



**IDENTIFICATION AND QUANTIFICATION OF  
MICROPLASTICS IN SEDIMENT FROM  
PATENGA SEA BEACH, CHATTOGRAM,  
BANGLADESH**

**Khing Khing U Marma**

Roll No. 0122/06

Registration No. 1120

Session: 2022-2023

**A thesis submitted in the partial fulfillment of the requirements for the degree of  
Master of Science in Fisheries Resource Management**

**Department of Fisheries Resource Management**

**Faculty of Fisheries**

**Chattogram Veterinary and Animal Sciences University**

**Chattogram-4225, Bangladesh**

**JUNE 2023**

## **AUTHORIZATION**

I hereby declare that I am the sole author of the thesis. I also authorize the Chattogram Veterinary and Animal Sciences University (CVASU) to lend this thesis to other institutions or individuals for the purpose of scholarly research. I further authorize the CVASU to reproduce the thesis by photocopying or by other means, in total or in part, at the request of other institutions or individuals for the purpose of scholarly research.

I, the undersigned, and author of this work, declare that the electronic copy of this thesis provided to the CVASU Library, is an accurate copy of the print thesis submitted, within the limits of the technology available.

**The Author**

**June 2023**

**IDENTIFICATION AND QUANTIFICATION OF  
MICROPLASTICS IN SEDIMENT FROM  
PATENGA SEA BEACH, CHATTOGRAM,  
BANGLADESH**

**Khing Khing U Marma**

Roll No. 0122/06

Registration No. 1120

Session: 2022-2023

**This is to certify that we have examined the above Master's thesis and have found that is complete and satisfactory in all respects, and that all revisions required by the thesis examination committee have been made**

.....  
**Shahida Arfine Shimul**  
Supervisor

.....  
**Dr. Sk Ahmad Al Nahid**  
Co-supervisor

.....  
**Chairman of the Examination Committee**

**Department of Fisheries Resource Management  
Faculty of Fisheries  
Chattogram Veterinary and Animal Sciences University  
Chattogram-4225, Bangladesh**

**JUNE 2023**

## ACKNOWLEDGEMENTS

All the praises and thanks to the Almighty who has enabled her to pursue the study in fisheries science successfully and to submit the thesis for the degree of Master of Science in Fisheries Resource Management and also pay gratitude to the Almighty for enabling and giving strengths to complete research work as well as thesis within due course of time.

The author expresses her deepest sense of gratitude and sincere appreciation to her honorable teacher and research supervisor, **Shahida Arfine Shimul**, Assistant Professor, Department of Fisheries Resource Management, Chattogram Veterinary and Animal Sciences University, Chattogram for her unfailing support, authoritative guidance, constructive criticism, advice, and continuous motivation. It would never have been possible for her to take this work to completion without her incredible support and continuous encouragement. Her dynamism, vision and confidence inspired her and gave her confidence and strength.

The author also sincerely expresses her gratitude to her co-supervisor, **Dr. Sk Ahmad Al Nahid**, Associate Professor and Head, Department of Fisheries Resource Management, Chattogram Veterinary and Animal Sciences University, Chattogram for his valuable guidance, intellectual suggestions, knowledge, patience, and time to teach her to be a more confident person that she is going to be in the work world.

The author is extremely glad by expressing her heartfelt thanks and gratitude to all of her respected teachers of the Faculty of Fisheries, Chattogram Veterinary and Animal Sciences University, Chattogram for their valuable teaching and continuous encouragement during the study period.

The author expresses her sincere thanks to **Saifuddin Rana, Zannatul Bakeya, Kaji Mohammad Sirajum Monir, Farhan Azim** for their co-operation during sampling and data analysis in the laboratory which made her work easier.

The author expresses her thanks to Mohammad Bokhteyar Hasan, Supria Biswas and all other laboratory technicians, Faculty of Fisheries, CVASU, for their sincere cooperation.

Finally, the author expresses her heartfelt gratitude to her beloved parents for their selfless love, blessings, care, dedicated efforts, valuable prayers, continuous support during the academic life.

**The Author**

## TABLE OF CONTENTS

<b>Contents</b>	<b>Page No.</b>
Title page	i
Authorization	ii
Signature page	iii
Acknowledgements	iv-v
Table of contents	vi-vii
List of tables	viii
List of figures	ix
List of abbreviations	x
Abstract	xi
<b>Chapter-1: Introduction</b>	<b>1-4</b>
1.1 Background	1-3
1.2 Significance of the study	3
1.3 Objectives of the study	4
<b>Chapter-2: Review of Literature</b>	<b>5-9</b>
2.1 Microplastics concentration in sea water and beach sediment	5-6
2.2 Microplastics in deep sea sediment	6
2.3 Microplastics in fresh water sediment	6-7
2.4 Microplastics in estuarine sediment	7-8
2.5 Microplastic pollution in the beach sediment of Bangladesh	8-9
<b>Chapter-3: Materials and Methods</b>	<b>10-14</b>
3.1 Study area	10-11
3.2 Sampling protocol	11
3.3 Laboratory analysis	11-14
3.3.1 Weighing and drying	12
3.3.2 Density separation-I	12
3.3.3 Wet per oxidation (WPO)	12
3.3.4 Density separation-II	13
3.3.5 Filtration	13
3.3.6 Identification of microplastics	13-14
3.3.7 Size measurement of microplastics	14

3.4 Microplastic abundance determination	14
3.5 Statistical analysis	14
<b>Chapter-4: Results</b>	15-21
4.1 Abundance of microplastics	15-17
4.1.1 Spatial variation of microplastics abundance	15
4.1.2 Seasonal differences of microplastics abundance	16-17
4.2 Physiochemical characteristics of collected microplastics	17-21
4.2.1 Type features	17-18
4.2.2 Color features	18-19
4.2.3 Shape features	19-20
4.2.4 Size features	20-21
<b>Chapter-5: Discussion</b>	22-27
5.1 Spatial variation of microplastics abundance	22-24
5.2 Seasonal differences of microplastics abundance	24
5.3 Type features	24-25
5.4 Color features	25-26
5.5 Shape features	26
5.6 Size features	26-27
<b>Chapter-6: Conclusions</b>	28
<b>Chapter-7: Recommendations</b>	29
References	30-43
Appendices	44-46
Biography	47

## LIST OF TABLES

<b>Serial No.</b>	<b>Table No.</b>	<b>Title</b>	<b>Page No.</b>
01	1	Comparison of mean abundance of beach sediment from Patenga Sea Beach, Bangladesh, with other relevant studies	23-24



## LIST OF FIGURES

<b>Serial No.</b>	<b>Figure No.</b>	<b>Title</b>	<b>Page No.</b>
01	1	Map of study area	11
02	2	Spatial variation of microplastics abundance	15
03	3	Seasonal differences of microplastics abundance among sampling sites	16
04	4	Seasonal differences of microplastics mean abundance	17
05	5	Percentage of microplastics types among sampling sites	18
06	6	Percentage of different microplastics types	18
07	7	Percentage of microplastics colors among sampling sites	19
08	8	Percentage of different microplastics colors	19
09	9	Percentage of microplastics shapes among sampling sites	20
10	10	Percentage of different microplastics shapes	20
11	11	Percentage of microplastics size range among sampling sites	21
12	12	Percentage of different microplastics size range	21

## LIST OF ABBREVIATION

<b>Words</b>	<b>Abbreviation</b>
Km <sup>2</sup>	Kilometer square
MT	Metric ton
Particles/m <sup>3</sup>	Particles per meter cube
Items/kg	Items per kilogram
Items/g	Items per gram
g/cm <sup>3</sup>	Gram per centimeter cube
Cm	Centimeter
M	Meter
cm <sup>2</sup>	Centimeter square
Mm	Millimeter
ml	Milliliter
μm	Micro meter
L	Liter
M	Molar
G	Gram
m <sup>2</sup>	Meter square
e.g.	Exempli gratia
ANOVA	Analysis of variance
UV	Ultraviolet
POPs	Persistent organic pollutant
Items/L	Items per liter
n/kg	Newton per kilogram

## ABSTRACT

The prevalence of microplastics along the coastal habitats has become a global concern owing to the increased input of plastic debris from multiple sources. This study was the first effort on the identification and characterization of microplastics, the abundance, spatial distribution, and seasonal variation of microplastics from Patenga Sea Beach sediments. A total of 72 surface sediment samples were collected from four sampling locations (Abir point and Patenga beach denoted as tourist area, Bay terminal and Charpara denoted as non-tourist area) in four seasons (Spring, Summer, Rainy, Winter) from January 2022 to December 2022. This study revealed that the microplastics abundance ranged from 4.44 to 11.81 items/kg, where Abir point had the highest abundance ( $11.81 \pm 0.87$  items/kg) and Bay terminal had the lowest ( $4.44 \pm 0.98$  items/kg). This study also showed that tourist area had higher mean abundance (11.39 items/kg) over the non-tourist area (4.06 items/kg). The findings also revealed that microplastics abundance in spring was the highest and significantly varied from winter season. Physiochemical characteristics were also measured in this study and found that fragments (53.74%) and filaments (40.92%) were the dominant types among five categories of microplastics types. Seven different colors of microplastics were observed, of which transparent (59.14%) were predominant rather than colored (40.86%), with irregular (51.94%) and elongated (40.28%) shapes were found to be predominant among six different shapes of microplastics. The majority (71.48%) of the microplastics measured were 300 to < 500  $\mu\text{m}$  in size rather than other four categories of size classes. This research provided primary information on microplastic contamination in the marine environment that policymakers might utilize to develop effective management strategies.

**Keywords:** Microplastics, beach sediment, abundance, identification, seasonal variations