

REPRESENTATION OF THREATENED VERTEBRATES BY A PROTECTED AREA SYSTEM IN SOUTHEAST ASIA: THE IMPORTANCE OF NON-FOREST HABITATS

Naruemon Tantipisanuh

*Conservation Ecology Program, School of Bioresources and Technology
King Mongkut's University of Technology Thonburi, Bangkok, 10150, Thailand
Email: ttpisanu@gmail.com (Corresponding author)*

George A. Gale

*Conservation Ecology Program, School of Bioresources and Technology
King Mongkut's University of Technology Thonburi, Bangkok, 10150, Thailand
Email: george.and@kmutt.ac.th*

ABSTRACT. — Many of the protected area systems in newly developed countries are established on an ad hoc basis and as such may not be sufficiently representative to protect significant portions of their threatened biota. Thailand has one of the most extensive protected area systems in Southeast Asia, a region with particularly high levels of habitat destruction, but the representation of even this system has not been assessed for threatened species. This study assessed the representation of near-threatened and threatened species of terrestrial vertebrates using habitat type as a surrogate (i.e., how well these species were represented by Thailand's current protected area system). Habitat use data of potential focal species was reviewed from 286 original survey publications and other primary data sources. For each major habitat type, we calculated representation indices and the degree of representation. These indices were then used to evaluate the degree of representation of 505 focal species. Several habitats are underrepresented by the current protected area system including lowland mixed deciduous forest (below 200 m), dry dipterocarp forest, mangrove forest, swamp forest, grassland & shrub habitat, wetlands, salt flats, freshwater habitat, and beach habitat, indicating that the current protected area system is heavily biased toward a few specific habitat types, resulting in the underrepresentation of 229 near-threatened and threatened species which 128 of them were globally threatened. Evergreen forest was the most widely used habitat for all taxa. The second-most used was freshwater habitats for amphibians, reptiles and birds, as well as mixed deciduous forest for mammals. Approximately 13% of the threatened vertebrates were restricted to non-forest habitats (e.g., open wetlands, beaches, salt flats, etc.), while another 32% could utilise both forest and non-forest habitats. Near-threatened and threatened species utilising non-forest habitats are the least represented by Thailand's protected area system, and highly likely to be underrepresented by all other protected areas in Southeast Asia.

KEY WORDS. — conservation planning, gap analysis, representation targets, degree of representation

INTRODUCTION

The use of officially designated government-protected areas as a tool to manage biodiversity has been applied worldwide because of their ability to reduce threats within their boundaries (Balmford et al., 1995; Bruner et al., 2001; Andam et al., 2008). In the past, the designation of protected areas was usually biased towards areas with low economic value or limited development potential (e.g., areas with less-productive soils or steep topography), meaning that productive areas with higher biodiversity were often unprotected (Pressey et al., 1993; Margules & Pressey, 2000; Oldfield et al., 2004; Rodrigues et al., 2004a). An assessment of the current status of global protected areas indicated that total terrestrial protected

areas worldwide approached 12% (Brooks et al., 2004) surpassing the 10% target proposed at the fourth World Congress on National Parks and Protected Areas (McNeely, 1993). However, the coverage varied substantially among bioregions from 5% of temperate grasslands, savannas, and shrublands to 25% of temperate coniferous forests (Brooks et al., 2004). Moreover, from a sample of 11,633 bird, mammal, amphibian, and turtle species worldwide, at least 1,424 species (12.2%) were not covered by any protected area, indicating that the coverage of many protected area systems was still inadequate (Brooks et al., 2004; Rodrigues et al., 2004a).

Although Southeast Asia's protected area system covers approximately 13.8% of the land (IUCN & UNEP-WCMC,

2011), the biodiversity of this region is under particular threat, with the highest annual deforestation rate (about 1.5% between 2000 and 2005) and the highest proportion of threatened vertebrates (except amphibians) among all tropical regions (Sodhi et al., 2010). In order to increase the representation of the region's protected area systems, we need to know first what or where the gaps in the current network are. Gap analysis is an approach used to identify 'gaps' in the coverage of an existing protected area system (Jennings, 2000; Possingham et al., 2006). A gap can be either species or communities which are underrepresented or not represented in the existing conservation network system. This approach has been applied in multiple countries and sites (e.g., Oldfield et al., 2004; Rodrigue et al., 2004b, Catullo et al., 2008).

Several techniques have been developed to determine representation targets. The most basic approach is the use of an arbitrary level such as 10% or 12% (e.g., Nicholls & Margules, 1993; Wright et al., 1994; Sierra et al., 2002). However, these levels are more likely to be due to political expediency while targets based on ecological knowledge are likely to be much higher (Soule & Sanjayan, 1998). Another technique which might be more appropriate is to set the representation targets according to the extent of occurrences (e.g., Rodrigues et al., 2004b; Catullo et al., 2008). The target for features with smaller occurrence extents will be higher than features with larger extents. However, since each feature faces different threats and requires different levels of protection, determining targets from occurrence extents alone might not be sufficient.

Thailand has an extensive protected area system covering 20% of its land surface, the second most extensive system in the region (IUCN & UNEP-WCMC, 2011), beginning with the designation of Khao Yai National Park in 1962. Even though the percentage of protected area coverage is quite high, it is likely that Thailand also suffers from protected area designation bias. Most of the protected areas in Thailand were either national parks (58% of total protected area) or wildlife sanctuaries (36%) in which their main objectives were to protect areas with beautiful scenery for recreational use (national parks) or areas with perceived levels of high biodiversity (wildlife sanctuaries). Consequently, most designated areas were located in forest areas far from human settlements, while most lowland and non-forest areas were already occupied by humans.

The first gap analysis in Thailand was performed using a comparison index (Trisurat, 2007). The author measured representation in three dimensions: forest type, elevation and natural land system (a combination between forest type and elevation). While five forest types (dry evergreen forest, moist evergreen forest, hill evergreen forest, bamboo forest and pine forest) were well represented, two (mangrove forest and inundated forest) were extremely underrepresented. Likewise, the coverage of protected areas at elevations above 400 m was much greater than below 400 m. Although an important baseline study, Trisurat (2007) did not evaluate which species might be underrepresented nor was there an

examination of non-forest (e.g., open wetlands, beaches, salt flats, etc.) habitats.

This paper identifies gaps in Thailand's protected area system including both forest and non-forest habitats as well as four groups of terrestrial vertebrate species as focal groups. Two hypotheses are tested: (1) non-forest habitats (i.e., habitats outside the forest) are utilised by a significant proportion of Thailand's threatened species; and (2) a significant proportion of threatened species (particularly those occurring in non-forest habitats and lowland forests) are underrepresented by the current protected area system.

MATERIAL AND METHODS

Data sources. — The four focal species groups found in Thailand used in the gap analysis were amphibians, reptiles, birds and mammals categorised as near-threatened or threatened (vulnerable, endangered, critically endangered) by (1) the International Union for Conservation of Nature (IUCN) Red List (IUCN, 2010); or (2) the Office of Natural Resources and Environmental Policy and Planning (ONEP) of Thailand (Nabhitabhata & Chan-ard, 2005; Sanguansombat, 2005). The first source provided a list of species that are globally threatened, while the second source listed the species threatened in Thailand. However, we did not include species which are nationally threatened solely due to their natural range occurring almost entirely outside of Thailand.

In total, 505 species from four taxa were included in this study (38 species of amphibians, 77 reptiles, 275 birds, and 115 mammals). Among these, 257 species were globally threatened (17 species of amphibians, 20 reptiles, 145 birds and 75 mammals), 12 species were categorised by IUCN as data deficient but were nationally threatened (two species of amphibians, four reptiles and six mammals), and 52 species were nationally threatened, but not included in the IUCN Red List with the vast majority of these being reptiles (48 species), along with three birds, and one amphibian.

The habitat use data of the focal species employed in this gap analysis was derived from books and papers published in Thailand and elsewhere. The list of references used for each focal species was included in the Appendix. Among these focal species, there were 219 species (43%) with less than five references available for review. These included 28 species of amphibians (74%), 53 reptiles (69%), 82 birds (30%), and 56 mammals (50%). It is worth noting that the habitat-use data available for most of the amphibians, reptiles and small mammals come from highly localised surveys unlike the typically broadscale coverage for birds and large mammals.

The habitat types identified from the data sources, and which, were used in the gap analysis included evergreen forest, mixed deciduous forest, dry dipterocarp forest, mangrove forest, swamp forest, bamboo forest, grassland and shrub habitat, wetlands, salt flats, freshwater habitat, beach habitat, and two special habitat features (waterfalls

and limestone caves). Spatial maps of these habitat types were developed using the following sources: (1) land-use maps developed in 2000 and provided by the Department of National Parks, Wildlife and Plant Conservation (DNP); (2) land-use maps developed in 2008–2009 and provided by the Land Development Department (LDD); (3) cave location maps sourced from <http://www.thailandcaves.shepton.org>; (4) limestone maps from the Department of Mineral Resources (DMR); (5) ASTER Global Digital Elevation Model (GDEM) downloaded from the Earth Remote Sensing Data Analysis Center (<http://www.ersdac.or.jp>); and (6) protected area maps provided by the DNP. For the land-use maps provided by DNP and LDD, neither agency performed formal, quantified accuracy assessments for the final versions of the maps; however, ground checking by government officials is conducted routinely during the map production process.

Development of habitat GIS layers. — We used ArcGIS 9.3 to produce the habitat maps. All data was reprojected to the WGS 84 datum. Spatial layers of the forest habitat types listed in Table 1 were derived from the DNP landuse map. The grassland and shrub habitat, salt flats, freshwater habitat, and beach habitat layers were derived from the LDD landuse map. The limestone cave layer was created from the geographic intersection between the cave layer and limestone bedrock areas. The waterfall layer was created from the intersection between freshwater habitats and areas with slopes greater than 15 degrees. This 15 degree value was approximated from known waterfall locations. Elevation data was derived from the ASTER GDEM.

Gap analysis (habitat). — We used ArcGIS 9.3 to intersect the forest and non-forest habitat layers with the protected area layer to determine the percentage of each habitat that fell within the boundaries of the protected area system. The representation targets of all habitats were then set to define the minimum area which should be protected. We set the representation target at 100% for habitats with total areas smaller than 1,000 km² (Rodrigues et al., 2004b) as partial protection (target less than 100%) might not be sufficient to maintain animal populations and ecological processes within these habitats. Representation targets for habitat types with larger total areas were calculated from the summation of baseline and retention targets (Pressey et al., 2003).

The baseline target (B) was determined by the level of heterogeneity of each habitat. Habitats with greater heterogeneity need larger targets to represent environmental differences and geographic variation (Pressey et al., 2003). B was calculated as (equation 1):

$$B = \frac{b * A}{100} \quad (\text{eq. 1})$$

where A is the total area (km²) and b is the heterogeneity coefficient. The heterogeneity coefficient in this study was defined from the species richness and was set to 10 for habitats with a focal species richness less than 10 for the entire habitat, 15 for a richness between 10–40, 20 for a richness between 40–80, 25 for a richness between 80–120,

and 30 for a species richness higher than 120, analogous to Pressey et al. (2003).

The retention target (R) was determined by the degree of alteration opportunity (the risk that habitats would be altered in the near future). Habitats with a higher chance to be transformed require larger targets to ensure the persistence of biodiversity. R was calculated as (equation 2):

$$R = \frac{t * A}{100} \quad (\text{eq. 2})$$

where A is the total area (km²) and t is the threat weight. The threat weight was based on the threat intensity which was elicited from eleven experts via a questionnaire. The term t was set to 10 for habitats with very low threat intensity, 15 for low intensity, 20 for moderate, 25 for high, and 30 for habitats with very high threat intensity similar to Pressey et al. (2003). We did not attempt to estimate a specific alteration rate for each threat level.

The representation index (RI) for each habitat type was calculated as the percentage of area which currently falls inside the protected area system divided by the representation target of that habitat type. The representation degree of each habitat was considered low for habitats with a RI less than 0.9 (i.e., less than 90% of the target), medium when RI was between 0.9 and 1.1, and high when the RI was higher than 1.1.

For forest habitats with high degrees of representation, we intersected their layers with six elevation ranges: 0–200 m, 200–600 m, 600–1000 m, 1000–1500 m, 1500–2000 m, and above 2000 m because representation at different elevations might vary considerably. Degrees of representation of habitats at different elevation ranges were recalculated using the above procedures.

Species representation. — It was assumed that species utilising habitats with a high degree of representation within protected areas would receive higher protection than species utilising habitats with low representation. The representation score (RS) of each species was therefore calculated according to their relative habitat use (equation 3):

$$RS = \frac{(L' * 1) + (M' * 4) + (H' * 7) + F * \left[\frac{(L' * 1) + (M' * 4) + (H' * 7)}{L' + M' + H'} \right]}{L + M + H + F} \quad (\text{eq. 3})$$

where L, M and H are the number of low, medium and highly represented habitats that were not intersected with the elevation layers, respectively. F is the number of forest habitats which were intersected with the elevation layers. L', M' and H' are the number of elevational-habitats (i.e., primary habitats subdivided by elevation range) with low, medium and high representation, respectively.

The RS ranged from 1–7. A RS of 1 was interpreted as a species which is heavily underrepresented by the current

protected area system, 2 for moderately underrepresented, 3 for slightly underrepresented, 4 for adequately represented, 5 for slightly overrepresented, 6 for moderately overrepresented, and 7 for heavily overrepresented.

Species were then aggregated into three groups according to their RS: species that are underrepresented by the current protected area system (RS equals 1–3); species that are adequately represented (RS equals 4); and species that are overrepresented (RS equals 5–7).

Comparison with previous gap analysis for Thailand. — The degree of representation of each habitat estimated in this study was compared with the results from Trisurat (2007). However, some habitat types (e.g., non-forest habitats) were not evaluated in Trisurat (2007), and thus were not available for comparison.

RESULTS

Species habitat use. — For all taxa, evergreen forest was the most widely used habitat (74% of all species), while freshwater habitat was used by approximately 40% of species (Fig.1). When considering each vertebrate group separately, the evergreen forest was still the greatest used, but the second-most used were different; i.e., freshwater habitat for amphibians, reptiles, and birds (74%, 48%, and 38%, respectively), and mixed deciduous forest for mammals (43%).

About half (55%) of the focal species (276 of 505 species) strictly utilised forest habitats, 13% (66 of 505 species) strictly used non-forest habitats, and 32% (163 of 505 species) used both forest and non-forest habitats. For amphibians, 79% of them (30 of 38 species) appeared to be forest-restricted, while only four (11%) amphibians appeared to be restricted to non-forest habitat. For reptiles and birds, both taxa had similar trends with 55% forest-restricted species (42 of 77 species and 150 of 275 species, respectively), and approximately one-third (34% and 28%, respectively) utilising both forest and non-forest habitats. Mammals appeared to be somewhat different from the others as the proportion of forest-restricted species (47%) was lower than the proportion of species utilising both habitats (50%), while only four of 115 (3%) species were restricted to non-forest habitats.

Regarding forest disturbance, more than 400 species (approximately 86%) used primary forest, while 200 species (40%) utilised secondary forest. A total of 248 species (50%) strictly utilised primary forest, while 185 species (37%) used both.

Gap analysis (by habitat). — From the gap analysis, mixed deciduous forest had the largest area under formal protection (nearly 50,000 km²), while evergreen forest and dry dipterocarp forests were the second and third (about 40,000 and 6,000 km² respectively). However, the percentage of protection for mixed deciduous forest and dry dipterocarp forest was approximately 55% and 30% of their total area,

respectively. Beach, swamp forest and mangrove forest each had areas less than 600 km² in the protected area system (about 40%, 45% and 25% of their total area, respectively), with no protection for salt flats.

The comparison of the current protection level with the representation targets indicated that the habitats with a

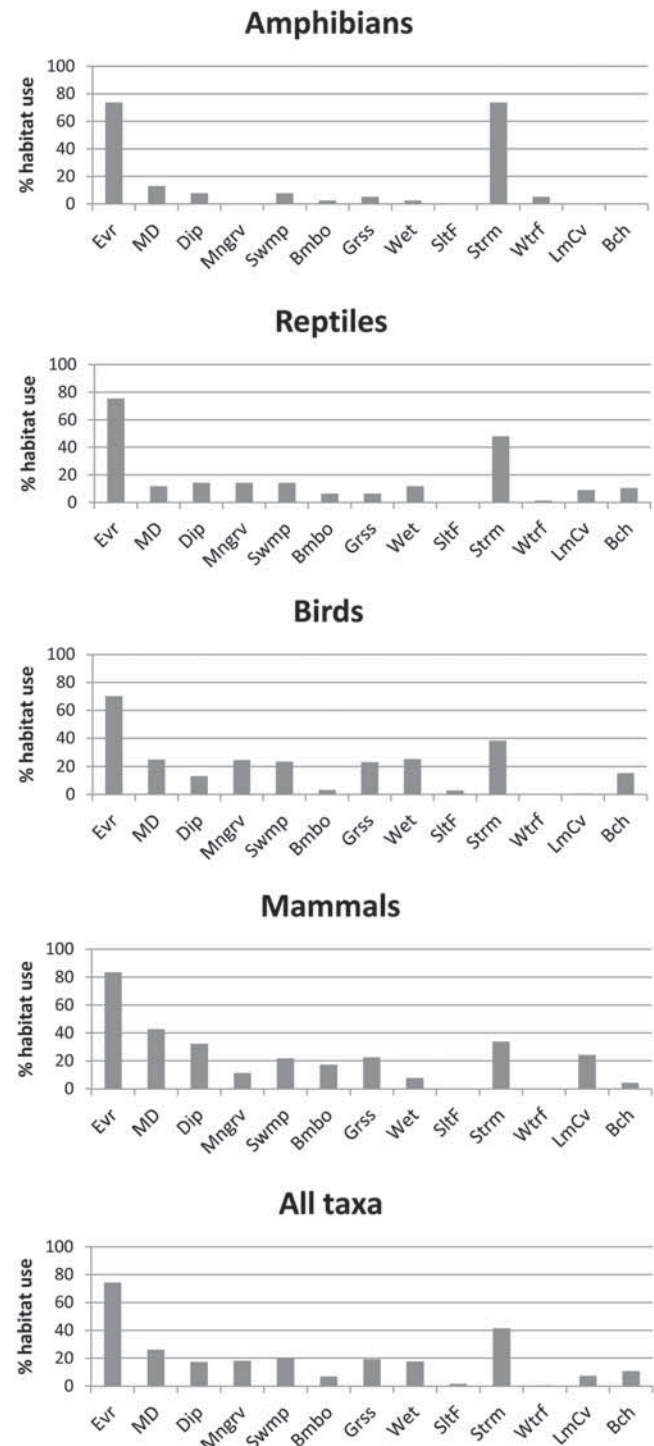


Fig. 1. Percentage of habitat use by amphibians, reptiles, birds, mammals and all taxa combined. The habitat types include Evr (evergreen forest), MD (mixed deciduous forest), Dip (dry dipterocarp forest), Mngrv (mangrove forest), Swmp (swamp forest), Bmbo (bamboo forest), Grss (grassland & shrub), Wet (wetland), Slf (salt flat), Strm (freshwater), Wtrf (waterfall), LmCv (limestone cave), and Bch (beach)

Table 1. Representation targets, current protection levels, representation indices (RI) and representation degrees (RD) of habitat types and the combined forest habitats with elevation.

	Layer	Representation Target (%)	Protection (%)	RI	RD
Forest Habitat	Evergreen Forest (Evr)	55	76.0	1.4	high
	Mixed Deciduous Forest (MD)	45	56.6	1.3	high
	Dry Dipterocarp Forest (Dip)	40	32.4	0.8	low
	Mangrove Forest (Mngrv)	50	24.0	0.5	low
	Swamp Forest (Swmp)	100	44.6	0.4	low
	Bamboo Forest (Bmbo)	30	64.5	2.1	high
Non-Forest Habitat	Grassland & Shrub (Grss)	40	4.0	0.1	low
	Wetland (Wet)	45	12.8	0.3	low
	Salt Flat (SlfF)	100	0.0	0.0	no
	Freshwater (Strm)	45	25.4	0.6	low
	Beach (Bch)	100	38.7	0.4	low
Special Habitat Feature	Waterfall (Wtrf)	20	32.9	1.6	high
	Limestone Cave (LmCv)	35	56.4	1.6	high
Combination	Evr: 0–200 m	60	58.0	1.0	med
	Evr: 200–600 m	55	81.9	1.5	high
	Evr: 600–1000 m	55	81.7	1.5	high
	Evr: 1000–1500 m	45	65.1	1.4	high
	Evr: 1500–2000 m	40	77.9	1.9	high
	Evr: 2000 m up	35	100.0	2.9	high
	MD: 0–200 m	45	25.8	0.6	low
	MD: 200–600 m	45	52.2	1.2	high
	MD: 600–1000 m	45	69.8	1.6	high
	MD: 1000–1500 m	40	69.0	1.7	high
	MD: 1500–2000 m	35	74.9	2.1	high
	Bmbo: 0–200 m	30	26.3	0.9	med
	Bmbo: 200–600 m	30	73.8	2.5	high
	Bmbo: 600–1000 m	30	96.3	3.2	high
	Bmbo: 1000–1500 m	25	83.3	3.3	high

relatively high degree of representation included evergreen forest, mixed deciduous forest, bamboo forest and two special habitat features (waterfalls and limestone caves), while dry dipterocarp forest, mangrove forest, swamp forest, grassland and shrub, wetland, freshwater, beach and salt flat habitat types were poorly represented by the current protected area system (Table 1). The areas of underrepresented habitat types that are lacking protection are shown in Fig.2.

Considering the degree of representation at various elevation ranges, evergreen forest, mixed deciduous forest and bamboo forest were well represented at elevations above 200 m, although the representation of these forests decreased at lower elevations. Evergreen forest and bamboo forest were adequately represented at elevations below 200 m, but the representation was low for mixed deciduous forest (Table 1).

Species representation. — 229 of the near-threatened and threatened species in this study were underrepresented by Thailand's current protected area system (i.e., mostly utilised habitats with inadequate protection), 111 species were adequately represented and 148 species were well represented (mostly utilised well protected habitats) (Table 2). Within the underrepresented group, 128 species were

globally threatened including 10 critically endangered, 26 endangered, 38 vulnerable, and 54 near threatened. More than half of the birds in this study (150 of 271 species) were underrepresented, compared with one-third of mammals (37 of 108 species). For amphibians and reptiles, 36% (12 of 33 species) and 39% (30 of 76 species) were underrepresented, respectively. The representation score of each species was shown in the Appendix (column 'RS-1').

When considering the underrepresented bird species ($n = 150$) in more detail, we found that around half (48%) of the threatened/near-threatened resident birds (106 of 223 species) were underrepresented, while 85% of winter-visitors (44 of 52 species) were underrepresented.

Method comparison. — Of the seven habitat types considered in both this study and Trisurat (2007), two of the degrees of representation (dry dipterocarp forest and swamp forest) differed from those estimated by Trisurat (2007; Table 3). The results also differed when elevation was incorporated into the analysis. Trisurat (2007) found no difference in the degree of representation at different elevation ranges, while in this study, evergreen forest, mixed deciduous forest and bamboo forest at elevations below 200 m were not well-represented.

Table 2. The number of amphibian, reptile, bird, and mammal species and all of these combined taxa at each representation scale and degree of representation. The representation scale ranged from 1 to 7, 1 being the lowest and 7 indicating the highest representation. The degree of representation was derived from the representation scale: under (scale 1–3), adequate (scale 4) and over represented (scale 5–7).

Taxa	Number of Species									
	Representation Scale (1–7)					Representation Degree				
	Heavily under (1)	Moderately under (2)	Slightly under (3)	Adequate (4)	Slightly over (5)	Moderately over (6)	Heavily over (7)	Under	Adequate	Over
Amphibian	4	1	7	14	3	1	3	12	14	7
Reptile	11	5	14	15	4	6	21	30	15	31
Bird	66	32	52	48	4	40	29	150	48	73
Mammal	7	6	24	34	7	8	22	37	34	37
All	88	44	97	111	18	55	75	229	111	148

DISCUSSION

The results from this study agreed with our predictions that non-forest habitats are important for the conservation of threatened species in Thailand and presumably elsewhere within these species ranges. Although the number of focal species solely dependent on non-forest habitats was relatively low (13%) when compared with the number of forest-dependent species (55%), more than 30% of species utilised both forest and non-forest habitats. Most of the non-forest habitats were still underrepresented by the current protected area system in Thailand. However, the representation of lowland evergreen forest was not as low as what we had anticipated (see below for additional discussion of this point).

Land-use maps. — Although quantitative accuracy assessments of land cover maps is particularly important, such assessments are currently not Thai government practice. Thus, while the accuracy of land-use maps available to us was unknown, given that ground-truthing was conducted during map development, it would seem unlikely that systematic, large and broad scale errors were present in the data. Nevertheless, we do encourage agencies to incorporate accuracy assessments in such maps to build greater confidence in the available data.

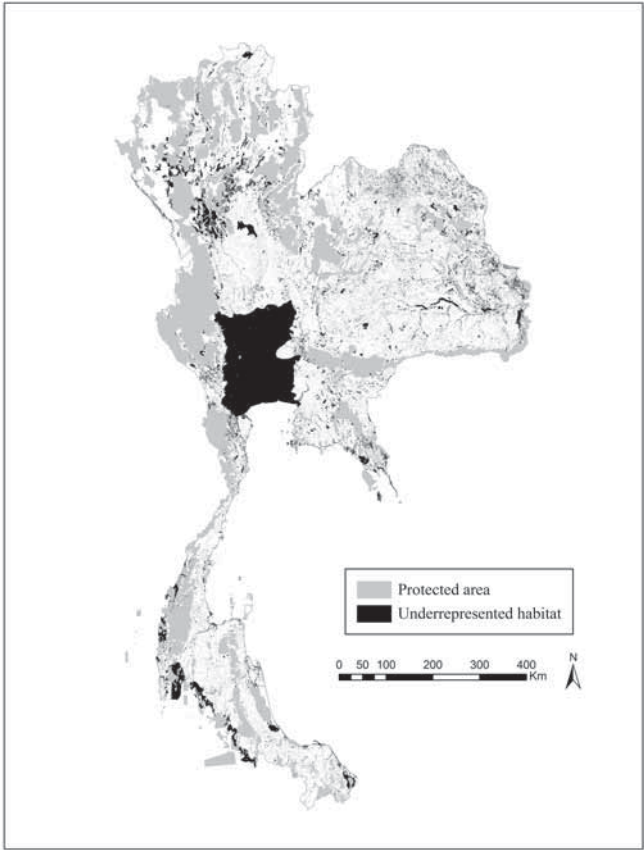


Fig. 2. Map showing areas of underrepresented habitats in Thailand still lacking official protection. The light grey areas represent protected areas, while the black areas are underrepresented habitats outside the protected area system.

Table 3. The degree of representation of each habitat type from this study and Trisurat (2007). NA means that the representation degrees of these habitats were either not available or not tested.

	Layer	Representation Degree	
		This study	Comparison Index (Trisurat, 2007)
Forest Habitat	Evergreen Forest	High	High
	Mixed Deciduous Forest	High	High
	Dry Dipterocarp Forest	Low	High
	Mangrove Forest	Low	Low
	Swamp Forest	Low	Adequate
	Bamboo Forest	High	High
Non-forest Habitat	Grassland & Shrub	Low	NA
	Wetland	Low	NA
	Salt Flat	No	NA
	Freshwater	Low	NA
	Beach	Low	NA
Special habitat feature	Waterfall	High	NA
	Limestone Cave	High	NA
Combination	Evr: 0–200 m	Adequate	High
	Evr: 200–600 m	High	High
	Evr: 600–1000 m	High	High
	Evr: 1000–1500 m	High	High
	Evr: 1500–2000 m	High	High
	Evr: 2000 m up	High	High
	MD: 0–200 m	Low	High
	MD: 200–600 m	High	High
	MD: 600–1000 m	High	High
	MD: 1000–1500 m	High	High
	MD: 1500–2000 m	High	High
	Bmbo: 0–200 m	Adequate	High
	Bmbo: 200–600 m	High	High
	Bmbo: 600–1000 m	High	High
	Bmbo: 1000–1500 m	High	High

Focal species. — More than 60% of near-threatened or threatened reptile species (particularly lizards and snakes) in Thailand have not yet been assessed under the IUCN Red List Categories and Criteria, and thus were not yet recorded in the IUCN Red List. This suggested that the overall amount and quality of data for reptiles were inadequate compared to birds and mammals. As can be seen from the literature review in this study, about 30% of reptiles had five or more references available to be reviewed, while approximately 70% of birds and more than half of mammals had more than five references available.

Habitat use and threats. — Most near-threatened and threatened vertebrate species used evergreen forest as their primary habitat. The higher number of species in this forest type might be due to several reasons. Firstly, evergreen forest is the second largest forest type in Thailand (>40,000 km²) and can thus sustain a larger number of species (Preston, 1962). Also, the level of protection of this forest type is also relatively high. Approximately 75% of evergreen forest was included within the current protected area system. However, although most species in this study used evergreen forest as their habitat, only 172 species (34%) appeared to be strictly dependent on this forest type (22 amphibians, 38 reptiles, 84 birds, and 28 mammals). The remaining species utilised one or more other habitat types. Interestingly, while nearly 50,000 km² of mixed deciduous forest was protected, only 26% of the target species (132 species) used this habitat.

Freshwater habitat is also utilised by a number of near-threatened and threatened species. This habitat type was underrepresented by the current protected area system, and is currently subjected to several threats. Water quality in the gulf of Thailand and several rivers upstream have declined due to the discharge of untreated waste water from both residential and industrial sources (Cheevaporn & Menasveta, 2003; Simachaya, 2003). The underrepresentation of freshwater habitat in the protected area system, combined with multiple threats from human activities will increase the extinction risk of several species which rely on these habitats.

From our literature review, we found that 40% of focal species can utilise secondary forest, suggesting there is significant conservation/management potential of such habitats, though the biodiversity is not as high as in primary forest. It is also important to note that primary forest is irreplaceable as can be seen by the number of focal species that strictly depend on primary forest (50%). This result is likely to be similar elsewhere (Gibson et al., 2011).

More than 40% of focal species had particularly limited information (most amphibians, reptiles, and small mammals) regarding their habitat use due to several reasons, including the lack of public interest and the consequently limited budgets for conducting field surveys, the rarity or low detectability of the species themselves, and inadequate numbers of experts to verify species identifications. Although

the habitat use data was inadequate for several species, we attempted here to make maximum use of this data to generate convincingly robust recommendations. Since all of the focal species were threatened, waiting for adequate data to be available for all species of concern before taking action might be counterproductive.

Habitat representation. — Our gap analysis suggests that the coverage of Thailand's current protected area system was biased toward some specific habitat types, leaving others mostly unprotected. Habitats which were still underrepresented are the habitats of higher economic value, or located near areas most suitable for human settlement (e.g., lowlands and topographically flat areas). For instance, several species of mangrove forest trees are suitable material for furniture and charcoal (Bunyavejchewin & Buasalee, 2011), while beaches are heavily used for Thailand's tourism industry. These characteristics of underrepresented habitats are consistent with studies elsewhere including Australia (Pressey et al., 1996) and the UK (Oldfield et al., 2004). In contrast, areas containing waterfalls or limestone caves often can provide recreational value, while sub-montane and montane evergreen and mixed deciduous forests also have relatively high biodiversity and therefore more tightly match the original national park and wildlife sanctuary designation process of Thailand. Consequently, these forest types and two special habitat features have high representation.

We also found that lowland evergreen forest (altitudes below 200 m) was adequately represented, conflicting with previous research (Scott et al., 2001; Oldfield et al., 2004). This is probably because we estimated the representation target based on the remaining forest area, not the amount thought present historically. The amount of lowland evergreen forest has been dramatically reduced from 81,172 km² (assuming original 100% forest cover) to 7,875 km² in 1982 (based on data from the MacKinnon-Ali Software System (MASS) database, Mahidol University), and declined to 5,783 km² in 2010. When we calculated the target from the estimated original forest amount, the representation of lowland evergreen forests is very low (just 4%, while the representation target is 60%). Moreover, the current protected forests are highly fragmented in which most are smaller than 10 km², and possibly too small to sustain viable populations and processes vital for maintaining these ecosystems (Rodriguez et al., 2007). Based on the original forest cover, in order to reach the representation target utilizing our methods above, at least 45,000 km² of lowland evergreen forests would need to be protected. This amount is now impossible to achieve. More feasible ways for lowland forest conservation might be (1) the improvement of existing lowland forest habitat quality by restoring degraded lowland forest already within the protected area system; and (2) the enlargement of patch sizes by restoring the connections among these fragments.

Species representation. — The proportions of underrepresented species within each vertebrate group were varied. Birds had the highest proportion (55%), while mammals had the lowest (34%). This result reflects differences in habitat use of birds versus mammals. Birds in our list used a wide range

of habitats, with half of them utilising underrepresented habitats, e.g., swamp forest, mangrove forest, open wetland, and freshwater habitats. Mammals, in contrast, were also found in a wide range of habitats but most of these were adequately or well-represented, e.g., evergreen forest and mixed deciduous forest. However, these trends only reflect current distributions, and may not reflect historical species distributions. For example the now extinct Schomburgk's deer (*Rucervus schomburgki*) only inhabited non-forest swampy grasslands at least during the dry season (Duckworth et al., 2008).

The 229 underrepresented species (12 amphibians, 30 reptiles, 150 birds, and 37 mammals) were based on the assumptions of our above criteria using currently available habitat, which treated lowland evergreen forest as adequately represented. However, when considering the historical habitat availability, it is clear that lowland evergreen forest is currently highly underrepresented. Consequently, this lowland habitat type should also be incorporated as an underrepresented habitat which increases the number of underrepresented species to 274 species (13 amphibians, 35 reptiles, 175 birds and 51 mammals). The representation score of each species after including lowland evergreen forest as underrepresented is shown in the Appendix (column 'RS-2').

Method comparison. — The comparison index used by Trisurat (2007) determined the representation degree of each habitat type from the proportion of area regardless of species richness and threat intensity (Hazen & Anthamatten, 2004). However, each habitat has different species richness and different levels of threat intensity (Gaston, 2000) implying a need for case-specific protection levels. To evaluate the degree of representation of each habitat, species richness and threat intensity should be included in gap analyses for longer-term management considerations.

Our study incorporated habitat area, species richness, and threat intensity to define the representation targets which were used to determine the degree of representation. Dry dipterocarp forest, swamp forest and mixed deciduous forest at elevations below 200 m were identified as having low representation. This was not identified by the gap analyses of Trisurat (2007). The inclusion of species richness and threat factors is also believed to be more suitable for assessing threats on the ground, although adjustments of some indices (e.g., the coefficients and thresholds used for calculating representation targets and the thresholds which determine the representation degree) are needed for more ecologically-realistic solutions.

Conservation implications. — The approach used in this study to identify habitat representation was based on methods used extensively in other countries. Thus, this approach could be applied widely across the protected area systems in Southeast Asia region, not just in Thailand. Approximately 45% of threatened species (229 of 505 species) surveyed in this study utilise non-forest habitats which appear to be mostly unprotected throughout Southeast Asia and this lack of protection is probably driving the decline of these

species. For example, there are only 39 sites (16,942 km² or 0.004% of the total region area) in Southeast Asia designated as RAMSAR wetlands (<http://ramsar.wetlands.org>). This is another indication that more conservation efforts should be given to non-forest habitats and to species that do not rely solely on forest habitats (up to the present, conservation efforts have been mostly targeting forest). The problem of non-forest habitat conservation is that it is not as easy to designate them as protected areas (e.g., wildlife sanctuaries or national parks) as most of these areas are already converted and typically heavily utilised by people and provide significant economic or social benefits. Prohibiting the use of these areas will adversely impact people living nearby as well as the local economies which will not be acceptable to many stakeholders. However, protection of these non-forest habitats might still be possible if careful zoning and enforcement of access regulations could be implemented.

An alternative strategy might be to work more in collaboration with local people to assist them in utilizing land more sustainably (e.g., BirdLife International, 2010). One study conducted in Thailand suggested that traditional salt farms support significant numbers of migratory shorebirds, including highly threatened species (Sripanomyom et al., 2011). With this model, in some cases it may be possible for local people to earn an additional income from ecotourism activities (e.g., Clifton & Benson, 2006). One successful example in Thailand of such collaboration includes the Khok Kham Conservation Club (Hails & Koopmanschap, 2010). This group was established by local people, who continue to do salt farming, shrimp farming and fisheries using traditional methods in order to maintain these semi-natural wetland areas; consequently, Khok Kham remains an important area for migratory shorebirds in Thailand. This local group has also arranged activities such as bird-watching, organised annually to introduce shorebirds to visitors and provide information about their importance and their potential habitats as well as methods to conserve them.

An additional issue for non-forest habitats is that although some of these habitats lie within protected area boundaries, the survival of several species within these areas are not guaranteed due to the varying protection levels given to different protected areas with different designation levels within Thailand. Non-hunting areas (5% of the protected area system), for example, in theory prohibit hunting, but it does not prohibit the alteration of habitat within these or nearby areas. Although the species are not directly threatened by hunting, they are still indirectly impacted by habitat degradation, reducing their chances of survival and/or reproduction.

More than 80% of threatened birds visiting Thailand during the winter period are underrepresented as they mostly utilise non-forest areas. This also stresses the importance of non-forest habitats and the urgent need for their effective conservation and management. Neglect of this issue will not only affect Thailand, but also create adverse impacts to the region's overall biodiversity. Greater collaboration with other countries within migration routes will be particularly

important for ensuring the persistence of these migratory species.

Finally, more research should be focused on reptiles since basic biological and ecological knowledge of many reptile species in the region appears to be inadequate. Without this information, it will be especially difficult to create proper conservation management plans which maximize levels of species richness and representation.

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APPENDIX

The general description of 505 focal species (scientific name, common name, IUCN status, and Thailand status), the representation score (RS) of each species before and after including lowland evergreen forest as an underrepresented habitat (RS-1 and RS-2, respectively) and a list of references used to determine their habitat use. RS ranges are listed from 1 to 7 (1 = heavily under, 2 = moderately under, 3 = slightly under, 4 = adequate, 5 = slightly over, 6 = moderately over, 7 = heavily over). The N/A in RS-1 and RS-2 means that the representation level cannot be evaluated. The migration status of birds is also provided (R = resident, V = winter visitor).

Amphibians

Scientific Name	Common Name	IUCN Status	Thailand Status	RS-1	RS-2	References
<i>Ansonia inthanon</i>	Inthanon Stream Toad	DD	NT	7	7	158
<i>Ansonia siamensis</i>	Siamese Stream Toad	VU	NT	4	4	158
<i>Babina chapaensis</i>	Chapa Frog	LC	NT	3	3	33, 158
<i>Brachytarsophrys carinense</i>	Burmese Horned Frog	LC	NT	4	4	31, 158, 198, 236–238
<i>Glyphoglossus molossus</i>	Truncat-snouted Spadefoot Frog	NT	NT	3	2	31, 33, 53–54, 96, 158–159, 187, 237–238, 240
<i>Humerana miopus</i>	Three Striped Frog	LC	NT	7	7	158
<i>Hylarana banjarana</i>	Banja Frog	NT	DD	1	1	158, 210
<i>Hylarana leptoglossa</i>	Cope's Frog	LC	NT	4	4	158
<i>Hylarana mortenseni</i>	Mortensen's Frog	NT	DD	4	4	33, 53–54, 158
<i>Hylarana signata</i>	Spotted Stream Frog	LC	NT	4	4	33, 158, 253
<i>Ingerana tasanee</i>	Tasan Frog	VU	NT	4	4	33, 158, 236
<i>Ingerana tenasserimensis</i>	Tenasserim Frog	LC	NT	4	4	33, 158
<i>Kaloula mediolineata</i>	Mediam-striped Bullfrog	NT	NT	3	3	31, 33, 53–54, 96, 158, 187, 240, 285
<i>Leptolalax gracilis</i>		NT	DD	1	1	158, 236
<i>Limnonectes blythii</i>	Blyth's River Frog	NT	NT	4	3	31, 33, 158–159, 210, 236–238, 253
<i>Limnonectes kuhlii</i>	Kuhl's Creek Frog	LC	NT	5	5	31, 33, 96, 128–129, 136, 158, 162–163, 177–178, 198, 210, 214, 236, 240, 253
<i>Limnonectes malesianus</i>	Peat Swamp Frog	NT	NT	3	3	33, 158, 253
<i>Limnonectes paramacrodon</i>	Masked Swamp Frog	NT	NT	1	1	33, 158
<i>Limnonectes tweediei</i>		NT	—	N/A	N/A	
<i>Nanorana bourreti</i>	Bourret's Spiny-breasted Frog	DD	VU	1	1	158
<i>Nyctialus pictus</i>	Cinnamon Tree Frog	NT	DD	3	2	158, 210, 236, 253
<i>Ophryophryne microstoma</i>	Narrow-mouthed Horned Frog	LC	NT	N/A	N/A	33, 158
<i>Pelophylax lateralis</i>	Yellow Frog	LC	NT	2	2	31, 53–54, 96, 158, 162–163, 187, 238, 240, 285
<i>Quasipaa fasciculispina</i>	Spiny-breasted Frog	VU	VU	5	5	42, 53–54, 158, 162–163, 168
<i>Rhacophorus feae</i>	Fea's Tree Frog	LC	NT	4	4	33, 158, 177–178
<i>Rhacophorus kio</i>		VU	—	N/A	N/A	
<i>Rhacophorus maximus</i>	Giant Tree Frog	LC	NT	4	4	158, 237–238
<i>Rhacophorus nigropalmatus</i>	Wallace's Tree Frog	LC	NT	3	1	158, 210, 236, 253

APPENDIX (Cont'd)

Amphibians

Scientific Name	Common Name	IUCN Status	Thailand Status	RS-1	RS-2	References
<i>Rhacophorus reinwardtii</i>	Reinwardt's Tree Frog	NT	NT	4	4	158, 236–238, 240
<i>Rhacophorus robinsoni</i>	Robinson's Tree Frog	—	NT	N/A	N/A	33, 158
<i>Theloderma gordoni</i>	Large Warted Tree Frog	LC	VU	N/A	N/A	33, 158, 240
<i>Theloderma stellatum</i>	Taylor's Warted Tree Frog	NT	VU	3	1	158, 162–163
<i>Tylotriton verrucosus</i>	Himalayan Salamander	LC	NT	4	4	33, 158, 177, 184, 240
<i>Xenophrys aceras</i>	Malayan Horned Frog	LC	NT	6	4	158, 210
<i>Xenophrys longipes</i>	Long-legged Horned Frog	NT	NT	4	4	158, 210, 236, 240
<i>Xenophrys major</i>	Glandular Horned Toad	LC	NT	4	4	158, 177, 198, 238
<i>Xenophrys minor</i>	Little Horned Toad	LC	NT	7	7	33, 158, 260
<i>Xenophrys parva</i>	Concave-crowned Horned Toad	LC	NT	5	5	31, 33, 96, 141, 158, 162–163, 178, 236–238

Reptiles

Scientific Name	Common Name	IUCN Status	Thailand Status	RS-1	RS-2	References
<i>Acrochordus javanicus</i>	Elephant Trunk Snake	LC	NT	1	1	32, 49, 55, 158, 191, 242
<i>Amyda cartilaginea</i>	Asian Softshell Turtle	VU	VU	1	1	32, 49, 55, 74, 132, 158, 174, 191, 225–226, 243
<i>Batagur baska</i>	River Terrapin	CR	CR	1	1	49, 55, 110, 158, 165, 191, 243
<i>Batagur borneoensis</i>	Painted Terrapin	CR	CR	1	1	49, 55, 158, 191, 243
<i>Boiga sangsomii</i>	Banded Green Cat Snake	—	NT	4	1	49, 55, 158
<i>Bungarus flaviceps flaviceps</i>	Red-headed Krait	—	NT	4	3	49, 55, 158
<i>Calliophis bivirgatus flaviceps</i>	Blue Coral Snake	—	NT	6	6	55, 158, 188
<i>Calliophis intestinalis lineata</i>	Malayan Striped Coral Snake	LC	NT	6	5	55, 158
<i>Calliophis maculiceps</i>	Speckled Coral Snake	—	NT	4	4	49, 55, 130, 158, 188, 231, 233
<i>Chitra chitra</i>	Striped Narrow-headed Softshell Turtle	CR	CR	1	1	49, 55, 126–127, 158, 243
<i>Chitra vandijki</i>	Burmese Narrow-headed Softshell Turtle	—	CR	1	1	55, 127, 158
<i>Chrysopelea paradisi paradisi</i>	Garden Flying Snake	—	NT	6	6	49, 55, 158
<i>Chrysopelea pelias</i>	Twin-banded Flying Snake	LC	NT	6	4	55, 158
<i>Crocodylus siamensis</i>	Siamese Crocodile	CR	CR	2	1	15, 49, 55, 158, 174
<i>Cuora amboinensis</i>	Malayan Box Turtle	VU	VU	1	1	32, 49, 55, 61, 74, 130, 158, 226, 243
<i>Cyclemys atripons</i>	Black-bridged Leaf Turtle	—	VU	3	3	55, 158, 226
<i>Cyclemys dentata</i>	Common Leaf Turtle	NT	VU	3	3	32, 49, 55, 61, 132, 158, 233, 243
<i>Cyclemys oldhami</i>	Oldham's Leaf Turtle	—	VU	4	4	55, 158
<i>Cyclemys shanensis</i>	Indochinese Leaf Turtle	—	VU	4	4	158
<i>Cyrtodactylus angularis</i>	Angled Bent-toed Gecko	—	NT	5	5	132, 158, 233

APPENDIX (Cont'd)

Reptiles

Scientific Name	Common Name	IUCN Status	Thailand Status	RS-1	RS-2	References
<i>Cyrtodactylus brevipalmatus</i>	Short-fingered Bent-toed Gecko	—	NT	4	3	49, 55, 158, 241
<i>Cyrtodactylus chanhomeae</i>	Chanhome's Bent-toed Gecko	—	NT	7	7	55, 90, 158
<i>Cyrtodactylus jarujini</i>	Jarujin's Bent-toed Gecko	—	NT	7	7	55, 158
<i>Cyrtodactylus sumonthai</i>	Sumontha's Bent-toed Gecko	—	NT	7	7	10, 55, 158
<i>Cyrtodactylus tigroides</i>	Striped Bent-toed Gecko	—	NT	7	7	55, 158
<i>Davewakeum miriamae</i>	Miriam's Limbless Skink	—	NT	4	4	55, 158, 233
<i>Dogania subplana</i>	Malayan Softshell Turtle	—	NT	3	3	49, 55, 61, 158, 243
<i>Dryocalamus thungsongensis</i>	Thungsong Wolf Snake	—	NT	7	7	158
<i>Eumeces quadrilineatus</i>	Blue-tailed Skink	—	NT	7	7	158
<i>Gekko siamensis</i>	Siamese Gecko	—	NT	7	7	55, 90, 158
<i>Gonocephalus abbotti</i>	Abbott's Angle-headed Lizard	—	VU	3	3	49, 55, 158
<i>Gonocephalus bellii</i>	Blue-necked Angle-headed Lizard	—	VU	3	3	49, 55, 158
<i>Gonocephalus grandis</i>	Giant Angle-headed Lizard	—	VU	4	3	49, 55, 158, 241
<i>Heosemys annandalii</i>	Yellow-headed Temple Turtle	EN	VU	1	1	49, 55, 130, 158, 226, 243
<i>Heosemys grandis</i>	Giant Asian Pond Turtle	VU	VU	2	1	49, 55, 158–159, 174, 226, 243
<i>Heosemys spinosa</i>	Spiny Terrapin	EN	VU	3	3	49, 55, 61, 158
<i>Indotestudo elongata</i>	Elongated Tortoise	EN	EN	2	2	49, 55, 130, 132, 158–159, 174, 226, 229, 233
<i>Isopachys borealis</i>	Northern Limbless Skink	—	NT	6	4	55, 158
<i>Isopachys gyldenstolpei</i>	Gyldenstolpe's Legless Skink	DD	NT	4	4	158, 188
<i>Isopachys roulei</i>	Roule's Legless Skink	DD	NT	3	1	55, 158
<i>Leiolepis belliana belliana</i>	Southern Butterfly Lizard	—	NT	3	3	55, 158–159, 174
<i>Leiolepis belliana ocellata</i>	Bell's Butterfly Lizard	—	NT	7	7	158
<i>Leiolepis boehmei</i>	Bohme's Butterfly Lizard	—	NT	1	1	158
<i>Leptoceps osellai</i>	Osella's Limbless Skink	—	NT	7	7	55, 158
<i>Lycodon cadamomensis</i>	Cardamom Mountains Wolf Snake	—	NT	5	5	55, 158, 172
<i>Lygosoma corpulentum</i>	Annam Supple Skink	—	NT	7	7	55, 158
<i>Lygosoma haroldyoungi</i>	Banded Supple Skink	LC	NT	7	7	55, 158
<i>Lygosoma isodactylum</i>	Central Supple Skink	—	NT	7	7	55, 158
<i>Lygosoma koratense</i>	Korat Supple Skink	LC	NT	7	7	55, 158, 241
<i>Malayemys subtrijuga</i>	Mekong Snail-eating Turtle	VU	VU	3	3	25, 49, 55, 74, 130, 158, 174, 226, 243
<i>Manouria emys emys</i>	Asian Brown Tortoise	EN	EN	7	7	49, 55, 158–159, 243
<i>Manouria emys phayrei</i>	Burmese Giant Tortoise	EN	EN	4	4	49, 55, 158–159, 188, 243
<i>Manouria impressa</i>	Impressed Tortoise	VU	EN	5	5	49, 55, 132, 158, 225–226, 260

APPENDIX (Cont'd)

Reptiles

Scientific Name	Common Name	IUCN Status	Thailand Status	RS-1	RS-2	References
<i>Mantheyus phuwanensis</i>	Phu Wua Lizard	—	VU	3	3	55, 158
<i>Notochelys platynota</i>	Malayan Flat-shelled Turtle	VU	VU	3	3	49, 55, 158, 225
<i>Ophiophagus hannah</i>	King Cobra	VU	LC	2	2	32, 49, 55, 130, 132, 158, 174, 191, 233
<i>Ophisaurus gracilis</i>	Indian Glass Snake	—	NT	7	7	55, 90, 158
<i>Opisthotropis praemaxillaris</i>	Angel's Mountain Keelback	—	NT	4	4	158
<i>Opisthotropis spenceri</i>	Spencer's Stream Snake	DD	NT	4	4	55, 158
<i>Oreocryptophis porphyraceus coxi</i>	Cox's Racer	—	NT	7	6	55, 158
<i>Oreocryptophis porphyraceus porphyraceus</i>	Red Mountain Racer	—	NT	7	7	55, 158
<i>Parahelicops boonsongi</i>	Boonsong's Keelback	DD	NT	4	4	55, 158
<i>Pelochelys cantorii</i>	Asian Giant Softshell Turtle	EN	CR	1	1	49, 55, 61, 158, 174, 226
<i>Physignathus cocincinus</i>	Indo-Chinese Water Dragon	—	EN	5	5	49, 55, 158
<i>Platysternon megacephalum</i>	Big-headed Turtle	EN	EN	3	3	49, 55, 158, 182, 225–226, 243, 260
<i>Pseudocalotes floweri</i>	Flower's Long-headed Lizard	—	NT	7	7	55, 158
<i>Pseudocalotes microlepis</i>	Small-scaled Long-headed Lizard	—	NT	N/A	N/A	49, 55, 158
<i>Pseudorabdion longiceps</i>	Dwarf Reed Snake	—	NT	7	7	55, 158, 242
<i>Ptyas fusca</i>	White-bellied Rat Snake	—	NT	4	3	55, 158, 173
<i>Scincella melanosticta kohtaoensis</i>	Koh Tao Ground Skink	—	NT	6	5	55, 158
<i>Siebenrockiella crassicolis</i>	Black Pond Turtle	VU	VU	1	1	32, 49, 55, 158, 226, 243
<i>Sinomicrurus maclelandi maclelandi</i>	MacClelland's Coral Snake	—	NT	7	6	55, 158
<i>Trimeresurus sumatranus</i>	Sumatran Palm Pit Viper	—	NT	7	7	158
<i>Tropidolaemus wagleri</i>	Wagler's Keeled Green Pit Viper	—	NT	3	2	49, 55, 158
<i>Varanus dumerilii</i>	Dumeril's Monitor Lizard	—	NT	2	1	11, 32, 47, 49, 55, 137, 158, 284
<i>Varanus nebulosus</i>	South-east Asian Monitor Lizard	—	NT	3	3	32, 55, 71, 137, 158–159, 191, 229
<i>Varanus rudicollis</i>	Rough-necked Monitor Lizard	—	NT	4	4	11, 32, 137, 158–159, 188

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Scientific Name	Common Name	IUCN Status	Thailand Status	Migration Status	RS-1	RS-2	References
<i>Abroscopus albogularis</i>	Rufous-faced Warbler	LC	EN	R	7	7	78, 123, 140, 199, 259
<i>Aceros comatus</i>	White-crowned Hornbill	NT	EN	R	7	7	72, 83, 125, 140, 175, 199, 208, 219
<i>Aceros corrugatus</i>	Wrinkled Hornbill	NT	CR	R	6	5	72, 83, 125, 140, 199, 251
<i>Aceros nipalensis</i>	Rufous-necked Hornbill	VU	EN	R	4	4	8, 17–18, 78, 123, 140, 170, 199

APPENDIX (Cont'd)

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Scientific Name	Common Name	IUCN Status	Thailand Status	Migration Status	RS-1	RS-2	References
<i>Aceros subruficollis</i>	Plain-pouched Hornbill	VU	EN	R	4	4	35, 83, 140, 199, 202
<i>Aceros undulatus</i>	Wreathed Hornbill	LC	NT	R	5	5	8, 17, 79, 83, 111, 116, 123, 125, 132, 140, 150, 159, 175, 186, 199
<i>Acridotheres fuscus</i>	Jungle Myna	LC	NT	R	1	1	8, 122, 140, 160, 191, 199, 218
<i>Acrocephalus tangorum</i>	Manchurian Reed Warbler	VU	EN	V	1	1	199–200, 205
<i>Actenoides concretus</i>	Rufous-collared Kingfisher	NT	VU	R	6	5	88, 116, 140, 175, 199
<i>Aegithalos concinnus</i>	Black-throated Tit	LC	VU	R	7	7	78, 123, 140, 199, 259
<i>Aegithina viridissima</i>	Green Iora	NT	—	R	4	3	12, 72, 88, 140, 175, 199, 207–208, 245
<i>Aegypius monachus</i>	Cinereous Vulture	NT	NT	V	1	1	140, 199
<i>Aethopyga nipalensis</i>	Green-tailed Sunbird	LC	NT	R	7	7	78, 123, 140, 199, 259
<i>Aethopyga temminckii</i>	Temminck's Sunbird	—	EN	R	4	3	88, 140, 175, 199, 208, 245
<i>Alcedo euryzona</i>	Blue-banded Kingfisher	VU	VU	R	3	3	46, 88, 116, 140, 175, 199, 219, 245
<i>Alcedo hercules</i>	Blyth's Kingfisher	NT	CR	V	3	3	6, 17–18, 78–79, 123, 140, 199, 213
<i>Alcippe brunneicauda</i>	Brown Fulvetta	NT	—	R	3	3	12, 46, 72, 88, 140, 199, 208, 245
<i>Alcippe grotei</i>	Black-browed Fulvetta	LC	NT	R	N/A	N/A	
<i>Alcippe rufogularis</i>	Rufous-throated Fulvetta	LC	EN	R	4	3	85, 91, 123, 140, 199
<i>Alophoixus bres</i>	Grey-cheeked Bulbul	LC	NT	R	6	5	88, 140, 175, 199, 208
<i>Alophoixus finschii</i>	Finsch's Bulbul	NT	VU	R	6	4	140, 199
<i>Amandava amandava</i>	Red Avadavat	LC	NT	R	1	1	63, 140, 160, 199
<i>Amaurornis bicolor</i>	Black-tailed Crane	LC	EN	R	1	1	140, 199
<i>Anas falcata</i>	Falcated Duck	NT	—	V	1	1	6–7, 140, 151, 199
<i>Anas formosa</i>	Baikol Teal	VU	VU	V	1	1	7, 151, 199
<i>Anhinga melanogaster</i>	Oriental Darter	NT	EN	R	2	2	6, 14, 75, 105, 116, 132, 140, 150, 160, 199, 262
<i>Anorrhinus austeni</i>	Austen's Brown Hornbill	NT	—	R	7	7	140, 186
<i>Anorrhinus galeritus</i>	Bushy-crested Hornbill	LC	NT	R	4	4	12, 83, 88, 116, 124–125, 140, 175, 186, 199, 207
<i>Anorrhinus tickelli</i>	Tickell's Brown Hornbill	NT	VU	R	7	7	17, 91, 140, 150, 171, 199
<i>Anser cygnoides</i>	Swan Goose	VU	VU	V	1	1	7
<i>Anthracoceros malayanus</i>	Black Hornbill	NT	CR	R	3	2	12, 72, 83, 88, 140, 175, 199, 207
<i>Anthreptes rhodolaemus</i>	Red-throated Sunbird	NT	—	R	6	4	12, 88, 140, 175, 199
<i>Apus acuticauda</i>	Dark-rumped Swift	VU	VU	V	7	7	18, 140, 199
<i>Aquila clanga</i>	Greater Spotted Eagle	VU	EN	V	2	2	2, 5, 8, 18, 122, 140, 199

APPENDIX (Cont'd)

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Scientific Name	Common Name	IUCN Status	Thailand Status	Migration Status	RS-1	RS-2	References
<i>Aquila heliaca</i>	Imperial Eagle	VU	EN	V	1	1	2, 140, 150, 199
<i>Aquila nipalensis</i>	Steppe Eagle	LC	NT	V	1	1	8, 18, 40, 123, 199
<i>Aquila rapax</i>	Tawny Eagle	LC	NT	V	N/A	N/A	140, 199
<i>Arachnothera robusta</i>	Long-billed Spiderhunter	LC	NT	R	6	5	12, 88, 140, 199
<i>Arborophila brunneoppectus</i>	Bar-backed Partridge	LC	NT	R	7	7	140, 199, 216, 261
<i>Arborophila cambodiana</i>	Chestnut-headed Partridge	LC	EN	R	7	7	140, 199
<i>Arborophila charltonii</i>	Scaly-breasted Partridge	NT	CR	R	4	4	70, 79, 85, 91, 140, 150, 159, 199
<i>Arborophila rufogularis</i>	Rufous-throated Partridge	LC	NT	R	7	7	123, 140, 171, 176, 199, 259, 261
<i>Ardea purpurea</i>	Purple Heron	LC	VU	R	2	2	2, 73, 75, 79, 101, 105, 116, 140, 150, 191, 199, 219, 262
<i>Ardea sumatrana</i>	Great-billed Heron	LC	CR	R	1	1	101, 140, 191, 199, 262
<i>Argusianus argus</i>	Great Argus	NT	VU	R	6	5	12, 88, 116, 124, 140, 175, 199, 250
<i>Aviceda jerdoni</i>	Jerdon's Baza	LC	NT	R	4	4	5, 8, 12, 79, 101, 116, 140, 142, 199, 213, 218
<i>Aythya baeri</i>	Baer's Pochard	EN	EN	V	1	1	6–7, 63, 140, 151, 199
<i>Aythya nyroca</i>	Ferruginous Pochard	NT	VU	V	1	1	2, 7, 40, 63, 73, 140, 151, 199
<i>Batrachostomus auritus</i>	Large Frogmouth	NT	CR	R	4	1	140, 199
<i>Batrachostomus hodgsoni</i>	Hodgson's Frogmouth	LC	NT	R	6	5	78, 140, 199
<i>Batrachostomus javensis</i>	Javan Frogmouth	LC	NT	R	3	3	78–79, 140, 150, 159, 199
<i>Batrachostomus stellatus</i>	Gould's Frogmouth	NT	EN	R	6	5	88, 116, 121, 140, 199
<i>Brachypteryx montana</i>	White-browed Shortwing	LC	VU	R	7	7	8, 48, 123, 140, 199, 259
<i>Bubo coromandus</i>	Dusky Eagle-Owl	LC	CR	R	2	1	140, 199
<i>Bubo nipalensis</i>	Spot-bellied Eagle Owl	LC	NT	R	6	6	8, 140, 150, 199
<i>Bubo sumatranus</i>	Barred Eagle Owl	LC	NT	R	4	3	88, 140, 199
<i>Buceros bicornis</i>	Great Hornbill	NT	NT	R	3	3	17, 79, 83, 91, 111, 116, 123, 125, 140, 150, 159, 170–171, 186, 199, 245
<i>Buceros rhinoceros</i>	Rhinoceros Hornbill	NT	EN	R	6	5	12, 72, 83, 88, 125, 140, 175, 186, 199
<i>Burhinus oedicnemus</i>	Eurasian Thick-knee	LC	NT	V	1	1	8, 63, 73, 140, 199, 203
<i>Butastur liventer</i>	Rufous-winged Buzzard	LC	NT	R	3	3	5, 79, 140, 150, 199
<i>Cairina scutulata</i>	White-winged Duck	EN	CR	R	3	3	8, 17, 39, 79, 132, 140, 150, 169, 199
<i>Calidris tenuirostris</i>	Great Knot	EN	—	—	1	1	151, 161, 203, 212, 221, 262
<i>Calopodix oculus</i>	Ferruginous Partridge	NT	EN	R	6	5	140, 199
<i>Calyptomena viridis</i>	Green Broadbill	NT	—	R	3	2	12, 46, 72, 88, 116, 140, 175, 199, 207, 245

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Scientific Name	Common Name	IUCN Status	Thailand Status	Migration Status	RS-1	RS-2	References
<i>Carpococcyx renaildi</i>	Coral-billed Ground-Cuckoo	LC	VU	R	6	5	79, 132, 140, 150, 199
<i>Centropus rectunguis</i>	Short-toed Coucal	VU	EN	R	N/A	N/A	72, 175
<i>Charadrius peronii</i>	Malaysian Plover	NT	EN	R	1	1	3, 140, 157, 199, 203, 262, 270, 281–282
<i>Charadrius placidus</i>	Long-billed Plover	LC	NT	V	1	1	6–8, 91, 140, 160, 199, 203
<i>Charadrius veredus</i>	Oriental Plover	LC	NT	V	1	1	89, 199, 262
<i>Chloropsis cyanopogon</i>	Lesser Green Leafbird	NT	—	R	6	5	12, 72, 88, 116, 140, 175, 199, 207–208
<i>Ciconia episcopus</i>	Woolly-necked Stork	LC	CR	R	2	2	8, 14, 79, 140, 150, 160, 199, 232
<i>Ciconia stormi</i>	Strom's Stork	EN	CR	R	2	1	116, 140, 169, 199
<i>Cinclus pallasii</i>	Brown Dipper	LC	EN	V	3	3	8, 123, 140, 199, 260
<i>Cissa hypoleuca</i>	Yellow-breasted Magpie	LC	EN	R	7	7	140, 199
<i>Cochoa purpurea</i>	Purple Cochoa	LC	EN	R	7	7	18, 123, 140, 199, 261
<i>Cochoa viridis</i>	Green Cochoa	LC	NT	R	7	7	18, 79, 91, 123, 140, 199, 259, 261
<i>Collocalia esculenta</i>	Glossy Swiftlet	LC	NT	R	3	3	3, 101, 199, 219
<i>Collocalia maxima</i>	Black-nest Swiftlet	LC	NT	R	1	1	140, 199
<i>Columba pulchricollis</i>	Ashy Wood-pigeon	LC	VU	R	7	7	17, 68, 140, 199
<i>Columba punicea</i>	Pale-capped Pigeon	VU	VU	R	3	3	140, 150, 176, 191, 199
<i>Coturnix chinensis</i>	Blue Quail	LC	NT	R	1	1	101, 116, 122–123, 140, 199
<i>Coturnix coromandelica</i>	Rain Quail	LC	NT	R	3	3	140, 159, 199
<i>Cuculus vagans</i>	Moustached Hawk-cuckoo	NT	—	R	6	6	88, 140, 175, 199, 207
<i>Cutia nipalensis</i>	Himalayan Cutia	LC	EN	R	7	7	78, 123, 140, 199
<i>Cyornis concretus</i>	White-tailed Flycatcher	LC	NT	R	4	4	88, 91, 140, 175, 199
<i>Cyornis rufigaster</i>	Mangrove Blue-flycatcher	LC	VU	R	1	1	86, 101, 140, 191, 199
<i>Cyornis turcosus</i>	Malaysian Blue-flycatcher	NT	VU	R	1	1	12, 88, 140, 199, 245–246
<i>Dendrocopos hyperythrus</i>	Rufous-bellied Woodpecker	LC	VU	R	3	3	91, 123, 140, 150, 154, 199
<i>Dendrocopus mahrattensis</i>	Yellow-crowned Woodpecker	LC	CR	R	1	1	140
<i>Dicaeum melanoxanthum</i>	Yellow-bellied Flowerpecker	LC	NT	R	7	7	8, 140, 199
<i>Dinopium rafflesii</i>	Olive-backed Woodpecker	NT	EN	R	4	3	12, 72, 88, 140, 199, 219, 245
<i>Dryocopus javensis</i>	White-bellied Woodpecker	LC	NT	R	3	3	12, 79, 132, 140, 150, 175, 199, 263
<i>Ducula aenea</i>	Green Imperial-pigeon	LC	NT	R	3	3	8, 12, 79, 101, 140, 150, 175, 191, 199
<i>Egretta eulophotes</i>	Chinese Egret	VU	EN	V	1	1	140, 151, 199, 270
<i>Emberiza aureola</i>	Yellow-breasted Bunting	VU	—	V	2	2	14, 68, 140, 150, 160, 199, 259
<i>Enicurus immaculatus</i>	Black-backed Forktail	LC	VU	R	2	2	8, 123, 140, 199
<i>Enicurus ruficapillus</i>	Chestnut-naped Forktail	NT	—	R	4	3	46, 72, 88, 116, 140, 175, 199

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Scientific Name	Common Name	IUCN Status	Thailand Status	Migration Status	RS-1	RS-2	References
<i>Ephippiorhynchus asiaticus</i>	Black-necked Stork	NT	CR	R	2	1	6, 79, 140, 199
<i>Erythrura prasina</i>	Pin-tailed Parrofinch	LC	NT	R	5	5	88, 116, 140, 199
<i>Esacus recurvirostris</i>	Great Thick-knee	LC	CR	R	1	1	6, 8, 77, 79, 122, 140, 199, 203
<i>Eupetes macrocerus</i>	Malaysian Rail-babbler	NT	VU	R	6	5	12, 88, 140, 175, 199
<i>Eurochelidon sirintarae</i>	White-eyed River-martin	CR	CR	V	1	1	140, 271
<i>Eurylaimus ochromalus</i>	Black-and-yellow Broadbill	NT	—	R	6	6	12, 46, 72, 88, 116, 140, 175, 199, 207–208
<i>Eurynorhynchus pygmeus</i>	Spoon-billed Sandpiper	CR	EN	V	1	1	28, 76, 140, 161, 199, 203, 221
<i>Falco peregrinus</i>	Peregrine Falcon	LC	VU	R	2	2	5, 8, 79, 91, 101, 122–123, 140, 155, 199
<i>Falco severus</i>	Oriental Hobby	LC	NT	R	3	3	5, 18, 70, 79, 91, 123, 140, 199
<i>Ficedula dumetoria</i>	Rufous-chested Flycatcher	NT	VU	R	6	6	88, 140, 157, 199, 219
<i>Gallicrex cinerea</i>	Watercock	LC	NT	R	1	1	6, 73, 75, 140, 160, 191, 199, 212, 219
<i>Gallinago nemoricola</i>	Wood Snipe	VU	VU	V	3	3	6, 140, 199
<i>Garrulax chinensis</i>	Black-throated Laughingthrush	LC	NT	R	3	3	70, 91, 140, 150, 159, 176, 199, 259
<i>Garrulax milnei</i>	Red-tailed Laughingthrush	LC	EN	R	4	4	78–79, 91, 140, 199, 259–260
<i>Glareola lactea</i>	Small Pratincole	LC	NT	R	1	1	2, 8, 73, 75, 77, 79, 122, 140, 150, 154, 199, 203
<i>Gorsachius melanolophus</i>	Malaysian Night-heron	LC	NT	V	3	3	8, 77, 79, 122, 140, 150, 199
<i>Gracula religiosa</i>	Hill Myna	LC	NT	R	3	3	12, 77, 79, 91, 111, 140, 150, 159, 191, 199, 245
<i>Gyps bengalensis</i>	White-rumped Vulture	CR	CR	R	2	2	2, 8, 18, 79, 122, 140, 142, 199
<i>Gyps himalayensis</i>	Himalayan Vulture	LC	NT	V	4	4	143, 199
<i>Gyps tenuirostris</i>	Slender-billed Vulture	CR	CR	R	1	1	8, 142
<i>Gypsophila crispifrons</i>	Limestone Wren-Babbler	LC	EN	R	3	3	91, 140, 199
<i>Halcyon coromanda</i>	Ruddy Kingfisher	LC	NT	R	3	2	6, 8, 86, 91, 101, 116, 122, 140, 150, 191, 199, 218
<i>Haliaeetus albicilla</i>	White-tailed Eagle	LC	NT	V	1	1	6, 8, 140, 199
<i>Haliaeetus leucogaster</i>	White-bellied Sea Eagle	LC	NT	R	3	3	5, 28, 101, 116, 122, 140, 142, 191, 199, 212, 270
<i>Haliaeetus leucorhynchus</i>	Pallas's Fish Eagle	VU	VU	V	1	1	6, 8, 17, 140, 199
<i>Harpactes diardii</i>	Diard's Trogon	NT	VU	R	4	3	12, 72, 88, 140, 175, 199, 207–208, 245
<i>Harpactes duvaucelii</i>	Scarlet-rumped Trogon	NT	NT	R	4	3	12, 72, 88, 140, 175, 199, 207, 245
<i>Harpactes kasumba</i>	Red-naped Trogon	NT	EN	R	4	4	12, 72, 88, 140, 175, 199, 245
<i>Harpactes orrhophaeus</i>	Cinnamon-rumped Trogon	NT	EN	R	6	5	12, 88, 140, 199, 207

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<i>Heliopais personatus</i>	Masked Finfoot	EN	CR	V	2	2	122, 140, 150, 191, 199
<i>Hemipus hirundinaceus</i>	Black-winged Flycatcher-shrike	LC	VU	R	3	3	12, 88, 140, 175, 199, 245
<i>Hirundo concolor</i>	Dusky Crag-martin	LC	NT	R	4	4	79, 140, 199, 213
<i>Hirundo smithii</i>	Wire-tailed Swallow	LC	NT	R	2	2	68, 77, 79, 95, 140, 199
<i>Ichthyophaga humilis</i>	Lesser Fish-eagle	NT	VU	R	3	3	5, 8, 14, 79, 140, 142, 199, 212, 245
<i>Ichthyophaga ichthyaeus</i>	Grey-headed Fish-eagle	NT	CR	R	2	2	5-6, 91, 116, 140, 142, 150, 199, 245-246, 251, 257
<i>Ictinaetus malayensis</i>	Black Eagle	LC	NT	R	4	4	5, 8, 79, 91, 123, 140, 142, 150, 199, 219
<i>Indicator archipelagicus</i>	Malaysian Honeyguide	NT	EN	R	6	5	140, 199
<i>Iole olivacea</i>	Buff-vented Bulbul	NT	—	R	4	3	72, 88, 111, 116, 140, 175, 199, 208
<i>Ixos malaccensis</i>	Streaked Bulbul	NT	—	R	6	5	72, 88, 140, 175, 199
<i>Kenopia striata</i>	Striped Wren-babbler	NT	CR	R	4	3	12, 72, 88, 140, 175, 199, 207
<i>Ketupa ketupu</i>	Buffy Fish-owl	LC	NT	R	2	2	122, 140, 191, 199, 207
<i>Ketupa zeylonensis</i>	Brown Fish-owl	LC	NT	R	2	2	8, 122, 140, 150, 160, 199
<i>Lalage nigra</i>	Pied Triller	LC	VU	R	2	1	3, 12, 140, 199, 220
<i>Leptoptilos dubius</i>	Greater Adjutant	EN	CR	V	1	1	6, 140, 150, 199
<i>Leptoptilos javanicus</i>	Lesser Adjutant	VU	CR	R	2	1	8, 17, 75, 79, 116, 122, 140, 150, 169, 191, 199, 247
<i>Limnodromus semipalmatus</i>	Asian Dowitcher	NT	VU	V	1	1	51, 140, 151, 191, 199, 203-204, 221
<i>Limosa limosa</i>	Black-tailed Godwit	NT	—	V	1	1	3, 7, 27-28, 51, 75, 122, 140, 161, 191, 199, 203, 212, 221, 262
<i>Liocichla phoenicea</i>	Red-faced Liocichla	LC	VU	R	4	4	8, 123, 140, 199
<i>Lonchura maja</i>	White-headed Munia	LC	VU	R	1	1	140, 199
<i>Lophotriorchis kienerii</i>	Rufous-bellied Eagle	LC	NT	R	6	6	5, 8, 78, 101, 140, 142, 199
<i>Lophura diardi</i>	Siamese Fireback	NT	NT	R	6	5	22, 70, 79, 132, 140, 150, 188, 199
<i>Lophura ignita</i>	Crested Fireback	NT	CR	R	3	1	72, 116, 140, 199
<i>Lophura nycthemera</i>	Silver Pheasant	LC	NT	R	4	4	79, 91, 140, 150, 176, 199, 216, 261
<i>Luscinia obscura</i>	Black-throated Blue Robin	VU	VU	V	1	1	140, 199
<i>Macheiramphus alcinus</i>	Bat Hawk	LC	CR	R	6	6	5, 88, 140, 142, 199
<i>Macronous ptilosus</i>	Fluffy-backed Tit-Babbler	NT	VU	R	4	4	12, 46, 72, 88, 140, 175, 199, 245-246
<i>Malacocincla malaccensis</i>	Short-tailed Babbler	NT	—	R	6	5	46, 72, 88, 116, 140, 175, 199, 208
<i>Malacopteron affine</i>	Sooty-capped Babbler	NT	EN	R	4	3	72, 88, 116, 140, 175, 199, 245
<i>Malacopteron magnum</i>	Rufous-crowned Babbler	NT	NT	R	4	3	12, 72, 88, 140, 175, 199, 207, 245

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<i>Megaceryle lugubris</i>	Crested Kingfisher	LC	EN	R	3	3	2, 8, 91, 123, 140, 199
<i>Megalaima henrici</i>	Yellow-crowned Barbet	NT	—	R	6	5	12, 72, 88, 140, 175, 199
<i>Megalaima mystacophanos</i>	Red-throated Barbet	NT	—	R	3	3	12, 46, 72, 88, 140, 175, 199, 207, 219, 245
<i>Megalaima rafflesii</i>	Red-crowned Barbet	NT	EN	R	3	3	12, 46, 88, 116, 140, 175, 199, 207, 219, 245
<i>Meiglyptes tukki</i>	Buff-necked Woodpecker	NT	—	R	3	2	12, 72, 88, 140, 175, 199, 207, 245
<i>Mergus squamatus</i>	Scaly-sided Merganser	EN	VU	V	1	1	7, 199
<i>Milvus migrans</i>	Black Kite	LC	EN	R	2	2	2, 5, 8, 73, 75, 91, 101, 122–123, 140, 150, 191, 199, 212
<i>Minla strigula</i>	Chestnut-tailed Minla	LC	VU	R	7	7	78, 123, 140, 190, 199, 259
<i>Motacilla samveasnae</i>	Mekong Wagtail	NT	—	R	1	1	56, 67–68, 154
<i>Mulleripicus pulverulentus</i>	Great Slaty Woodpecker	VU	NT	R	3	3	8, 79, 140, 150, 191, 199
<i>Muscicapa muttui</i>	Brown-breasted Flycatcher	LC	EN	R	4	4	140, 199
<i>Muscicapa williamsoni</i>	Brown-streaked Flycatcher	—	NT	R	3	3	140, 191, 199
<i>Muscicapella hodgsoni</i>	Pygmy Blue Flycatcher	LC	VU	R	7	7	8, 78, 88, 123, 140, 199
<i>Mycerobas melanozanthos</i>	Spot-winged Grosbeak	LC	VU	R	4	4	140, 199
<i>Mycteria cinerea</i>	Milky Stork	VU	CR	V	1	1	75, 102–103, 140, 199
<i>Mycteria leucocephala</i>	Painted Stork	NT	VU	R	1	1	6, 75, 140, 160, 191, 199, 203, 232
<i>Nectarinia calcostetha</i>	Copper-throated Sunbird	LC	VU	R	1	1	140, 191, 199, 220
<i>Nisaetus alboniger</i>	Blyth's Hawk-eagle	LC	NT	R	4	3	46, 88, 140, 142, 199, 208
<i>Nisaetus nipalensis</i>	Mountain Hawk-eagle	LC	NT	R	5	5	8, 123, 140, 150, 142, 199, 259
<i>Niseatus nanus</i>	Wallace's Hawk-eagle	VU	EN	R	6	4	5, 72, 140, 142, 199
<i>Numenius arquata</i>	Eurasian Curlew	NT	—	V	1	1	6–7, 27–28, 122, 140, 191, 199, 203, 212, 221
<i>Numenius madagascariensis</i>	Far Eastern Curlew	VU	NT	V	1	1	51, 140, 151, 199, 203, 212, 262
<i>Oriolus melianus</i>	Silver Oriole	VU	VU	V	6	6	140, 150, 199, 213
<i>Oriolus xanthonotus</i>	Dark-throated Oriole	NT	NT	R	3	2	8, 12, 46, 72, 122, 140, 175, 199, 207
<i>Otus rufescens</i>	Reddish Scops Owl	NT	EN	R	4	3	88, 121, 140, 199, 245–246
<i>Otus sagittatus</i>	White-fronted Scops Owl	VU	EN	R	2	1	116, 140, 199
<i>Paradoxornis davidianus</i>	Short-tailed Parrotbill	LC	VU	R	5	5	85, 140, 199, 213
<i>Pavo muticus</i>	Green Peafowl	EN	EN	R	3	3	14, 79, 116, 140, 150, 159, 199, 215
<i>Pelargopsis amauroptera</i>	Brown-winged Kingfisher	NT	NT	R	1	1	140, 160, 191, 199
<i>Pelecanus philippensis</i>	Spot-billed Pelican	NT	EN	V	1	1	6, 73, 75, 120, 140, 150, 199, 203

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Scientific Name	Common Name	IUCN Status	Thailand Status	Migration Status	RS-1	RS-2	References
<i>Pericrocotus igneus</i>	Fiery Minivet	NT	VU	R	3	3	88, 140, 175, 199, 245
<i>Phaenicophaeus diardi</i>	Black-bellied Malkoha	NT	—	R	3	2	12, 72, 88, 140, 175, 199, 245
<i>Phaenicophaeus sumatranus</i>	Chestnut-bellied Malkoha	NT	NT	R	2	2	12, 72, 88, 140, 175, 191, 199, 207, 219, 245
<i>Phalacrocorax carbo</i>	Great Cormorant	LC	EN	V	1	1	2, 7-8, 123, 140, 191, 199, 212
<i>Phalacrocorax fuscicollis</i>	Indian Cormorant	LC	NT	R	1	1	2, 8, 27, 29, 75, 140, 191, 199, 203
<i>Philentoma velata</i>	Maroon-breasted Flycatcher	NT	NT	R	6	6	12, 72, 88, 140, 175, 199, 219
<i>Phylloscopus cantator</i>	Yellow-vented Warbler	LC	VU	V	4	3	8, 17, 78, 123, 140, 159, 199, 216, 218
<i>Phylloscopus maculipennis</i>	Ashy-throated Warbler	LC	VU	R	7	7	123, 140, 199, 259
<i>Picus xanthopygaeus</i>	Streak-throated Woodpecker	LC	EN	R	2	2	122, 140, 150, 191, 199
<i>Pitta caerulea</i>	Giant Pitta	NT	EN	R	6	5	88, 140, 175, 199, 207
<i>Pitta granatina</i>	Garnet Pitta	NT	EN	R	3	1	72, 140, 175, 199, 256
<i>Pitta gurneyi</i>	Gurney's Pitta	EN	CR	R	3	1	140, 199-201, 207, 256, 271
<i>Pitta megarhyncha</i>	Mangrove Pitta	NT	VU	R	1	1	41, 122, 140, 144, 191, 199
<i>Pitta oatesi</i>	Rusty-naped Pitta	LC	NT	R	7	7	91, 140, 159, 176, 199, 216
<i>Pitta soror</i>	Blue-rumped Pitta	LC	EN	R	4	4	79, 91, 140, 199
<i>Platalea minor</i>	Black-faced Spoonbill	EN	EN	V	1	1	4, 7, 28, 140, 151, 199, 212, 235, 285
<i>Platysmurus leucopterus</i>	Black Magpie	NT	VU	R	4	3	12, 72, 88, 140, 175, 199, 207, 245
<i>Ploceus hypoxanthus</i>	Asian Golden Weaver	NT	NT	R	1	1	73, 75, 79, 104, 140, 199
<i>Ploceus manyar</i>	Streaked Weaver	LC	NT	R	1	1	2, 8, 63, 73, 75, 104, 140, 199
<i>Ploceus philippinus</i>	Baya Weaver	LC	NT	R	1	1	2, 8, 73, 75, 79, 122, 140, 150, 191, 199
<i>Polhierax insignis</i>	White-rumped Falcon	NT	VU	R	2	2	70, 140, 142, 150, 159, 199
<i>Polyplectron inopinatum</i>	Mountain Peacock-pheasant	VU	EN	R	N/A	N/A	
<i>Polyplectron malacense</i>	Malayan Peacock-pheasant	VU	CR	R	4	1	140, 199, 277
<i>Porzana paykullii</i>	Band-bellied Crane	NT	NT	V	1	1	140, 199
<i>Prionochilus thoracicus</i>	Scarlet-breasted Flowerpecker	NT	EN	R	3	3	72, 140, 175, 199, 207
<i>Psittacula eupatria</i>	Alexandrine Parakeet	LC	EN	R	2	2	8, 95, 140, 160, 199, 218
<i>Psittacula roseata</i>	Blossom-headed Parakeet	LC	NT	R	4	4	8, 79, 140, 150, 199
<i>Psittinus cyanurus</i>	Blue-rumped Parrot	NT	EN	R	3	3	12, 46, 72, 140, 175, 199
<i>Ptilinopus jambu</i>	Jambu Fruit-dove	NT	EN	R	4	3	72, 88, 140, 175, 199, 207
<i>Pycnonotus cyaniventris</i>	Grey-bellied Bulbul	NT	—	R	6	6	12, 88, 140, 175, 199, 207
<i>Pycnonotus eutilotus</i>	Puff-backed Bulbul	NT	VU	R	3	2	12, 72, 88, 140, 175, 199, 207, 245

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Scientific Name	Common Name	IUCN Status	Thailand Status	Migration Status	RS-1	RS-2	References
<i>Pycnonotus jocosus</i>	Red-whiskered Bulbul	LC	NT	R	2	2	8, 26, 29, 73, 79, 85, 91, 122–123, 135, 140, 159, 171, 176, 199, 259, 261
<i>Pycnonotus melanoleucos</i>	Black-and-White Bulbul	NT	CR	R	4	3	12, 72, 88, 140, 199, 207
<i>Pycnonotus squamatus</i>	Scaly-breasted Bulbul	NT	—	R	6	5	72, 88, 116, 140, 175, 199
<i>Pycnonotus zeylanicus</i>	Straw-headed Bulbul	VU	CR	R	3	3	46, 88, 140, 175, 199, 219, 251
<i>Rallina eurizonoides</i>	Slaty-legged Crane	LC	NT	V	3	3	79, 101, 140, 199
<i>Rallina fasciata</i>	Red-legged Crane	LC	NT	R, V	3	3	88, 140, 157, 199
<i>Reinwardtipicus validus</i>	Orange-backed Woodpecker	LC	NT	R	4	3	12, 88, 140, 175, 199
<i>Rhinomyias brunneatus</i>	Brown-chested Jungle-flycatcher	VU	VU	V	6	5	72, 116, 140, 199, 213
<i>Rhinomyias umbratilis</i>	Grey-chested Jungle-flycatcher	NT	VU	R	4	3	12, 72, 88, 140, 175, 199, 245
<i>Rhinoplax vigil</i>	Helmeted Hornbill	NT	EN	R	6	5	37, 72, 83, 88, 116, 125, 140, 175, 186, 199
<i>Rhipidura aureola</i>	White-browed Fantail	LC	VU	R	3	3	140, 150, 199
<i>Rhipidura hypoxantha</i>	Yellow-bellied Fantail	LC	NT	R	7	7	8, 123, 140, 199, 218, 259
<i>Rhipidura perlata</i>	Spotted Fantail	LC	VU	R	6	6	88, 140, 175, 199
<i>Rhizothera longirostris</i>	Long-billed Partridge	NT	CR	R	6	5	140, 175, 199
<i>Riparia paludicola</i>	Plain Martin	LC	VU	R	1	1	2, 68, 140, 199, 213
<i>Rollulus rouloul</i>	Crested Partridge	NT	EN	R	6	5	72, 88, 140, 175, 199
<i>Rynchops albigollis</i>	Indian Skimmer	VU	VU	V	1	1	6, 140, 199
<i>Sarcogyps calvus</i>	Red-headed Vulture	CR	CR	R	3	2	8, 79, 140, 142, 159, 199
<i>Sarkidiornis melanotos</i>	Comb Duck	LC	CR	V	1	1	6, 75, 140, 150, 199
<i>Saxicola jerdoni</i>	Jerdon's Bushchat	LC	EN	R	1	1	68, 140, 199
<i>Sitta formosa</i>	Beautiful Nuthatch	VU	CR	R	4	4	17–18, 78, 123, 140, 199, 259
<i>Sitta magna</i>	Giant Nuthatch	VU	EN	R	7	7	140, 199
<i>Stachyris leucotis</i>	White-necked Babbler	NT	EN	R	6	5	88, 140, 175, 199
<i>Stachyris maculata</i>	Chestnut-rumped Babbler	NT	VU	R	4	3	12, 46, 72, 88, 140, 175, 199, 207
<i>Stachyris nigricollis</i>	Black-throated Babbler	NT	VU	R	3	3	12, 88, 140, 175, 199, 245
<i>Sterna acuticauda</i>	Black-bellied Tern	NT	CR	R	1	1	2, 6, 8, 77, 140, 199
<i>Sterna albifrons</i>	Little Tern	LC	NT	R	1	1	8, 27–28, 43, 73, 77, 79, 122, 140, 199, 212, 262
<i>Sterna anaethetus</i>	Bridled Tern	LC	NT	R	1	1	140, 199
<i>Sterna aurantia</i>	River Tern	LC	CR	R	1	1	2, 8, 77, 79, 140, 199
<i>Sterna bernsteini</i>	Chinese Crested Tern	CR	CR	V	1	1	140, 199
<i>Sterna sumatrana</i>	Black-naped Tern	LC	NT	R	1	1	73, 101, 140, 199

APPENDIX (Cont'd)

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Scientific Name	Common Name	IUCN Status	Thailand Status	Migration Status	RS-1	RS-2	References
<i>Strix seloputo</i>	Spotted Wood-owl	LC	VU	R	2	1	140, 191, 199
<i>Symaticus humiae</i>	Hume's Pheasant	NT	CR	R	4	4	97-100, 140, 199
<i>Temnurus temnurus</i>	Ratchet-tailed Treepie	LC	VU	R	4	4	68, 199
<i>Terpsiphone atrocaudata</i>	Japanese Paradise-flycatcher	NT	NT	V	4	4	78, 140, 150, 154, 191, 199, 213
<i>Tesia castaneocoronata</i>	Chestnut-headed Tesia	LC	VU	R	7	7	8, 123, 140, 199, 218
<i>Tesia cyaniventer</i>	Grey-bellied Tesia	LC	EN	R	7	7	8, 91, 123, 140, 199, 218, 259
<i>Threskiornis melanocephalus</i>	Black-headed Ibis	NT	EN	V	1	1	6, 75, 122, 140, 191, 199, 232
<i>Treron apicauda</i>	Pin-tailed Green-pigeon	LC	NT	R	7	7	8, 123, 140, 190, 199, 218, 261
<i>Treron bicinctus</i>	Orange-breasted Green-pigeon	LC	NT	R	3	2	8, 122, 140, 150, 160, 191, 199
<i>Treron capellei</i>	Large Green-pigeon	VU	EN	R	3	3	72, 140, 175, 199, 251
<i>Treron fulvicollis</i>	Cinnamon-headed Green-pigeon	NT	CR	R	2	1	140, 191, 199
<i>Treron olax</i>	Little Green-pigeon	LC	EN	R	4	3	12, 88, 140, 175, 199
<i>Treron phoenicopterus</i>	Yellow-footed Green-pigeon	LC	VU	R	2	2	8, 79, 122, 140, 199, 218
<i>Treron pompadora</i>	Pompador Green-pigeon	LC	NT	R	3	3	8, 122, 140, 150, 160, 199
<i>Treron seimundi</i>	Yellow-vented Green-pigeon	LC	VU	R	4	4	78, 91, 140, 191, 199
<i>Treron sieboldii</i>	White-bellied Green-pigeon	LC	VU	R	7	7	78, 140, 150, 199, 216
<i>Trichastoma bicolor</i>	Ferruginous Babbler	LC	NT	R	6	6	12, 88, 140, 199, 207-208
<i>Trichastoma rostratum</i>	White-chested Babbler	NT	NT	R	2	2	72, 88, 140, 175, 191, 199, 220, 245
<i>Trichixos pyropygus</i>	Rufous-tailed Shama	NT	EN	R	3	3	88, 140, 175, 199, 245
<i>Tringa guttifer</i>	Spotted Greenshank	EN	EN	V	1	1	28, 140, 151, 160, 199, 203, 221
<i>Turdinus macrodactylus</i>	Large Wren-babbler	NT	EN	R	4	1	140, 199, 201
<i>Turdus feae</i>	Grey-sided Thrush	VU	VU	V	7	7	140, 199
<i>Tyto alba</i>	Barn Owl	LC	NT	R	2	2	29, 68, 73, 140, 159, 191, 199
<i>Vanellus cinereus</i>	Grey-headed Lapwing	LC	NT	V	2	1	3, 6-7, 27, 29, 73, 75, 79, 91, 122, 140, 150, 199, 203
<i>Vanellus duvaucelii</i>	River Lapwing	LC	VU	R	2	2	8, 69, 77, 79, 91, 123, 140, 154, 199
<i>Yuhina humilis</i>	Burmese Yuhina	LC	VU	R	7	7	140, 199
<i>Zoothera interpres</i>	Chestnut-capped Thrush	NT	EN	R	6	5	88, 140, 157, 199, 207

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Mammals

Scientific Name	Common Name	IUCN Status	Thailand Status	RS-1	RS-2	Reference
<i>Aonyx cinerea</i>	Asian Small-clawed Otter	VU	—	2	2	19, 59, 80–81, 93, 112, 117, 119, 131, 139, 150, 191, 249, 286
<i>Arctictis binturong</i>	Binturong	VU	—	4	3	24, 45, 81, 93–94, 112, 124, 132, 145, 150, 159, 286
<i>Arctonyx collaris</i>	Hog Badger	NT	—	4	4	45, 81, 93–94, 115, 132, 145, 159, 171, 286
<i>Axis porcinus</i>	Hog Deer	EN	EN	1	1	81, 132, 139, 158, 167
<i>Belomys pearsonii</i>	Hairy-footed Flying Squirrel	DD	VU	7	7	138, 158
<i>Bos gaurus</i>	Gaur	VU	VU	4	4	16, 81, 118, 132, 139, 150, 158–159, 223, 230, 272
<i>Bos javanicus</i>	Banteng	EN	CR	3	2	81, 113, 139, 150, 158–159, 180, 217, 223, 230, 272
<i>Bubalus arnee</i>	Indian Water Buffalo	EN	EN	3	3	30, 81, 139, 158, 192, 271–272
<i>Callosciurus nigrovittatus</i>	Black-striped Squirrel	NT	—	1	1	81, 134, 139, 209
<i>Canis aureus</i>	Golden Jackal	LC	VU	3	3	45, 66, 150, 158–159, 272
<i>Capricornis milneedwardsii</i>	Southwest China Serow	NT	—	4	4	34, 81
<i>Capricornis sumatraensis</i>	Sumatran Serow	VU	NT	4	4	81, 114, 118, 131–132, 150, 158–159, 272, 286
<i>Coelops frithii</i>	Tailless Leaf-nosed Bat	LC	VU	6	4	62, 81, 158, 179
<i>Craseonycteris thonglongyai</i>	Kitti's Hog-nosed Bat	VU	CR	4	3	62, 81, 139, 158, 193, 283
<i>Cuon alpinus</i>	Dhole	EN	VU	3	3	81, 115, 132, 150, 158–159, 272
<i>Cynogale bennettii</i>	Sunda Otter Civet	EN	CR	1	1	36, 45, 81, 112, 139, 158, 211, 266, 274
<i>Dendrogale murina</i>	Northern Smooth-tailed Treeshrew	LC	VU	7	7	81, 158
<i>Dyacopterus spadiceus</i>	Dayak Fruit Bat	NT	VU	4	4	81, 112, 158
<i>Echinosorex gymnura</i>	Moonrat	LC	VU	3	3	60, 81, 124, 139, 148, 158
<i>Elephas maximus</i>	Asian Elephant	EN	EN	4	3	44, 118, 132, 139, 150, 158–159, 171, 223, 227, 254, 272, 275
<i>Eptesicus dimissus</i>	Surat Serotine	DD	EN	7	7	113, 139, 158
<i>Eptesicus serotinus</i>	Serotine	LC	VU	4	4	81, 139, 158
<i>Felis chaus</i>	Jungle Cat	LC	CR	3	2	45, 66, 81, 139, 150, 158, 239
<i>Hapalomys longicaudatus</i>	Marmoset Rat	EN	VU	7	7	81, 139, 158
<i>Harpiocephalus harpia</i>	Lesser Hairy-winged Bat	LC	VU	4	3	81, 158, 196
<i>Hemigalus derbyanus</i>	Banded Civet	VU	EN	5	4	45, 81, 93, 115, 139, 146, 153, 158, 274
<i>Hesperoptenus blanfordi</i>	Blanford's Bat	LC	VU	6	6	81, 158, 196

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Scientific Name	Common Name	IUCN Status	Thailand Status	RS-1	RS-2	Reference
<i>Hesperoptenus tickelli</i>	Tickell's Bat	LC	VU	5	5	81, 158
<i>Hipposideros halophyllus</i>	Thailand Leaf-nosed Bat	EN	EN	4	4	62, 81, 158, 268
<i>Hipposideros lekaguli</i>	Large Asian Leaf-nosed Bat	NT	VU	4	3	62, 81, 139, 158
<i>Hipposideros turpis</i>	Lesser Leaf-nosed Bat	NT	VU	7	7	81, 139, 158, 193
<i>Hylobates agilis</i>	Dark-handed Gibbon	EN	CR	4	3	81, 158, 164, 166, 248
<i>Hylobates lar</i>	White-handed Gibbon	EN	VU	5	5	132, 134, 139, 150, 152, 158–159, 171, 223, 229–230, 252, 264–265
<i>Hylobates pileatus</i>	Pileated Gibbon	EN	EN	6	6	81, 139, 150, 152, 158, 180, 185, 267
<i>Hyloupes alboniger</i>	Particoloured Flying Squirrel	LC	VU	4	4	81, 158
<i>Hyloupes spadiceus</i>	Red-cheeked Flying Squirrel	LC	VU	7	7	81, 158
<i>Ia io</i>	Great Evening Bat	LC	VU	7	7	81, 158, 196
<i>Kerivoula hardwickii</i>	Hardwicke's Woolly Bat	LC	VU	4	4	9, 62, 81, 113, 158, 179, 196
<i>Kerivoula intermedia</i>	Small Woolly Bat	NT	—	N/A	N/A	81
<i>Kerivoula minuta</i>	Least Woolly Bat	NT	VU	4	1	81, 139, 158, 179
<i>Kerivoula papillosa</i>	Papillose Woolly Bat	LC	VU	3	1	9, 81, 158
<i>Kerivoula pellucida</i>	Clear-winged Woolly Bat	NT	—	N/A	N/A	81, 194
<i>Laruscus insignis</i>	Three-striped Ground Squirrel	LC	VU	3	1	81, 124, 134, 139, 158, 200
<i>Leopoldamys edwardsi</i>	Edward's Long-tailed Giant Rat	LC	VU	7	7	158
<i>Leopoldamys neilli</i>	Neill's Long-tailed Giant Rat	DD	VU	7	7	81, 158, 269
<i>Lutra lutra</i>	Eurasian Otter	NT	EN	3	3	58, 59, 81, 133, 139, 158
<i>Lutra sumatrana</i>	Hairy-nosed Otter	EN	CR	2	2	59, 64, 81, 94, 117, 119, 139, 158, 191
<i>Lutrogale perspicillata</i>	Smooth-coated Otter	VU	VU	2	2	19, 59, 80–81, 93–94, 112, 115, 119, 139, 145, 150, 158, 181, 191, 249
<i>Macaca arctoides</i>	Stump-tailed Macaque	VU	VU	4	4	81, 139, 150, 158–159, 200
<i>Macaca assamensis</i>	Assam Macaque	NT	EN	7	7	81, 109, 132, 139, 158, 168, 171
<i>Macaca leonina</i>	Northern Pig-tailed Macaque	VU	—	N/A	N/A	81
<i>Macaca nemestrina</i>	Southern Pig-tailed Macaque	VU	NT	5	4	81, 124, 132, 134, 139, 150, 158–159, 229
<i>Manis javanica</i>	Sunda Pangolin	EN	NT	3	3	81, 112, 124, 139, 150, 158
<i>Manis pentadactyla</i>	Chinese Pangolin	EN	EN	5	5	81, 139, 158, 279–280
<i>Maxomys rajah</i>	Rajah Spiny Rat	VU	—	3	3	81, 222
<i>Maxomys whiteheadi</i>	Whitehead's Spiny Rat	VU	VU	4	3	81, 106, 124, 148, 158
<i>Muntiacus feae</i>	Fea's Muntjac	DD	EN	4	4	81, 118, 139, 158, 271

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Scientific Name	Common Name	IUCN Status	Thailand Status	RS-1	RS-2	Reference
<i>Murina aenea</i>	Bronze Tube-nosed Bat	VU	—	1	1	81
<i>Murina leucogaster</i>	Greater Tube-nosed Bat	DD	VU	4	4	81, 158
<i>Mustela nudipes</i>	Malay Weasel	LC	VU	3	3	65, 81–82, 93, 115, 158
<i>Mustela sibirica</i>	Siberian Weasel	LC	VU	7	7	81, 139, 158, 278, 286
<i>Mustela strigidorsa</i>	Stripe-backed Weasel	LC	EN	3	3	1, 57, 81, 92, 158
<i>Myotis altarium</i>	South-western Mouse-eared Bat	LC	VU	5	5	81, 158
<i>Myotis annectans</i>	Hairy-faced Bat	LC	NT	7	7	81, 158
<i>Myotis chinensis</i>	Large Myotis	LC	VU	4	4	81, 139, 158
<i>Myotis ridleyi</i>	Ridley's Bat	NT	—	3	3	81, 189
<i>Naemorhedus griseus</i>	Chinese Goral	VU	CR	7	7	34, 81, 158
<i>Neofelis nebulosa</i>	Clouded Leopard	VU	VU	6	6	45, 81, 115, 118, 132, 134, 150, 158, 239
<i>Niviventer cremoriventer</i>	Dark-tailed Tree Rat	VU	—	N/A	N/A	81, 106, 148
<i>Niviventer hinpoon</i>	Limestone Rat	DD	EN	7	7	81, 158, 269
<i>Nyctalus noctula</i>	Noctule	LC	VU	7	7	81, 158
<i>Nycteris tragata</i>	Malayan Slit-faced Bat	NT	VU	7	7	81, 158, 179
<i>Nycticebus bengalensis</i>	Bengal Slow Loris	VU	—	4	4	38, 81, 183, 197, 234
<i>Nycticebus coucang</i>	Greater Slow Loris	VU	—	3	3	81, 112, 132, 139, 159, 191
<i>Panthera pardus</i>	Leopard	NT	VU	4	3	81, 112, 124, 139, 150, 158–159, 171, 223, 272
<i>Panthera tigris</i>	Tiger	EN	EN	4	3	81, 118, 124, 132, 134, 139, 150, 158–159, 171, 272
<i>Pardofelis marmorata</i>	Marbled Cat	VU	EN	4	4	24, 45, 81, 118, 150, 158, 239, 255, 271
<i>Pardofelis temminckii</i>	Asiatic Golden Cat	NT	VU	4	4	45, 81, 112, 115, 118, 124, 139, 150, 158–159, 239
<i>Petaurista elegans</i>	Spotted Giant Flying Squirrel	LC	VU	4	4	81, 139, 158
<i>Petinomys setosus</i>	Temminck's Flying Squirrel	VU	—	3	1	81
<i>Petinomys vordermanni</i>	Vordermann's Flying Squirrel	VU	VU	1	1	21, 81, 112, 158
<i>Phoniscus atrox</i>	Groove-toothed Trumpet-eared Bat	NT	VU	3	3	81, 158, 244
<i>Pipistrellus cadornae</i>	Cadorna's Pipistrelle	LC	NT	7	7	139, 158
<i>Pipistrellus pulveratus</i>	Chinese Pipistrelle	LC	NT	7	7	139, 158, 196
<i>Presbytis femoralis</i>	Banded Langur	NT	VU	2	2	50, 81, 112, 139, 147, 158
<i>Presbytis siamensis</i>	Pale-thighed Langur	NT	—	N/A	N/A	81
<i>Prionailurus planiceps</i>	Flat-headed Cat	EN	CR	2	2	13, 24, 45, 81, 112, 139, 156, 158, 273

APPENDIX (Cont'd)

Mammals

Scientific Name	Common Name	IUCN Status	Thailand Status	RS-1	RS-2	Reference
<i>Prionailurus viverrinus</i>	Fishing Cat	EN	VU	1	1	45, 52, 81, 139, 150, 158, 191, 239
<i>Prionodon linsang</i>	Banded Linsang	LC	VU	3	3	24, 45, 81, 93, 115, 118, 124, 139, 158, 224, 286
<i>Prionodon pardicolor</i>	Spotted Linsang	LC	EN	4	4	23, 45, 81, 94, 139, 145, 158, 195, 258, 286
<i>Pteromyscus pulverulentus</i>	Smoky Flying Squirrel	EN	—	N/A	N/A	81
<i>Pteropus lylei</i>	Lyle's Flying Fox	VU	NT	1	1	21, 81, 139, 158, 191
<i>Pteropus vampyrus</i>	Large Flying Fox	NT	VU	2	2	81, 112–113, 139, 158, 191
<i>Ratufa affinis</i>	Pale Giant Squirrel	NT	VU	3	3	20, 81, 112, 134, 158
<i>Ratufa bicolor</i>	Black Giant Squirrel	NT	—	4	3	20, 81, 134, 150, 159, 171, 223, 229
<i>Rhinolophus marshalli</i>	Marshall's Horseshoe Bat	LC	EN	6	5	81, 139, 158
<i>Rhinolophus paradoxolophus</i>	Bourret's Horseshoe Bat	LC	VU	7	7	81, 139, 158, 196
<i>Rhinolophus robinsoni</i>	Peninsular Horseshoe Bat	NT	VU	6	4	81, 158, 179
<i>Rhinosciurus laticaudatus</i>	Shrew-faced Squirrel	NT	VU	3	1	21, 81, 112, 134, 139, 158
<i>Rusa unicolor</i>	Sambar	VU	—	3	3	81, 118, 132, 139, 217, 228, 230, 272
<i>Saccolaimus saccolaimus</i>	Bare-rumped Sheath-tail-bat	LC	VU	N/A	N/A	81
<i>Scotomanes ornatus</i>	Harlequin Bat	LC	VU	7	7	81, 139, 158
<i>Sphaerias blanfordi</i>	Blanford's Fruit Bat	LC	VU	7	7	81, 139, 158
<i>Sundasciurus hippurus</i>	Horse-tailed Squirrel	NT	EN	4	3	81, 134, 139, 158
<i>Symphalangus syndactylus</i>	Siamang	EN	NT	6	6	81, 84, 134, 158, 164, 166
<i>Tadarida mops</i>	Malayan Free-tailed Bat	NT	NT	4	4	81, 158
<i>Tapirus indicus</i>	Malayan Tapir	EN	EN	3	3	81, 118, 124, 139, 158–159, 223, 271–272
<i>Trachypithecus germaini</i>	Indochinese Silvered Langur	EN	NT	3	1	81, 158
<i>Trachypithecus obscurus</i>	Spectacled Langur	NT	VU	6	4	81, 124, 134, 158
<i>Trachypithecus phayrei</i>	Phayre's Langur	EN	VU	5	5	81, 158, 171, 223, 260
<i>Tragulus napu</i>	Larger Mousedeer	LC	EN	7	7	81, 124, 158
<i>Ursus malayanus</i>	Malayan Sun Bear	VU	VU	4	3	81, 112, 115, 118, 139, 150, 158–159, 272, 276
<i>Ursus thibetanus</i>	Asiatic Black Bear	VU	VU	4	4	81, 115, 118, 150, 158, 171, 272, 276
<i>Viverra zibetha</i>	Large-spotted Civet	VU	EN	3	2	45, 81, 87, 94, 107–108, 149, 150, 158, 286
<i>Viverra zibetha</i>	Large Indian Civet	NT	—	4	3	81, 87, 94, 108, 115, 139, 145, 159, 286

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