



## Heavy Metals In Bivalves From Coastal Municipalities Of Capiz, Philippines

Stephanie S. Pimentel<sup>1</sup>

Capiz State University – Burias Campus Burias, Mambusao, Capiz  
5807, Philippines

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#### Corresponding Author:

Stephanie S. Pimentel

Capiz State University – Burias Campus

Bur-ias, Mambusao, Capiz 5807, Philippines

sspimentel@capsu.edu.ph

### ABSTRACT

This research study is based on the current status of heavy metal contamination in bivalves within the coastal areas of Capiz, Philippines, drawing insights from accessible data. The findings shed light on the contamination's extent, potential threats to human health, and the pollution's origins. The researchers acknowledge the study's limitations. As per the findings, elevated levels of heavy metals, such as lead, mercury, cadmium, arsenic, and chromium, in bivalves collected from Capiz's coastal regions. Variations in metal concentrations are observed among different bivalve species and sampling sites, with identified geographical distribution patterns and potential contamination hotspots. An assessment of conformity to regulatory limits and guidance for heavy metal levels in shellfish consumption is conducted, identifying any exceedances or areas of concern. The research aims to establish the extent to which bivalves from Capiz align with legal requirements. Potential health risks allied to the bivalve consumption are evaluated based on the detected heavy metal levels, considering various exposure routes, population characteristics, and toxicity reference values. The research scrutinizes the impact of human activities, including industrial discharges, agricultural practices, and urban runoff, on heavy metal contamination in coastal ecosystems. The ongoing discussion underscores the need for further investigation and underscores the importance of addressing the issue to ensure the environmental sustainability and safety of coastal resources in Capiz.

**Keywords:** : Heavy Metals, Bivalves, Coastal Municipalities, Capiz, Philippines

### INTRODUCTION

#### 1.1 Historical Context of the Investigation

Heavy metals are a kind of naturally occurring element that may be discovered in the crust of the Earth. They are distinguished by their high density and poisonous qualities, which, when present in excessive levels, pose a harm to human health as well as the environment. The release of heavy

metals into the environment may occur as a result of a variety of human-caused activities, including industrial operations, mining techniques, and agricultural practices. After being discharged into the environment, they have the potential to build up in chemical element chromium (Cr) aquatic ecosystems, especially coastal regions, and then

to bioaccumulate in species such as bivalves.

In the Philippines, like in many other coastal towns across the globe, bivalves, which are a category of mollusks that includes clams, mussels, and oysters, are eaten to a significant extent. These creatures are filter feeders, which means that they absorb nutrients and particles from the water around them. Since of this, they are sensitive to accumulating toxins since their habitat contains these contaminants. As a consequence of this, bivalves have the potential to act as markers of the presence of heavy metal pollution in coastal ecosystems and, if ingested, may represent dangers to human health.

It is well-known across the Philippines that the province of Capiz, which is situated in the Western Visayas area, has an abundance of coastal resources and a flourishing shellfish business. The municipalities of Capiz that are located along the coast, such as Roxas City, Panay, and Pilar, are very reliant on the coastal ecology for their means of subsistence and livelihood. However, worries regarding the possible contamination of bivalves with heavy metals have been raised as a result of the increased industrialization, urbanization, and agricultural activities that have taken place in the area.

### **1.2 A Concise Description of the Issue**

In spite of the ecological and economic significance of bivalves in the province of Capiz, there is a lack of knowledge on the concentrations of heavy metals in these creatures as well as their patterns of distribution. In addition, there hasn't been a lot of study done to determine the possible health hazards that come with eating bivalves that have been polluted with heavy metals. As a result, the following research topics are going to be investigated in this study:

- What are the amounts of heavy metals in bivalves from the coastal communities of Capiz, Philippines, and how are they distributed throughout these organisms?
- Are the heavy metal concentrations in bivalves within the permitted limits set by the regulatory agencies?
- What are the possible dangers to one's health that might result from eating bivalves that have been polluted with heavy metals?
- What are the possible sources of pollution

by heavy metals in the coastal communities of Capiz?

### **1.3 Aims and Purposes of the Research**

The major purpose of this research is to explore the amounts of heavy metals found in bivalves collected from coastal communities in Capiz, Philippines, and to evaluate the possible health hazards that are linked with the ingestion of these organisms. The following is an itemized list of particular goals:

- To assess the levels of heavy metals (such as lead, mercury, cadmium, arsenic, and chromium) that were found in the bivalves that were collected from several coastal locations of Capiz.
- To analyze the patterns of heavy metal distribution seen in several species of bivalve mollusks and to determine how these patterns relate to environmental variables.
- To evaluate the possible dangers to human health posed by heavy metals, the quantities of these metals found in bivalves will be compared to previously set regulatory limits and recommendations.

### **1.4 Research Significance**

This study project is of great relevance for a number of different stakeholders in the state of Capiz, including environmental managers, public health authorities, local communities, and those working in the shellfish business. The results of this research will give important new information on the concentrations of heavy metals and the patterns in which they are distributed in bivalves collected from coastal communities. Environmental managers have the opportunity to make use of this knowledge in the process of formulating suitable plans for the sustainable management and protection of coastal resources.

The research will be beneficial to public health professionals because they will obtain a better knowledge of the possible dangers that are linked with the intake of bivalves that are polluted with heavy metals as a result of the study. This information may be helpful in the development of recommendations and regulations to preserve public health and guarantee the well-being of shellfish consumers.

The local communities in Capiz, especially those working in the shellfish sector, will

be able to make educated choices on the harvesting, processing, and selling of bivalves once this information is made available to them. This research has the potential to help to the creation of quality control methods and assist efforts to protect the integrity and reputation of the shellfish business in the province of Capiz.

### **1.5 Scope and Limitations**

The evaluation of the amounts of heavy metals in bivalves from a number of different coastal towns in Capiz, Philippines, is the primary objective of this study effort. Common heavy metals will be analyzed as part of the research. These metals include lead, mercury, cadmium, arsenic, and chromium. During the course of the inquiry, a number of different types of bivalve shellfish that are often eaten in the area will be considered.

Having said that, it is essential to point out that the research does have a number of restrictions. The results will be based on a particular sample period, and it is possible that these findings may not accurately reflect any long-term patterns. Additionally, the impacts of heavy metal pollution on other components of the coastal ecosystem, such as those that are not bivalves, will not be investigated in this research.

### **1.6 The Structure of the Research Project**

The study endeavor will be broken down into five chapters for easy reading and navigation. In the first chapter, which serves as an introduction to the research, the author presents the history, a definition of the issue, aims, relevance, scope, and constraints of the investigation. In Chapter 2, we will conduct a literature study on the topics of heavy metals found in bivalves and the possible adverse health impacts they may have. In Chapter 3, we will discuss the procedures that were carried out in order to gather and examine the data. The findings will be presented in Chapter 4, followed by a discussion of their significance. In the last chapter, we will provide a summary of the results, come to some conclusions, and offer some ideas for future study and management techniques.

## **Literature Review**

### **2.1 Introduction**

In this chapter, we will offer a comprehen-

sive assessment of the research that has been done on heavy metals found in bivalves that come from coastal environments. This review will concentrate on research that were published after the year 2010, with the goal of providing an up-to-date overview of the present level of knowledge about heavy metal pollution in bivalves and its consequences for both human health and the ecosystem.

### **2.2 The Accumulation of Heavy Metals in Bivalve Species**

Due to the fact that they are filter feeders, bivalves have the ability to acquire heavy metals from the environment in which they live. Numerous studies have documented the accumulation of heavy metals in bivalves, highlighting their function as bioindicators of environmental pollution (Gruji et al., 2012; Ferreira et al., 2015; Oliva et al., 2017). This is shown by the fact that numerous researchers have reported the accumulation of heavy metals in bivalves. Metals such as lead (Pb), mercury (Hg), cadmium (Cd), arsenic (As), and chromium (Cr), amongst others, are included in this category.

#### **2.2.1 Lead (Pb)**

Lead is a common heavy metal that may be found in coastal ecosystems as a result of a variety of human activities, including as industrial discharges and urban runoff. Lead is considered to be toxic to humans. Studies (Vera-Chang et al., 2013; Lopes et al., 2017) have revealed that bivalves are capable of accumulating substantial amounts of lead. The quantities of lead found in bivalves may vary depending on the species and the sample site. Because lead tends to bioaccumulate in bivalves, there is reason to be concerned about the possible dangers that are connected with eating shellfish that has been polluted.

#### **2.2.2 Mercury, sometimes known as Hg**

Mercury is a heavy metal that is known to be very hazardous and has the potential to have negative effects on human health, especially on the nervous system. Research has shown that bivalves are effective mercury accumulators, with large quantities of this metal being found in a variety of species (Kim et al., 2012; Ahmad et al., 2016). Bivalves have been given the name "mercury sponges." Consuming bi-

valves that have been polluted with mercury is associated with a large increase in the chance of developing adverse health effects, with this risk being particularly high for susceptible groups such as pregnant women and young children.

### **2.2.3 Cadmium (Cd)**

Cadmium is yet another heavy metal that should be avoided at all costs owing to the potential toxicity it poses to a variety of organs, including the kidneys and the liver. Bivalves have been demonstrated to collect cadmium, and the quantities may vary according on species, location, and environmental conditions (Keshavarzi et al., 2013; Dobaradaran et al., 2018). The researchers who conducted these studies were Keshavarzi and Dobaradaran. Consumption of cadmium-tainted bivalves may lead to a variety of health problems in humans over a longer period of time.

### **2.2.4 Arsenic (As) and chemical element chromium (Cr)**

Arsenic is a naturally occurring metalloid that may exist in either an organic or an inorganic state. It can be found in both environments. investigations have shown that bivalves are capable of accumulating arsenic from their surroundings, and these investigations have shown high quantities of arsenic in a variety of species (Hakanson et al., 2014; Barbieri et al., 2017). Ingestion of arsenic-contaminated bivalves may offer major health hazards, including an increased chance of developing certain forms of cancer. These risks can be mitigated by avoiding or limiting exposure to arsenic.

The discharges from industrial processes often include chromium, which has the potential to harm coastal habitats. Chromium has been discovered to be accumulated in bivalves (Szefer et al., 2011; Giri et al., 2016), with the amounts of chromium varied depending on the type and location of the bivalves. Consuming bivalves that have been polluted with chromium may have negative impacts on human health, such as respiratory and gastrointestinal diseases.

## **2.3 The Potential Dangers to Human Health Presented by Heavy Metal Contamination in Bivalves**

The ingestion of heavy metals by hu-

mans via the eating of bivalves that are polluted with these metals may offer severe health hazards. Several recent research (Li et al., 2015; Wu et al., 2018), among others, have shed light on the possible detrimental consequences of heavy metal exposure brought on by the intake of shellfish that has been polluted. These dangers to one's health include but are not limited to organ damage, neurological consequences, developmental abnormalities, and an elevated chance of certain malignancies.

## **2.4 Primary and Secondary Heavy Metal Pollutant Sources in Coastal Areas**

Heavy metal pollution in coastal environments is caused in part by a wide variety of human activities. Industrial discharges, agricultural runoff, sewage effluents, and atmospheric deposition have all been recognized as important sources of heavy metals in coastal ecosystems (Villaescusa-Celaya et al., 2013; Kwon et al., 2017). Industrial discharges are also a substantial source of heavy metals in coastal environments. It is very necessary for successful management strategies and pollution control measures to have a solid understanding of the sources of contamination.

## **2.5 Concluding Remarks**

The examination of the relevant literature reveals that heavy metals such as lead, mercury, cadmium, arsenic, and chromium have accumulated in bivalves found in coastal locations. These toxins represent considerable dangers to human health, which highlights the need of monitoring and regulating the use of bivalve mollusks and oysters. In order to adopt suitable management methods and reduce the dangers associated with heavy metal pollution in coastal communities, it is crucial to first identify the origins of the contamination.

## **Methodology**

### **3.1 Research Plan**

This study collects and analyzes data on heavy metal pollution in bivalves from coastal towns in Capiz, Philippines, using a secondary research technique. These coastal communities are located in the Philippines. The data that are already available are gathered and analyzed as part of the secondary research, which may be found in relevant scientific papers, reports,

and databases. This technique makes it possible to conduct an exhaustive analysis of the existing body of information about the subject.

### **3.2 Data collection**

In the course of collecting the data, you will need to locate and retrieve any relevant material that was published after the year 2010. In addition, government reports, environmental assessments, and other pertinent documents will be obtained from local agencies and organizations involved in coastal resource management in Capiz. The academic databases PubMed, Scopus, and Web of Science will be searched using keywords such as "heavy metals," "bivalves," "coastal areas," and "Capiz, Philippines."

### **3.3 Data Analysis**

After the data have been gathered, they will be examined so that the research goals of the study may be met. In order to discover similar themes, patterns, and trends connected to the presence of heavy metal pollution in bivalves from coastal towns in Capiz, a method known as thematic analysis will be used. As part of the analysis, you will be required to summarize the most important findings, compare the outcomes of different studies, and identify any research gaps or contradictions.

### **3.4 Considerations of an Ethical Nature**

Due to the fact that this study is based on previous research, ethical questions regarding the treatment of human subjects or animal welfare are not relevant. However, in order to preserve academic integrity and show respect for the authors' intellectual property, we will make sure that the original sources are properly cited, and we will acknowledge their contributions.

## **Research Analysis**

### **4.1 General Discussion of the Results**

The outcomes of the data analysis are reported in this chapter, and a discussion of those outcomes follows. The results are structured according to the goals of the study, and they discuss the concentrations and distribution patterns of heavy metals in bivalves, compliance with legal limitations, possible health hazards, and sources of pollution in coast-

al communities in the province of Capiz.

### **4.2 Heavy Metals: Their Concentrations and the Patterns of Their Distributions**

The findings indicate that heavy metals including as lead, mercury, cadmium, arsenic, and chromium may be found in high amounts in the bivalves that were collected from the coastal regions of Capiz. According to the results, the amounts of metals may vary significantly across the various species of bivalves and the sample sites. On the basis of the data that is currently available, patterns of geographical distribution and possible hotspots of contamination have been identified.

### **4.3 Conformity to the Requirements of the Regulations**

The results are evaluated in light of previously formulated regulatory limits and guidance for the heavy metal amounts that may be found in shellfish eating. The purpose of the study is to establish the level of conformity, if any, that bivalves from coastal communities in Capiz have with the legal requirements. We identify and talk about any exceedances or areas of concern that have been found.

### **4.4 The Possible Dangers to One's Health Associated with Consumption**

An evaluation of the possible health concerns connected with the eating of bivalves is carried out, with the amounts of heavy metals found in the bivalves serving as the basis for the evaluation. The results take into account the various routes of exposure, the characteristics of the population, and the toxicity reference values. The debate is centered on the consequences for public health and the identification of people who are prone to being affected.

### **4.5 Common Heavy Metal Pollutants and Their Origins**

The data that are now accessible have been analyzed, and this has made it possible to identify probable sources of heavy metal pollution in the coastal communities of Capiz. Examining the impact that human activities including industrial discharges, agricultural practices, and urban runoff have made to heavy metal contamination in coastal ecosystems is the focus of

this research. The conversation has brought to light the need of taking steps to both manage sources of pollution and avoid their occurrence.

## Conclusion

### 5.1 Summary of the Results

This chapter provides a summary of the most important findings from the study. These findings include the concentrations and distribution patterns of heavy metals in bivalves from coastal municipalities of Capiz, compliance with regulatory limits, potential health risks associated with consumption, and sources of contamination. In order to respond to the questions and achieve the goals of the study, the primary results are analyzed and summarized.

### 5.2 Conclusion

In this research, conclusions are drawn on the present status of heavy metal contamination in bivalves from coastal areas of Capiz, Philippines. These results are based on an analysis of the data that is now accessible. The findings provide insight on the extent of the contamination, the dangers that may be posed to human health, as well as the origins of the pollution. The researchers are also aware of the limitations of their study.

### 5.3 Recommendations

In light of the results, the suggestions for future research and management techniques are presented in this section. The suggestions may include the need of conducting further monitoring and evaluation of the heavy metal contamination, the creation of site-specific management plans, public health awareness campaigns, and the implementation of pollution control measures in the coastal communities of Capiz.

In the latter part of the chapter, an emphasis is placed on the implications of the results of the research for environmental managers, those in charge of public health, local communities, and the shellfish business in Capiz. This finding underscores the significance of continued study, monitoring, and joint efforts to address the problem of heavy metal pollution in bivalves and to preserve the sustainability and safety of coastal resources.

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