters	Unit	Results			Test Method
		Trial 1	Trial 2	Trial 3	
Cadmium	mg/kg	0.0822	0.0812	0.0817	Flame AAS
Lead	mg/kg	Not Detected	Not Detected	Not Detected	

Note: Not Detected = Below Reporting Limit
 Reporting Limit of Lead = 0.25 mg/kg

Reference: Official Method of Analysis of AOAC International, 21st ed., 2019.
 Shimadzu AA-7000 Manual.

Results are those obtained at time of examination and relate only to the sample(s) tested.

CERTIFIED BY: *[Signature]*
M.R.T. SULLANO, RCh
 Laboratory Supervisor
 Chem Reg No. 0014490

APPROVED BY: *[Signature]*
M.L.S. MENDOZA, RCh
 Laboratory Business Manager
 Chem Reg No. 08239

Terms and Conditions:

- Sampling details such as sample description, sampling location point, date and time of sampling are customer declared information which can affect the validity of results and the laboratory cannot confirm its accuracy and therefore should not be held liable.
- This report is prepared for the SOLE USE of the customer and is prepared based on the item submitted, the services required by the customer and the conditions under which the services are performed by F. A. S. T. Laboratories. The report is not intended to be representative of similar or equivalent items and does not constitute endorsement by F.A.S. T. Laboratories on the item.
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APPENDIX E Cont'd



FOCUS ON EXCELLENCE • ADAPTABILITY TO CHANGE • SOCIAL RESPONSIBILITY • TEAMWORK • LEARNING AND GROWTH • ACCOUNTABILITY • BALANCED

F.A.S.T. Laboratories - CDO
Lapasan Hi-way corner Camp Alagar Road CDO City

Reference No. CD2604-2094
Page 1 of 2

TEST REPORT

CUSTOMER : JUDECAEL KALIL ZAMBRA
ADDRESS : P1 Lapasan, Clarin, Misamis Occidental
CONTACT PERSON : Judecael Kalil Zambra
CONTACT DETAILS : judecaelkalilzambra@gmail.com
SAMPLE(S) SUBMITTED : OYSTER FLESH – 1 (In Plastic Jar) (*Crassostrea iredalei*)
SAMPLE CODE : CD2604-2094-01
SAMPLED BY : Customer
SAMPLING LOCATION : Nailon, Tudela, Misamis Occidental
DATE / TIME RECEIVED : 10 April 2026 / 10:21 AM
DATE ANALYZED : 20 April – 04 May 2026
ANALYZED BY : S.S. PAHILAN J.A. CANATOY
DATE REPORTED : 07 MAY 2026

Parameters	Unit	Results			Test Method
		Trial 1	Trial 2	Trial 3	
Cadmium	mg/kg	0.0677	0.0648	0.0663	Flame AAS
Lead	mg/kg	Not Detected	Not Detected	Not Detected	

Note: Not Detected - Below Reporting Limit
Reporting Limit of Lead = 0.25 mg/kg

Reference: Official Method of Analysis of AOAC International, 21st ed., 2019.
Shimadzu AA-7000 Manual.

Results are those obtained at time of examination and relate only to the sample(s) tested.

CERTIFIED BY: *[Signature]*

M.R.T. SULLANO, RCh
Laboratory Supervisor
Chem Reg No 0014490

APPROVED BY: *[Signature]*

M.L.S. MENDOZA, RCh
Laboratory Business Manager
Chem Reg No 08239

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F.A.S.T. Laboratories
The First Analytical Services And Technical Cooperative

Page 1 of 4

CUSTOMER	: JUDECAEL KALIL ZAMBRA
ADDRESS	: P1 Lapasan, Clarin, Misamis Occidental
CONTACT PERSON	: Judecael Kalil Zambra
CONTACT DETAILS	: judecaelkalilzambra@gmail.com
SAMPLE(S) SUBMITTED	: OYSTER FLESH – 01 (In Plastic Jar) (<i>Crassostrea iredalei</i>)
SAMPLE CODE	: CD2605-1841-01
SAMPLED BY	: Customer
SAMPLING LOCATION	: Nailon, Tudela, Misamis Occidental
DATE / TIME RECEIVED	: 18 May 2026 / 09:41 AM
DATE ANALYZED	: 19 May – 02 June 2026
ANALYZED BY	: S.S. PAHILAN J.A. CANATOY
DATE REPORTED	: 03 JUNE 2026

Parameters	Unit	Results		Test Method
		Trial 1	Trial 2	Flame AAS
Cadmium	mg/kg	0.0689	0.0674	

APPROVED BY: *[Signature]* 05 June 2016
N.L.B. MENDOZA, RCh
Laboratory Business Manager
Chem. Reg. No. 08239

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Cebu H. City Central Bldg., M. C. Burgos Highway, Marikina City, 0804 Tels. (035) 501 8272 Fax: (017) 625 6022 E-mail: mikajales.fastlaboratorios@gmail.com
Cajayon de Oro 217 Castrillo Bldg., C.M. Recto Ave., Carr. Agdao Rd., Brgy. Laganan, Cagayan de Oro City, Marikina District 9600 Tels. (068) 822 4348 (017) 624 6321 mikajales.fastlaboratorios@gmail.com
Cebu-Angeles 503 S.B. Bldg. 317 Magkang Road, Pindar, Angeles City 2026 Tels. (049) 681 017 070 (017) 108 4643 mikajales.fastlaboratorios@gmail.com

APPENDIX E Cont'd



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F.A.S.T. Laboratories - CDO

Lapasan HI-way corner Camp Alagar Road CDO City

Reference No. CD2605-1841

Page 2 of 4

TEST REPORT

CUSTOMER : JUDECAEL KALIL ZAMBRA
 ADDRESS : P1 Lapasan, Clarin, Misamis Occidental
 CONTACT PERSON : Judecael Kalil Zambra
 CONTACT DETAILS : judecaelkalilzambra@gmail.com
 SAMPLE(S) SUBMITTED : OYSTER FLESH – 02 (In Plastic Jar) (*Crasostrea iredalei*)
 SAMPLE CODE : CD2605-1841-02
 SAMPLED BY : Customer
 SAMPLING LOCATION : Nailon, Tudela, Misamis Occidental
 DATE / TIME RECEIVED : 18 May 2026 / 09:41 AM
 DATE ANALYZED : 19 May – 02 June 2026
 ANALYZED BY : S.S. PAHILAN J.A. CANATOY
 DATE REPORTED : 03 JUNE 2026

Parameters	Unit	Results		Test Method
		Trial 1	Trial 2	Flame AAS
Cadmium	mg/kg	0.0641	0.0657	

Note: Not Detected = Below Reporting Limit
 Reporting Limit of Lead = 0.25 mg/kg

Reference: Official Method of Analysis of AOAC International, 21st ed., 2019.
 Shimadzu AA-7000 Manual.

Results are those obtained at time of examination and relate only to the sample(s) tested.

CERTIFIED BY:

M.R.T. SULLANO, RCh
 Laboratory Supervisor
 Chem. Reg. No. 0014490

APPROVED BY:

M.L.A. MENDOZA, RCh
 Laboratory Business Manager
 Chem. Reg. No. 06239

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Reference No. CD2605-1841

Page 3 of 4

TEST REPORT

CUSTOMER : JUDECAEL KALIL ZAMBRA
 ADDRESS : P1 Lapasan, Clarin, Misamis Occidental
 CONTACT PERSON : Judecael Kalil Zambra
 CONTACT DETAILS : judecaelkalilzambra@gmail.com
 SAMPLE(S) SUBMITTED : OYSTER FLESH – 03 (In Plastic Jar) (*Magallana bilineata*)
 SAMPLE CODE : CD2605-1841-03
 SAMPLED BY : Customer
 SAMPLING LOCATION : Nailon, Tudela, Misamis Occidental
 DATE / TIME RECEIVED : 18 May 2026 / 09:41 AM
 DATE ANALYZED : 19 May – 02 June 2026
 ANALYZED BY : S.S. PAHILAN J.A. CANATOY
 DATE REPORTED : 03 JUNE 2026

Parameters	Unit	Results		Test Method
		Trial 1	Trial 2	Flame AAS
Cadmium	mg/kg	0.0837	0.0825	

Note: Not Detected = Below Reporting Limit
 Reporting Limit of Lead = 0.25 mg/kg

Reference: Official Method of Analysis of AOAC International, 21st ed., 2019.
 Shimadzu AA-7000 Manual.

Results are those obtained at time of examination and relate only to the sample(s) tested.

CERTIFIED BY:
 03 June 2026
M.R.T. SULLANO, RCh
 Laboratory Supervisor
 Chem. Reg. No. 0014480

APPROVED BY:
 03 June 2026
M.L.A. MENDOZA, RCh
 Laboratory Business Manager
 Chem. Reg. No. 08230

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Reference No. CD2605-1841
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TEST REPORT

CUSTOMER : JUDECAEL KALIL ZAMBRA
ADDRESS : P1 Lapasan, Clarin, Misamis Occidental
CONTACT PERSON : Judecael Kalil Zambra
CONTACT DETAILS : judecaelkalilzambra@gmail.com
SAMPLE(S) SUBMITTED : OYSTER FLESH – 04 (In Plastic Jar) (*Magallana bilineata*)
SAMPLE CODE : CD2605-1841-04
SAMPLED BY : Customer
SAMPLING LOCATION : Nailon, Tudela, Misamis Occidental
DATE / TIME RECEIVED : 18 May 2026 / 09:41 AM
DATE ANALYZED : 19 May – 02 June 2026
ANALYZED BY : S.S. PAHILAN J.A. CANATOY
DATE REPORTED : 03 JUNE 2026

Parameters	Unit	Results		Test Method
		Trial 1	Trial 2	Flame AAS
Cadmium	mg/kg	0.0802	0.0814	

Note: Not Detected = Below Reporting Limit
Reporting Limit of Lead = 0.25 mg/kg

Reference: Official Method of Analysis of AOAC International, 21st ed., 2019.
Shimadzu AA-7000 Manual.

Results are those obtained at time of examination and relate only to the sample(s) tested.

CERTIFIED BY: 03 June 2026

M.T. SULLANO, RCh
Laboratory Supervisor
Chem. Reg. No. 0014480

APPROVED BY:

M.L.S. MENDOZA, RCh 03 June 2026
Laboratory Business Manager
Chem. Reg. No. 08230

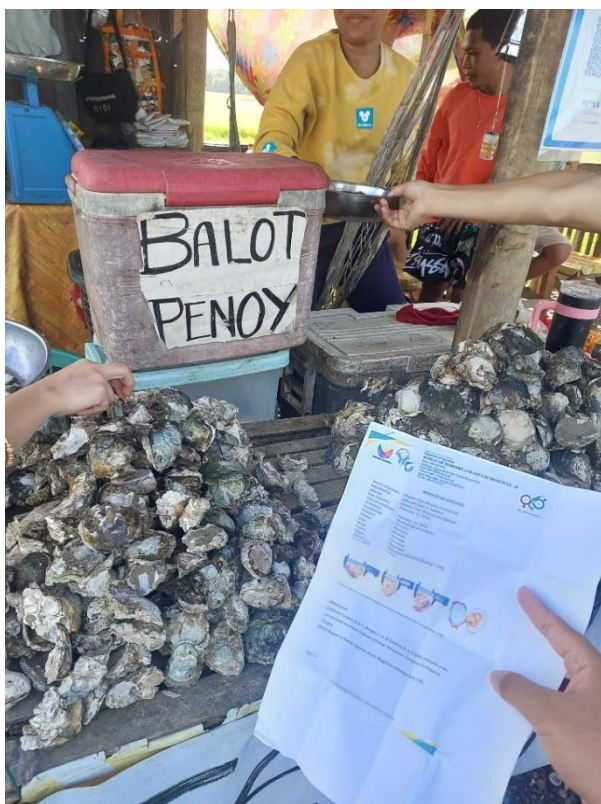
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APPENDIX F: Documentation



APPENDIX G: Grammarly Report and Turnitin Results

Report: ZAMBRA et al EDITED

ZAMBRA et al EDITED

by Misamis University

General metrics

32,571	4,662	320	18 min 38 sec	35 min 51 sec
characters	words	sentences	reading time	speaking time

Score

99

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

Writing Issues

15	2	13
Issues left	Critical	Advanced

Plagiarism

This text hasn't been checked for plagiarism

Page 2 of 35 - Integrity Overview

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-  **21 Missing Quotations** 5%
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-  **0 Missing Citation** 0%
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CURRICULUM VITAE

Name: Shannery Nicole R. Indoc

Age: 21

Birthdate: May 27, 2005

Civil Status: Single

Nationality: Filipino

Home Address: P-2 Dona Consuelo, Ozamiz City, Misamis Occidental

Current Address: Blck 4 Lot 3 R.S Tan Village, Ozamis City, Misamis Occidental

Contact Number: 09639352066

Email Address: ishannerynicole@gmail.com

Educational Background

Tertiary Education:

Misamis University
H.T. Feliciano St. Aguada, Ozamiz City
2021-Present

Secondary Education:

Ozamiz City School of Arts and Trades
Maningcol, Ozamiz City, Misamis Occidental
2017-2020

Primary Education:

Dona Consuelo Elementary School
Dona Consuelo, Ozamiz City, Misamis Occidental
2011-2016

CURRICULUM VITAE

Name: Daphne Jayce D. Laurete

Age: 21

Birthdate: March 13, 2005

Civil Status: Single

Nationality: Filipino

Home Address: P-6 Calabayan, Ozamiz City, Misamis Occidental

Current Address: P-6 Calabayan, Ozamiz City, Misamis Occidental

Contact Number: 09465829033

Email Address: daphnejaycelaurete13@gmail.com

Educational Background

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H.T. Feliciano St. Aguada, Ozamiz City
2022-Present

Secondary Education:

La Salle University-Integrated School
Valconcha Street Ozamiz City, Misamis Occidental
2017-2020

Primary Education:

Maximo S. Laurete Sr. Central School
Calabayan, Ozamiz City, Misamis Occidental
2011-2016

CURRICULUM VITAE

Name: Dannah Grace R. Sepe

Age: 21

Birthdate: May 31, 2005

Civil Status: Single

Nationality: Filipino

Home Address: P-5 Malaubang, Ozamiz City, Misamis Occidental

Current Address: P-5 Malaubang, Ozamiz City, Misamis Occidental

Contact Number: 09380209344

Email Address: dannah.sepe@gmail.com

Educational Background

Tertiary Education:

Misamis University
H.T. Feliciano St. Aguada, Ozamiz City
2021-Present

Secondary Education:

Ozamiz City National High School
Ozamiz City, Misamis Occidental
2017-2020

Primary Education:

Ozamiz City Elementary School-SPED Center
Ozamiz City, Misamis Occidental
2011-2016

CURRICULUM VITAE

Name: Judecael Kalil D. Zambra

Age: 20

Birthdate: July 25, 2005

Civil Status: Single

Nationality: Filipino

Home Address: P-2 Lapasan, Clarin, Misamis Occidental

Current Address: P-2 Lapasan, Clarin, Misamis Occidental

Contact Number: 09665739441

Email Address: judecaelkalilzambra@gmail.com

Educational Background

Tertiary Education:

Misamis University
H.T. Feliciano St. Aguada, Ozamiz City
2021-Present

Secondary Education:

Clarin National High School
Poblacion-3 Clarin, Misamis Occidental
2017-2020

Primary Education:

Canicapan Elementary School
Canicapan, Clarin, Misamis Occidental
2011-2016