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CHAPTER 9

Technical report on the herpetofauna of Peninsular Malaysia

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Abstract: This technical report summarises the current taxonomy and IUCN Red List conservation status of amphibians, lizards and snakes in Peninsular Malaysia. Chelonians and crocodilians are not covered. The total fauna assessed comprises 430 species, and the report highlights that lizards face the most severe threat levels, with a high percentage of species at elevated risk, followed by amphibians, while snakes currently show the lowest overall threat proportion. A critical finding is that 10 species are critically endangered across all three groups, requiring immediate intervention, while a large number of species, particularly amphibians, are data deficient or not evaluated. Priority recommendations emphasise habitat protection, increased research to reduce knowledge gaps, and emergency action for the most imperilled species.

INTRODUCTION

Peninsular Malaysia harbours exceptional herpetofaunal diversity, reflecting the region's tropical climate, diverse topography, and varied habitats spanning lowland rainforests to montane environments. This report provides a comprehensive assessment of the region's amphibians, lizards, and snakes based on current taxonomic knowledge and IUCN Red List conservation status data (Figure 1). The analysis examines species richness, family-level composition, threat status, and conservation priorities to guide effective biodiversity management and research efforts. Understanding the conservation status of these groups is critical, as herpetofauna serve as indicators of ecosystem health, contribute to essential ecological processes including pest control and nutrient cycling (Hocking and Babbitt 2014), and represent unique evolutionary lineages of global significance.

DIVERSITY AND STATUS OF AMPHIBIANS

The amphibian fauna of Peninsular Malaysia comprises 121 species distributed across seven families. The fauna is dominated by frogs and toads (anurans), with only a few caecilians (gymnophionans). The amphibian fauna shows relatively balanced family-level diversity (Table 1).

Table 1. Family-level composition of Amphibia in Peninsular Malaysia.

Family	Number of Species	Percentage (%)
Microhylidae	25	20.7
Rhacophoridae	21	17.4
Dicroglossidae	21	17.4
Bufonidae	19	15.7
Ranidae	18	14.9
Megophryidae	11	9.1
Ichthyophiidae	6	5.0

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This taxonomic composition reflects diverse ecological adaptations (Chan *et al.* 2010; Das *et al.* 2011; Ahmad 2017; Matsui 2019). Microhylids include many fossorial and terrestrial species associated with leaf litter and rotting logs. Rhacophorids are predominantly arboreal, with many species exhibiting foam nest construction and specialised reproductive behaviour. Dicroglossids and ranids occupy a range of aquatic and semi-aquatic habitats, from fast-flowing streams to stagnant ponds. Bufonids are largely terrestrial with explosive breeding aggregations at temporary water bodies. Megophryids are commonly associated with montane and submontane forest streams, often showing remarkable cryptic morphology. Caecilians (Ichthyophiidae) are fossorial, inhabiting moist soil and leaf litter in primary forests (Nishikawa *et al*. 2012).

Of the 121 amphibian species, 103 species (85.1%) have been formally assessed under IUCN Red List criteria, while 18 species (14.9%) are classified as Not Evaluated (NE) (IUCN 2025; Table 2). This relatively high assessment coverage provides a reasonably comprehensive understanding of conservation status, though the unassessed species require evaluation.

The majority of assessed amphibian species (69 species, 57.0%) are classified as being of least concern (LC). However, nine species (7.4%) are threatened, distributed across critically endangered (CR; n = 2; 1.7%), endangered (EN; n = 3; 2.5%), and vulnerable (VU; n = 4; 3.3%) categories (Table 2). An additional 8 species (6.6%) are near threatened, bringing the total number of species at elevated conservation risk to 17 (14.0% of the fauna).

Table 2. IUCN conservation status of the amphibians in Peninsular Malaysia.

IUCN Category	Number of Species	Percentage (%)
Least Concern (LC)	69	57.0
Not Evaluated (NE)	18	14.9
Data Deficient (DD)	17	14.0
Near Threatened (NT)	8	6.6
Vulnerable (VU)	4	3.3
Endangered (EN)	3	2.5
Critically Endangered (CR)	2	1.7

Conservation issues and knowledge gaps

A substantial proportion of species face knowledge gaps. Seventeen species (14.0%) are classified as data deficient, indicating insufficient information to properly assess extinction risk. Additionally, 18 species (14.9%) remain not evaluated under IUCN criteria. Combined, these 35 species (28.9% of the fauna) have uncertain conservation status, representing a major impediment to effective conservation planning. This high proportion of species with unknown status is concerning given that amphibians globally face severe threats from habitat loss, disease (particularly chytridiomycosis), and climate change.

The nine threatened amphibian species face multiple synergistic threats. Amphibians are particularly vulnerable to environmental changes due to their permeable skin, biphasic life cycles requiring both aquatic and terrestrial habitats, and limited dispersal abilities. The two critically endangered species (*Leptobrachella kecil* and *Kalophrynus yongi*) require immediate conservation intervention to prevent extinction. Priority actions include surveys to determine current population status, identification and protection of critical breeding sites, captive assurance colonies where appropriate, and disease monitoring programmes. For species classified as data deficient or not evaluated, targeted surveys focusing on taxonomic clarification and distribution mapping are essential to enable proper threat assessment.

DIVERSITY AND STATUS OF LIZARDS

The lizards of Peninsular Malaysia comprises 168 species distributed across eight families (Grismer 2011; Uetz 2025). This substantial diversity reflects the region's tropical biogeography and habitat heterogeneity, encompassing lowland rainforests, montane environments, limestone karst formations, and disturbed habitats. The distribution of species across the eight families is shown in Table 3.

Table 3. Family-level composition of Lacertilia in Peninsular Malaysia.

Family	Number of Species	Percentage (%)
Gekkonidae	82	48.8
Scincidae	42	25.0
Agamidae	33	19.6
Varanidae	4	2.4
Dibamidae	3	1.8
Leiolepididae	2	1.2
Eublepharidae	1	0.6
Lacertidae	1	0.6

The dominance of Gekkonidae, Scincidae, and Agamidae is characteristic of Southeast Asian lizard assemblages. Geckos exhibit remarkable ecological diversity, occupying arboreal, saxicolous, and terrestrial niches, with many species showing high degrees of microhabitat specialization and nocturnal activity patterns. Skinks are primarily terrestrial and fossorial, with several lineages adapted to leaf litter and subterranean environments. Agamids are largely diurnal and include both arboreal and terrestrial species, with several exhibiting elaborate social behaviors and color displays. The substantial representation of these families underscores their evolutionary success in the region's humid tropical conditions.

Of the 168 lizard species recorded from Peninsular Malaysia, 153 species (91.1%) have been formally assessed under the IUCN Red List criteria, while 15 species (8.9%) remain unassessed (Table 4). This high assessment coverage provides a comprehensive picture of the conservation status of the fauna, though the unassessed species warrant priority attention for future evaluation. The assessment reveals a concerning conservation picture for Peninsular Malaysia's lizard fauna. More species face a significantly higher proportion of threat than many other regional reptile faunas.

Table 4. IUCN conservation status of the lacertilians in Peninsular Malaysia.

IUCN Category	Number of Species	Percentage (%)
Least Concern (LC)	99	58.9
Not Evaluated (NE)	17	10.1
Data Deficient (DD)	15	8.9
Near Threatened (NT)	12	7.1
Vulnerable (VU)	12	7.1
Endangered (EN)	7	4.2
Critically Endangered (CR)	6	3.6

An additional 12 species (7.1%) are classified as near threatened (NT), indicating they are approaching threatened status or may qualify in the near future if current trends continue. When threatened and near-threatened categories are combined, 37 species (22.0% of the total fauna) are at elevated conservation risk. This proportion is substantially higher

than global reptile extinction risk patterns and represents a major conservation concern requiring urgent management intervention. The presence of six critically endangered species is particularly alarming, as these taxa face an extremely high risk of extinction in the wild. These species have severely restricted ranges and face acute habitat loss, requiring immediate conservation action to prevent extinction.

Seventeen species (10.1%) are classified as data deficient (DD), representing a significant knowledge gap in understanding the conservation status of the fauna. This designation indicates insufficient information to assess extinction risk, typically reflecting limited knowledge of species distributions, population trends, ecological requirements, or unresolved taxonomic uncertainties. The relatively high proportion of DD species is concerning because it may mask additional species at genuine extinction risk that cannot be identified without further data collection. These DD species should be prioritised for targeted field surveys, population studies, and taxonomic research to enable proper conservation assessment. Given the high proportion of threatened species already identified in the assessed fauna (16.3% of assessed species are threatened), it is plausible that several DD species may also be at risk once adequate data become available.

Fifteen species (8.9%) have not yet been assessed under IUCN Red List criteria. This gap in assessment coverage may reflect recently described species, recent taxonomic revisions splitting formerly recognised species, or species with poorly documented distributions. Given the ongoing discovery of cryptic diversity in Southeast Asian reptile faunas through molecular systematic techniques, some unassessed species may represent recently recognised taxa requiring urgent evaluation. A concerted effort to assess these 15 species would complete the conservation evaluation of Peninsular Malaysia's lizard fauna and enable more comprehensive conservation planning. Priority should be given to species with restricted distributions or those occurring in threatened habitats.

The 25 formally threatened species (14.9% of the fauna) represent the highest conservation priorities. The severity of threat is particularly concerning given the presence of six critically endangered (*Pseudocalotes flavigula*, *P. rhaegal*, *Cyrtodactylus jarakensis*, *C. guakanthanensis*, *Cnemaspis temiah*, *Larutia penangensis*) and seven endangered species (*Acanthosaura titiwangsaensis*, *Dibamus tiomanensis*, *Cyrtodactylus pulchellus*, *C. sworderi*, *C. trilatofasciatus*, *Hemiphyllodactylus titiwangsaensis*, and *Sphenomorphus cameronicus*). Effective conservation of threatened species requires immediate implementation of species-specific recovery plans incorporating habitat protection and restoration, population monitoring programmes, threat mitigation measures, and where appropriate, *ex situ* conservation in captive breeding facilities. The six critically endangered species require emergency intervention to prevent extinction. Near-threatened species should be monitored closely with proactive management to prevent further decline into threatened categories.

DIVERSITY AND STATUS OF SNAKES

The snake fauna of Peninsular Malaysia comprises 141 species distributed across 14 families (Table 5). The fauna includes representatives of all major snake lineages, from primitive burrowing snakes to highly derived venomous species.

Colubridae is overwhelmingly dominant, representing 83 species (58.9%) and encompassing the majority of snake diversity in the region. This family includes diverse ecological types from terrestrial to arboreal, fossorial, and semi-aquatic species, with varied feeding ecologies. Homalopsidae (mud snakes and water snakes) contributes 13 species (9.2%), all aquatic or semi-aquatic specialists. Elapidae (cobras, kraits, and coral snakes)

comprises 11 highly venomous species (7.8%), while Viperidae (pit vipers) accounts for ten venomous species (7.1%). Pareidae (slug snakes) is represented by seven specialised mollusk-eating species (5.0%), and Typhlopidae (blind snakes) includes six fossorial species (4.3%). The remaining eight families are represented by one or two species each, collectively accounting for 8.5% of the fauna.

Table 5. Family-level composition of Serpentine in Peninsular Malaysia.

Family	Number of Species	Percentage (%)
Colubridae	83	58.9
Homalopsidae	13	9.2
Elapidae	11	7.8
Viperidae	10	7.1
Pareidae	7	5.0
Typhlopidae	6	4.3
Pythonidae	2	1.4
Lamprophiidae	2	1.4
Acrochordidae	2	1.4
Anomochilidae	1	0.7
Cylindrophiidae	1	0.7
Xenodermidae	1	0.7
Xenopeltidae	1	0.7
Xenophidiidae	1	0.7

This taxonomic composition reflects remarkable ecological diversity. Colubrids occupy virtually all available niches from fossorial to highly arboreal, with specialised feeding ranging from generalist predators to specialists on frogs, lizards, birds, mammals, or eggs. Homalopsids are obligately aquatic, feeding primarily on fish and amphibians. Elapids and viperids are important predators of small mammals, birds, and reptiles, with sophisticated venom delivery systems. Pareids represent a unique evolutionary radiation of mollusk specialists. Typhlopids are fossorial, feeding primarily on ant and termite larvae. The presence of pythons, file snakes (Acrochordidae), and various primitive snake families highlights the region's significance for snake evolution and phylogenetic diversity.

Nearly all snake species (135 species, 95.7%) have been formally assessed under the IUCN Red List criteria, with only six species unassessed (based on their absence from evaluated categories). This exceptionally high level of assessment coverage provides comprehensive understanding of the conservation status of the snake fauna. The snake fauna shows a more favorable conservation status compared to amphibians and lizards. The majority of snakes (120 species, 85.1%) are classified as Least Concern. Only six species (4.3%) are threatened, comprising two Critically Endangered (1.4%) and four Vulnerable (2.8%) species. Notably, no species are currently classified as Endangered. An additional species is classified as Near Threatened, bringing the total number at elevated conservation risk to seven species (5.0% of the fauna).

Table 6. IUCN conservation status of the snakes in Peninsular Malaysia.

IUCN Category	Number of Species	Percentage (%)
Least Concern (LC)	120	85.1
Not Evaluated (NE)	8	5.7
Data Deficient (DD)	6	4.3
Near Threatened (NT)	4	2.8
Vulnerable (VU)	2	1.4
Endangered (EN)	1	0.7
Critically Endangered (CR)	0	0.0

The relatively low proportion of threatened snake species (4.3%) contrasts markedly with lizards (14.9%) and amphibians (7.4%), suggesting that snakes may be more resilient to habitat modification or face different threat profiles. However, this apparent resilience should not lead to complacency, as snake populations are harder to sample or may decline more slowly than other taxa, masking emerging conservation problems. Eight species (5.7%) are classified as data deficient, a relatively low proportion compared to amphibians (14.0%) and lizards (10.1%). These species likely have poorly documented distributions, uncertain taxonomic status, or insufficient population data. Priority should be given to resolving these knowledge gaps through targeted surveys and taxonomic research.

The six threatened snake species, while few in number, require conservation attention. The presence of two critically endangered species (*Gongylosoma mukutense* and *Oligodon booliati*) indicates that some taxa are at extreme risk of extinction and require immediate conservation action including population surveys, habitat protection, and threat mitigation. Given the low detection probability of many snake species (due to cryptic behavior, nocturnal activity, and low population densities), regular monitoring programmes using standardised protocols are essential to track population trends. Public education to reduce persecution of non-venomous species and promote coexistence with venomous species is also critical.

COMPARATIVE ANALYSIS

Species richness and assessment coverage

Comparing the three major herpetofaunal groups reveals important patterns. Lizards exhibit the highest species richness (S = 168), followed by snakes (S = 141) and amphibians (S = 121) (Figure 1 and Table 7). Assessment coverage is highest for snakes (95.7%), followed by lizards (91.1%) and amphibians (85.1%). The comprehensive assessment coverage across all groups provides a robust foundation for conservation planning.

Table 7. Conservation status comparison.

Taxon	Total Species	Threatened (%)	At Risk (%)	Data Deficient / Not Evaluated(%)
Amphibians	121	14.0	14.0	28.9
Lizards	168	22.0	22.0	19.0
Snakes	141	5.0	5.0	5.7

The differential threat profiles likely reflect differences in ecological vulnerability and threat exposure. Lizards, with many species, endemic to specific mountain ranges or limestone karst formations, often have restricted ranges making them highly vulnerable to localized habitat loss. Many lizard species are also diurnal and conspicuous, increasing vulnerability to collection for the pet trade. Amphibians face unique threats from emerging infectious diseases and are highly sensitive to changes in moisture and temperature regimes. Snakes may be more resilient to moderate habitat modification and some can persist in agricultural landscapes, though they face persecution pressures.

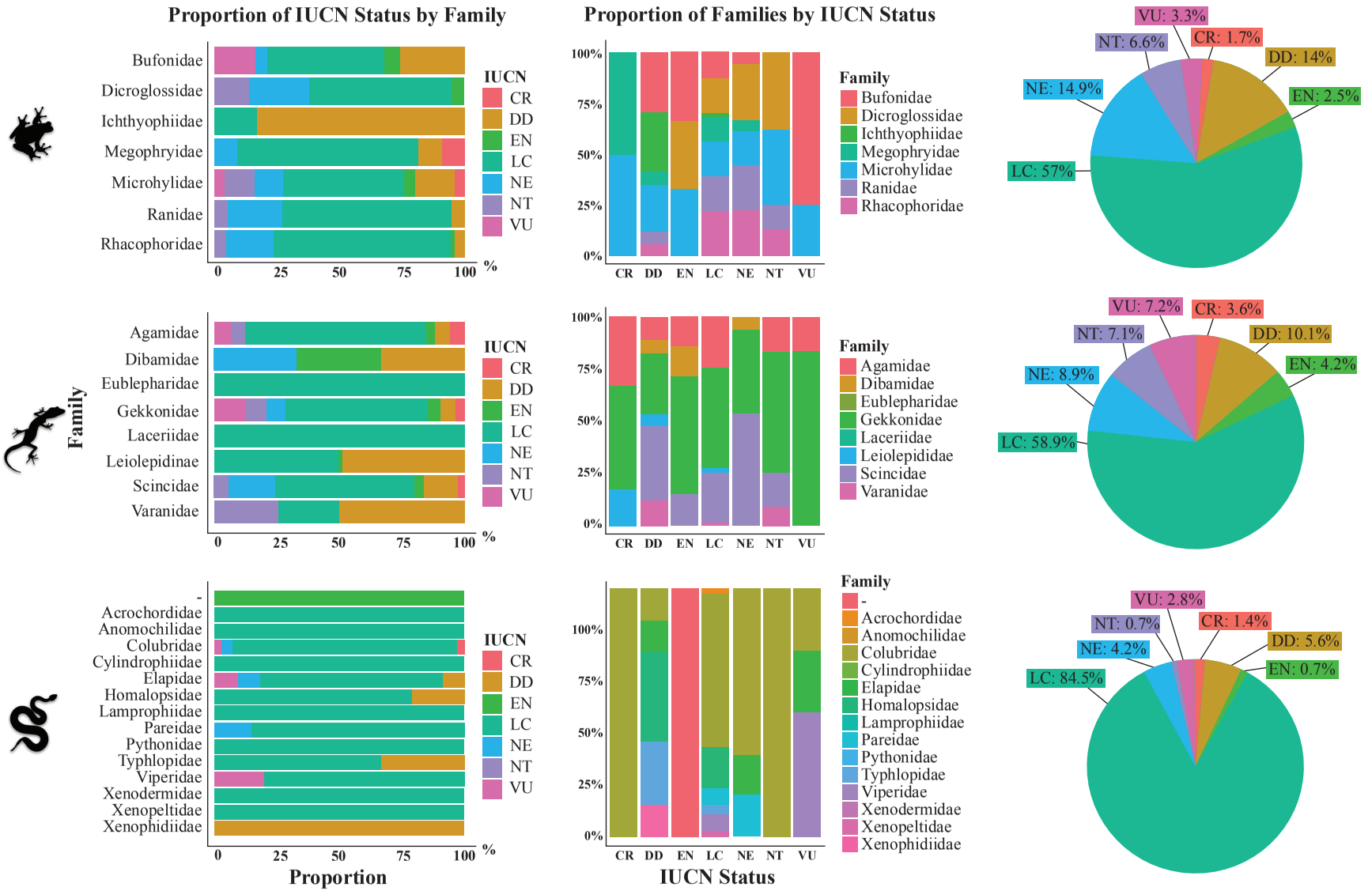

Figure 1. Comparative analysis of IUCN conservation status across the three major herpetofauna groups in Peninsular Malaysia.

CONCLUSION AND RECOMMENDATIONS

The herpetofauna of Peninsular Malaysia exhibits exceptional diversity, with 430 species comprising 121 amphibians across seven families, 168 lizards across eight families, and 141 snakes across 14 families. However, conservation status assessments reveal significant concerns, particularly for lizards where 14.9% are threatened and 22.0% are at elevated risk. Across all three groups, 40 species are formally threatened (9.3% of the total fauna), including ten critically endangered species facing imminent extinction risk. The presence of critically endangered species in all three taxonomic groups (two amphibians, six lizards, and two snakes) indicates that immediate emergency intervention is required to prevent extinctions. Additionally, substantial knowledge gaps persist, particularly for amphibians where nearly 29% of species have uncertain conservation status. These gaps hinder comprehensive conservation planning and may mask additional threatened species. The primary threats driving population declines are habitat loss and degradation from deforestation and agricultural expansion, direct persecution (particularly of snakes), collection for international trade, emerging infectious diseases (amphibians), and climate change impacts. Many threatened species are range-restricted endemics associated with specialised habitats such as montane forests or limestone karst, making them particularly vulnerable to localised threats.

Priority recommendations

Emergency intervention for Critically Endangered species

The ten CR species (two amphibians, six lizards, and two snakes) require immediate action including population surveys, habitat protection, threat assessment, and development of emergency recovery plans. *Ex situ* conservation measures should be considered for the most imperiled taxa to prevent further population declines and potential extinction.

Habitat protection and restoration

Expand and improve management of protected areas to encompass critical habitats for threatened species. Priority should be given to the protection and restoration of primary forests, montane environments, limestone karst systems, and wetlands. Ecological corridors should be established and maintained to enhance connectivity between isolated populations and facilitate species movement across fragmented landscapes.

Resolution of knowledge gaps

Systematic assessment of the 60 species (14% of fauna) with uncertain conservation status (DD or NE) should be undertaken to address the knowledge gaps. Modern survey techniques should be incorporated to improve the detection of rare and elusive species. This includes the use of environmental DNA. Priority should be given to species with restricted distributions or those occurring in threatened habitats.

Species-specific recovery plans

Develop and implement recovery plans for all 40 threatened species, incorporating population monitoring, threat mitigation, habitat management, and adaptive management strategies. Priority actions should be identified to support the population recovery and ensure the long-term survival of these species.

Disease surveillance for amphibians

Amphibians are particularly vulnerable to diseases such as chytridiomycosis and ranavirus, thus requiring monitoring programmes to be implemented to control disease outbreaks. Disease-free assurance populations should be established, especially for threatened species, alongside research on disease ecology, transmission, and management.

Reduction of human-wildlife conflict
Species affected by human-wildlife conflict, such as snakes, require targeted interventions, including public education programmes to reduce the persecution of snakes and promote coexistence with venomous species. Rescue and relocation programmes should be established and managed in urban areas.

Climate change adaptation
Climate vulnerability assessments should be conducted for threatened and range-restricted species to identify those most at risk from changing environmental condition. Priority should be given to the identification and protection of climate refugia, while ecological corridors shold be established to facilitate range shifts.

Trade regulation and enforcement
Species vulnerable to collection and trade require strengthened protection through enhanced monitoring and enforcement of wildlife trade regulations. Increased penalties for illegal collection should be considered to deter collection of these species. Populations of species targeted by collectors need to be regularly monitored.

Long-term monitoring programmes
All three taxa require long-term monitoring programmes to track the population trends. Standardised monitoring protocols should be established at representative sites spanning elevational and habitat gradients to ensure consistent assessment over time for more robust tracking of their populations.

Capacity building and community engagement
Effective conservation of herpetofauna requires increased capacity and public participation. More herpetologists should be trained in survey and conservation techniques. Accurate and informative identification guides can be developed to aid in the monitoring of herpetofauna populations. Local communities should also be engaged through citizen science and economic incentive programmes.

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