3.2 Phylogenetic considerations in conservation planning

Phylogenetic diversity (PD) is increasingly recognized as a vital measure in conservation planning, offering insights into the evolutionary and functional aspects of biodiversity that are not captured by species richness alone. By incorporating phylogenetic metrics, conservation efforts can prioritize regions and species that represent significant evolutionary history, thereby preserving a broader spectrum of biodiversity. For reptiles, this approach is particularly important as they have been historically underrepresented in conservation planning.

The development of new metrics that combine PD with human pressure highlights the need to protect areas of high evolutionary significance that are under threat from anthropogenic activities (Gumbs et al., 2020). These metrics reveal that regions with high human impact often coincide with areas of irreplaceable reptilian diversity, necessitating targeted conservation actions. By focusing on phylogenetic diversity, conservation strategies can ensure the protection of evolutionary lineages that contribute to the overall resilience and adaptability of ecosystems.

3.3 Reproductive strategies and life-history evolution

Reproductive strategies and life-history evolution play a crucial role in the conservation of reptiles, as they influence population dynamics and species survival. Assisted reproductive technologies (ART) offer promising tools for preserving reptile biodiversity by capturing and storing genetic material from select individuals (Perry and Mitchell, 2021). These technologies, including artificial insemination and genome resource banking, can help overcome natural and anthropogenic barriers to reproduction, thereby enhancing conservation efforts.

Furthermore, the study of squamate reptiles, which include lizards and snakes, reveals how ecological and developmental factors have driven their cranial evolution and diversification (Watanabe et al., 2019). The shared pattern of trait integration among these species suggests that selection has acted on conserved phenotypic architectures, allowing for diverse reproductive and life-history strategies. Understanding these evolutionary processes is essential for developing effective conservation plans that account for the unique reproductive adaptations of different reptile species.

3.4 The role of natural selection in population resilience

Natural selection plays a pivotal role in enhancing the resilience of reptile populations by driving adaptations that improve survival and reproduction in changing environments. The integration of genetic, physiological, and morphological data in studies of desert adaptation in reptiles, such as the Liolaemus fuscus, illustrates how natural selection shapes traits that are critical for coping with environmental challenges (Araya-Donoso et al., 2021). These adaptations, including reduced water loss and morphological changes, are vital for the persistence of species in arid habitats.

Moreover, the application of evolutionary principles in conservation strategies, such as selective breeding and the introduction of adaptive variants, can bolster population resilience (Pabijan et al., 2020). By leveraging natural selection, conservationists can enhance the adaptive capacity of reptile populations, increasing their chances of survival in the face of rapid environmental changes. This approach underscores the importance of considering evolutionary processes in conservation planning to ensure the long-term viability of reptile species.

4 Threats to Reptile Populations

4.1 Habitat destruction and fragmentation

Habitat destruction and fragmentation are significant threats to reptile populations worldwide. Urbanization and agricultural expansion lead to the loss of native vegetation, which is crucial for the survival of many reptile species. Reptiles are particularly sensitive to changes in landscape structure due to their limited dispersal abilities and reliance on specific habitat types (Delaney et al., 2021; Mulhall et al., 2022). The fragmentation of habitats can result in isolated populations, reducing genetic diversity and increasing the risk of local extinctions. In coastal regions, reptiles face additional pressures from coastal development, which further degrades their habitats.