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Endangerment Processes and Mechanisms: Examining the Impact of Environmental Changes on Species Using Ecology and Conservation Biology Theories

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Abstract This study systematically analyzes the primary drivers of species endangerment and explores the application of ecological and conservation biology theories in endangerment research. Based on island biogeography theory, metapopulation theory, and ecological niche theory, it examines the impacts of habitat fragmentation, climate change, and population decline on species survival. Furthermore, it discusses key endangerment mechanisms, including genetic diversity loss, food web disruptions, reduced reproductive success, and physiological and behavioral changes induced by environmental pressures. Using the global amphibian crisis as a case study, this study illustrates how environmental changes exacerbate species decline, summarizing the threats posed by disease, climate change, and habitat destruction to amphibian populations. Additionally, it proposes a series of mitigation strategies, including habitat restoration, captive breeding, genetic interventions, policy and regulatory frameworks, and community-based conservation approaches. This study aims to provide policymakers and conservation practitioners with systematic theoretical support and practical guidance to advance global biodiversity conservation.

Keywords Species endangerment; Habitat fragmentation; Genetic diversity; Conservation biology; Ecological connectivity

1 Introduction

The increasing rates of species extinction and biodiversity loss have become critical global concerns, necessitating a deeper understanding of the processes and mechanisms driving species endangerment. Environmental changes, driven by anthropogenic activities such as habitat alteration, climate change, and pollution, are major contributors to these threats (González-Suárez and Revilla, 2014; Ducatez and Shine, 2017; Peterson et al., 2017). The impact of these changes is not uniform across species, as different taxa exhibit varying levels of vulnerability due to intrinsic physiological and ecological traits (Bernardo et al., 2007). Understanding these differences is crucial for developing effective conservation strategies. The integration of ecological and conservation biology theories provides a comprehensive framework to assess and mitigate the risks posed by environmental changes (Bro-Jørgensen et al., 2019; Chase et al., 2020).

A robust theoretical framework is essential to systematically evaluate the complex interactions between species and their changing environments. Current conservation efforts often rely on ecological predictors without fully incorporating physiological and genetic factors that influence species' resilience to environmental stressors (Connon et al., 2018). Theories from metacommunity ecology and biophysical ecology offer valuable insights into how species interactions and environmental filtering processes affect biodiversity at multiple scales (Briscoe et al., 2022). By incorporating these theoretical perspectives, conservation biology can better predict species responses to environmental changes and identify critical thresholds for intervention.

This study aims to synthesize existing research on the endangerment processes and mechanisms affecting species, with a focus on the application of ecological and conservation biology theories, and to propose integrative approaches that enhance conservation strategies by bridging gaps between ecological, physiological, and genetic research, expecting to provide a comprehensive understanding of the multifaceted nature of species endangerment and offer actionable insights for policymakers and conservation practitioners.