PATTERNS OF JUVENILE REEF FISH DIVERSITY ACROSS A MANGROVE-SEAGRASS-CORAL REEF CONTINUUM IN SOUTH COAST KENYA

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A THESIS SUBMITTED TO THE SCHOOL OF APPLIED AND HEALTH SCIENCES IN THE DEPARTMENT OF ENVIRONMENT AND HEALTH SCIENCES IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF DEGREE OF MASTER OF SCIENCE IN FISHERIES AND AQUACULTURE OF TECHNICAL UNIVERSITY OF MOMBASA

2025

DECLARATION

This research is my original work and has not been submitted for examination in any other university or for any other award.

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We confirm that this research project was carried out by the candidate under our supervision and guidance.

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DEDICATION

I dedicate this thesis to God and my family: my mother, Ms. Grace Atieno; my siblings, Dr. Willis Ochieng and Ms. Janet Atieno; and my friends, Dr. Wahu Waitheru, Ms. Maorine Okeri, and Ms. Hannah Njoki Karanja for their endless support and perseverance in furthering my studies. I also dedicate this thesis to my friends for their continued encouragement during my research.

ACKNOWLEDGEMENT

My sincere thanks go to my supervisors, Prof. Cosmas Nzaka Munga and Dr. Gladys Okemwa, for their support and endless guidance from proposal development to the final production of my thesis. Special thanks to Ms. Immaculate Kinyua, Ms. Maorine Okeri, Ms. Bargitta Okoth, and Mr Joseph Kilonzi for assisting with my data collection during the field surveys. I am grateful to Kenya Marine and Fisheries Research Institute (KMFRI) for the opportunity to conduct my research under the MASMA project on Fish Juvenile Recruitment in Coastal Habitats of the Western Indian Ocean under the leadership of Dr. James Mwaluma. This MASMA project was funded by the Western Indian Ocean Marine Science Association (WIOMSA) under the MASMA research grant number MASMA/OP/202/03. Lastly, I thank Ms. Mary Mkunu, Mr. Sammy Kadhengi, and Mr. Ben Ogola for assisting me with the juvenile fish identification at the KMFRI laboratory and the Mombasa office.

ABSTRACT

Studying assemblage patterns of juvenile fishes across ecologically connected habitats is necessary for understanding connectivity. Mangroves, seagrass beds, and coral habitats are ecologically essential for the survival of juvenile fishes. These habitats are connected through various mechanisms related to larval supply, ontogenic feeding, juvenile migration, and opportunistic adult phases. A mangrove-seagrass-coral reef continuum on Kenya's south coast was investigated to assess connectivity using juvenile fish assemblages. Between August 2021 and August 2022, a beach seine was used to collect samples monthly for two days. Fish species diversity across habitats was determined using Shannon-Weiner diversity index (H'). Detrended Correspondence Analysis (DCA) was applied to investigate species associations with the three habitats. The trophic level of each fish species was obtained from FishBase. Sea surface temperature and salinity were measured monthly at each site using a YSI multi-parameter probe. Species associations with temperature and salinity were assessed using Canonical Correspondence Analysis (CCA). A total of 8,575 fish specimens representing 228 species from 52 families were recorded. The coral reef habitat had the most individuals (n = 3,186) and was the most species-rich (168 species), followed by seagrass (2,420 individuals, 132 species) and mangrove (1,783 individuals, 119 species). Significant differences in species diversity were observed across the habitats during the northeast monsoon (NEM) and the southeast monsoon (SEM) ($p = 0.026$). The Kruskall -Wallis test showed no significant differences in the mean number of individuals per haul across habitats $H (2, N = 60) = 4.81$, $p = 0.090$). It also showed no significant difference in the mean number of individuals per haul between seasons $H(1, N=60) = 2.10$, $p = 0.150$). A two-way ANOVA revealed significant differences in fish diversity across the habitats ($df = 2$; $f = 5.677$; $p = 0.006$). Pair-wise comparison using Tukey HSD test revealed differences in species diversity between the coral and mangrove habitats ($p = 0.044$), but no significant differences in species diversity between seasons ($df = 1$; $f = 0.818$; $p = 0.097$). Overall, 69 fish species were common across the three habitats. DCA results revealed a strong association of species *Pempheris mangula, Yarica hyalosoma, Pristotis obtusirostris, Taeniamia fucata*, and *Apogon fragilis* to mangrove habitat. CCA results showed a positive relationship with increased temperature in the mangrove habitat represented by *Apogon fragilis* and *Taeniamia fucata,* while species, such as *Siganus luridus* and *Sphyraena barracuda*, showed a positive relationship with increased salinity in seagrass habitat. The Kolmogorov-Smirnov (K-S) tests revealed no significant difference in trophic signatures between the mangrove and seagrass habitat ($D = 0.2308$; $p = 0.4402$), but a significant difference between the mangrove and coral habitat ($D = 0.5385$; $p = 0.00055$) as well as between the seagrass and coral habitat ($D = 0.4615$; $p = 0.004906$). This study demonstrates the existence of connectivity across a mangrove-coral-seagrass continuum in Shimoni and recommends long-term studies on nearshore habitat connectivity for better conservation and management strategies, including ecosystem-based fisheries management.

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LIST OF ABBREVIATIONS

BRUV	Baited Remote Underwater Video
CCA	Canonical Correspondence Analysis
DCA	Detrended Correspondence Analysis
DOV	Diver Operated Video
ITCZ	Inter-Tropical Convergence Zone
KeFS	Kenya Fisheries Service
KMFRI	Kenya Marine and Fisheries Research Institute
KS	Kolmogorov Smirnov
MASMA	Marine and Coastal Science for Management
NACOSTI	National Commission for Science, Technology and Innovation
NEM	Northeast monsoon
PAST	Paleontological Statistics Software Package for Education and Data Analysis
SEM	Southeast monsoon
TL	Trophic Level
TP	Trophic Positions
TUM ERC	Technical University of Mombasa Ethical Review Committee
URUV	Un-baited remote underwater video
UVC	Under Water Visual Census

WIO	Western Indian Ocean
WIOMSA	Western Indian Ocean Marine Science Association

DEFINITION OF TERMS

Ecosystem	A community consisting of biologically interacting living organisms and their physical environment.
Habitat	The natural home range for an organism or the physical surroundings around a species' population.
Juvenile Fish	Any fish that is not sexually mature.
Migratory Species	These species cyclically and predictably cross one or more national jurisdiction boundaries.
Reef Fish	Any fish species that spend time on the reef are relatively sedentary and spend their adult lives on a small part of the reef.
Trophic Composition	This refers to the overall makeup of an ecosystem. The trophic composition includes species diversity and abundance.
Trophic Guild	Refers to a species group with the same feeding habits occupying similar niches but might not be closely related.
Trophic Level	Position occupied by fish in a food chain/web.
Trophic Structure	How various organisms are grouped in an ecosystem based on their feeding relationships.