

Abstract:

The thesis presents a comprehensive overview and methodology for investigating molluscan diversity and population ecology along the South Saurashtra coast of Gujarat, India, and explores the application of selective breeding in enhancing desirable traits in agriculture. The research encompasses an extended period from February 2021 to March 2023, focusing on three distinct sites: Mangrol, Adri, and Veraval. These locations were meticulously chosen based on their unique coastal characteristics conducive to molluscan habitats, which include various intertidal zones—spray, upper, middle, and lower.

The study employed quadrat sampling to estimate species abundance and distribution, particularly focusing on four dominant species: *Cerithium caeruleum*, *Lunella coronatus*, *Peronia verruculata*, and *Trochus radiatus*. Species distribution models (SDMs) were developed using environmental data from Bio-Oracle and applied predictive mapping techniques such as Maxent, BIOMOD, Bayesian models, and Random Forest to optimize habitat suitability predictions for molluscan farming. Model training, testing, and validation were rigorously performed using cross-validation and ground-truth data to ensure accuracy.

Findings revealed significant variations in the density, abundance, and frequency of the selected species across different intertidal zones, influenced by factors such as air exposure, sunlight, tidal conditions, wave action, and environmental stressors. For instance, *Cerithium caeruleum* and *Lunella coronatus* showed notable density and abundance variations in the upper and lower intertidal zones, respectively, indicating their sensitivity to environmental conditions. In contrast, *Peronia verruculata* displayed relatively uniform density and abundance, suggesting broad environmental tolerance but some habitat selectivity.

The research also explored the reproductive biology of *Cerithium caeruleum* and *Lunella coronatus* through histological examinations of gonads across different seasons. Seasonal variations in reproductive activity were evident, with peak activity during the summer, reduced activity in winter, and transitional phases during the monsoon. These patterns underscore the significant influence of environmental factors on the reproductive strategies and ecological adaptations of these species.

Moreover, the chapter delves into the challenges and strategies for conserving and managing molluscan species in Gujarat, emphasizing the application of SDMs to predict and map their distributions. These models leverage environmental data to identify potential habitats and forecast changes in species distributions due to environmental variations, aiding in the development of targeted conservation strategies.

The integration of selective breeding principles, with a focus on genetic variation, selection pressure, and inheritance patterns, highlights its transformative impact on agriculture and human society. Advances in biotechnology, such as marker-assisted selection and genomic selection, demonstrate their contributions to precision breeding.

Overall, this chapter provides crucial insights into the population dynamics, habitat preferences, and ecological roles of marine molluscs along the South Saurashtra coast. The findings are essential for developing effective conservation and management strategies to preserve biodiversity and ensure the long-term health of marine ecosystems. The study underscores the importance of continuous monitoring and comprehensive data collection to inform sustainable resource management.

Keywords: Mollusca, diversity, distribution, population ecology, South Saurashtra coast, species distribution models (SDMs), reproductive biology.