



**DYNAMICS OF FISH LARVAL DIVERSITY
IN THE COX'S BAZAR COAST,
BANGLADESH: SPATIOTEMPORAL
DISTRIBUTION AND ENVIRONMENTAL
RELATION**

Antar Sarkar

Roll No.: 0122/01

Registration No.: 1115

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 affirm that I am the sole author of this thesis. Furthermore, I provide Chattogram Veterinary and Animal Sciences University (CVASU) with the permission to disseminate this thesis to other educational institutions or individuals for the purpose of scholarly research. Additionally, I grant CVASU the right to replicate the thesis, whether in full or part, through photocopying or any other means, as requested by other educational institutions or individuals engaged in scholarly research.

By appending my signature to this document, I validate that the digital version of this thesis, which has been submitted to the CVASU Library, accurately mirrors the printed edition of the thesis that I initially submitted.

June 2023

**DYNAMICS OF FISH LARVAL DIVERSITY
IN THE COX'S BAZAR COAST,
BANGLADESH: SPATIOTEMPORAL
DISTRIBUTION AND ENVIRONMENTAL
RELATION**

Antar Sarkar

Roll No.: 0122/01

Registration No.: 1115

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.

Dr. Sk. Ahmad Al Nahid
Supervisor

Mrs. Shahida Arfine Shimul
Co-supervisor

Dr. Sk. Ahmad Al Nahid
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

With gratitude and humility, all praise and thanks are offered to the Almighty, the most gracious, the most merciful, and the most benevolent. It is with his divine assistance that the author has successfully pursued his Master's course and submitted this thesis for the degree of Master of Science in Fisheries Resource Management. The author remains indebted to the Almighty for the strength and capability granted to complete both the research work and the thesis within the stipulated timeframe. The author's profound gratitude is directed towards his esteemed teacher and research supervisor, Dr. Sk Ahmad Al Nahid, Associate Professor and Head of the Department of Fisheries Resource Management at Chattogram Veterinary and Animal Sciences University (CVASU). His guidance, constructive critique, advice, and consistent motivation have been invaluable. Without his unwavering support and encouragement, this work would not have reached its fruition. His dynamic leadership, visionary outlook, and unwavering confidence have been a wellspring of inspiration and fortitude.

Special recognition is extended to Mrs. Shahida Afrine Shimul, Assistant Professor in the Department of Fisheries Resource Management, for her insightful guidance and invaluable suggestions in refining the research content. The author holds in high esteem the revered teachers and instructors at the Faculty of Fisheries, Chattogram Veterinary and Animal Sciences University, for their impactful teaching and unending encouragement throughout the academic journey. The author acknowledges the collaborative effort of Bokhteyar Hossain, the lab technician, and all members of the Aquatic Ecology Laboratory for their unwavering support during laboratory analyses. Grateful acknowledgment is extended to Md. Nazmul Hasan, Saifuddin Rana, Sabah-tuz-Zohora, Khing Khing U Marma, Sui Naing Aye Marma Milky, Kaji Mohammad Sirajum Monir, and Farhan Azim for their steadfast support during the research tenure. Lastly, the author's heart brims with appreciation for his beloved parents, Mr. Litan Sarkar and Mrs. Trisna Sarkar, for their boundless love, blessings, care, relentless efforts, earnest prayers, and unwavering support throughout his academic journey.

The Author

TABLE OF CONTENTS

Sl.	CHAPTER TITLE	PAGE NO.
	AUTHORIZATION	i
	SIGNATURE PAGE	ii
	ACKNOWLEDGEMENTS	iii
	LIST OF TABLES	vi
	LIST OF FIGURES	vi
	LIST OF PLATES	vii
	LIST OF APPENDICES	vii
	LIST OF ABBREVIATIONS	viii
	ABSTRACT	ix
01	INTRODUCTION	01-04
	1.1 Objectives of this study	
	1.2 Scopes of this study	
02	REVIEW OF LITERATURE	05-16
	2.1 Larval stage of fish	
	2.2 Importance of fish larval abundance and diversity in fisheries	
	2.3 Water quality, environment and fisheries biodiversity	
	2.4 Relation of fish larval abundance with season and area	
	2.5 Bangladesh perspective	
	2.6 Challenges and research need in fisheries biodiversity assessment and management	
03	MATERIALS AND METHODS	17-23
	3.1 Study area	
	3.2 Sampling of fish larva	
	3.3 Water quality measurement	
	3.4 Larval identification	
	3.4.1 Sorting and grouping	
	3.4.2 Morphological identification	
	3.5 Determination of larval abundance	
	3.6 Determination of the ecological indices	
	3.7 Statistical analysis and interpretation	

04	RESULT	24-37
	4.1 Larval abundance and occurrence	
	4.1.1 Station	
	4.1.2 Season	
	4.2 Relative abundance	
	4.3 Family composition	
	4.3.1 Station	
	4.3.2 Season	
	4.4 Diversity indices	
	4.4.1 Station	
	4.4.2 Season	
	4.5 Status of water quality parameters	
	4.6 Relationship of larval abundance with environmental variables	
05	DISCUSSION	38-43
	5.1 Larval abundance and occurrence	
	5.2 Family composition	
	5.3 Relative abundance	
	5.4 Diversity indices	
	5.5 Status of water quality parameters	
	5.6 Relationship of larval abundance with environmental variables	
6	CONCLUSION	44
7	RECOMMENDATION AND FUTURE PERSPECTIVES	45
	REFERENCES	46-64
	APPENDICES	65-74
	BRIEF BIOGRAPHY OF THE AUTHOR	75

LIST OF TABLES

Sl.	TITLE	PAGE NO.
1.	Seasonal variation in the mean count of fish larvae	26
2.	Larvae count (Larvae/1000m ³), abundance and family composition in the sampling stations	28
3.	Mean value and range of the water quality parameters	33

LIST OF FIGURES

Sl.	TITLE	PAGE NO.
1.	Five sampling stations of the study area	17
2.	Mean count of larva per 1000 m ³ and number of families found in each sampling station	24
3.	Season-wise comparison of total count of larvae per 1000 m ³ and number of families in each sampling station	25
4.	Relative abundance of fish larvae families in all sampling stations of the study area	27
5.	Station-wise and season-wise comparison of diversity, richness, and evenness indices; (a) Station-wise comparison and (b) Season-wise comparison	32
6.	Monthly variation of water quality variables in the sampling stations	33
7.	Canonical correspondence analysis (CCA) graph showing relationship of larval abundance with environmental variables	34

LIST OF PLATES

Sl.	TITLE	PAGE NO.
1.	Flow diagram of the research methodology	22
2.	Larvae and water sample collection and preservation	23
3.	Lab analysis, water quality assessment and larvae identification	23
4.	Identified families of fish larvae	35-37

LIST OF APPENDICES

SL.	TITLE	PAGE NO.
1.	Total scenario of larval abundance in the study area	65-71
2.	Biodiversity indices (Station)	71
3.	Biodiversity indices (Season)	72
4.	Relative abundance of 10 mostly occurring families of fish larva	72
5.	Monthly variation of water quality variables in the study area	73-74

LIST OF ABBREVIATIONS

ABBREVIATION	FULL FORM
DoF	Department of Fisheries
Kg	Kilogram
g	Gram
mg	Milligram
DO	Dissolved Oxygen
TSS	Total Suspended Solids
TDS	Total Dissolved Solids
mL	Milliliter
mm³	Millimeter Cube
ppm	Parts per Million
ppt	Parts per Thousand
SPSS	Statistical Package for the Social Sciences
°C	Degree Celsius
cm	Centimeter
Km	Kilometer
%	Percent
L	Liter

ABSTRACT

Fish larval abundance, diversity, and ecological indices along the southeast coast of Cox's Bazar were assessed at five sampling stations: Moheshkhali Para (S1), Naf River Estuary (S2), Bakkhali River Estuary (S3), Rezukhal Estuary (S4), and St. Martin (S5). Monthly sampling covered three seasons from January to December 2022. Samples were collected with a Bongo net. Water volume was determined with a flow meter and hydrological data (Temperature, pH, alkalinity, and salinity) were collected. Fish larvae were identified morphologically at the family level. The relationship between larval occurrence and environmental factors was investigated through Canonical Correspondence Analysis (CCA). A total of 3,082 larvae under 32 families were found. S2 had the most families (24), while S5 had the fewest (16). Clupeidae, Engraulidae, Gobiidae, Ambassidae, and Sillaginidae were most abundant. S3 had the highest count (40.11 ± 71.08) per 1000 m³, whereas S1 had the lowest (17.44 ± 22.17). Larval counts were greater in the monsoon and summer than in winter, and number of fish family was highest in the monsoon. S1 had the highest species richness (Margalef's index: 2.26 ± 1.26), diversity (Simpson's Index: 0.83 ± 0.09 , Shannon-Weiner Index: 1.95 ± 0.52), and evenness (Pielou's evenness index: 0.84 ± 0.01). In contrast, S5 had the lowest (1.54 ± 0.70 , 0.69 ± 0.09 , 1.47 ± 0.29 , and 0.64 ± 0.15). No significant variation ($p > 0.05$) was found in the indices among stations. Regarding seasons, Simpson's Index and Shannon-Weiner Index (H) exhibited significant variation ($p < 0.05$). Temperature, pH, total alkalinity, and salinity ranged from 22.7-32.9 °C, 6.6-8.5, 78-126 mg/L, and 15.3-37 ppt, respectively. Ambassidae and Mugillidae had positive correlations with alkalinity and pH and Engraulidae with temperature. These findings may enhance the understanding of coastal and marine fish larval research in Bangladesh.

Keywords: Fish larvae, aquatic ecology, estuary, biodiversity, management