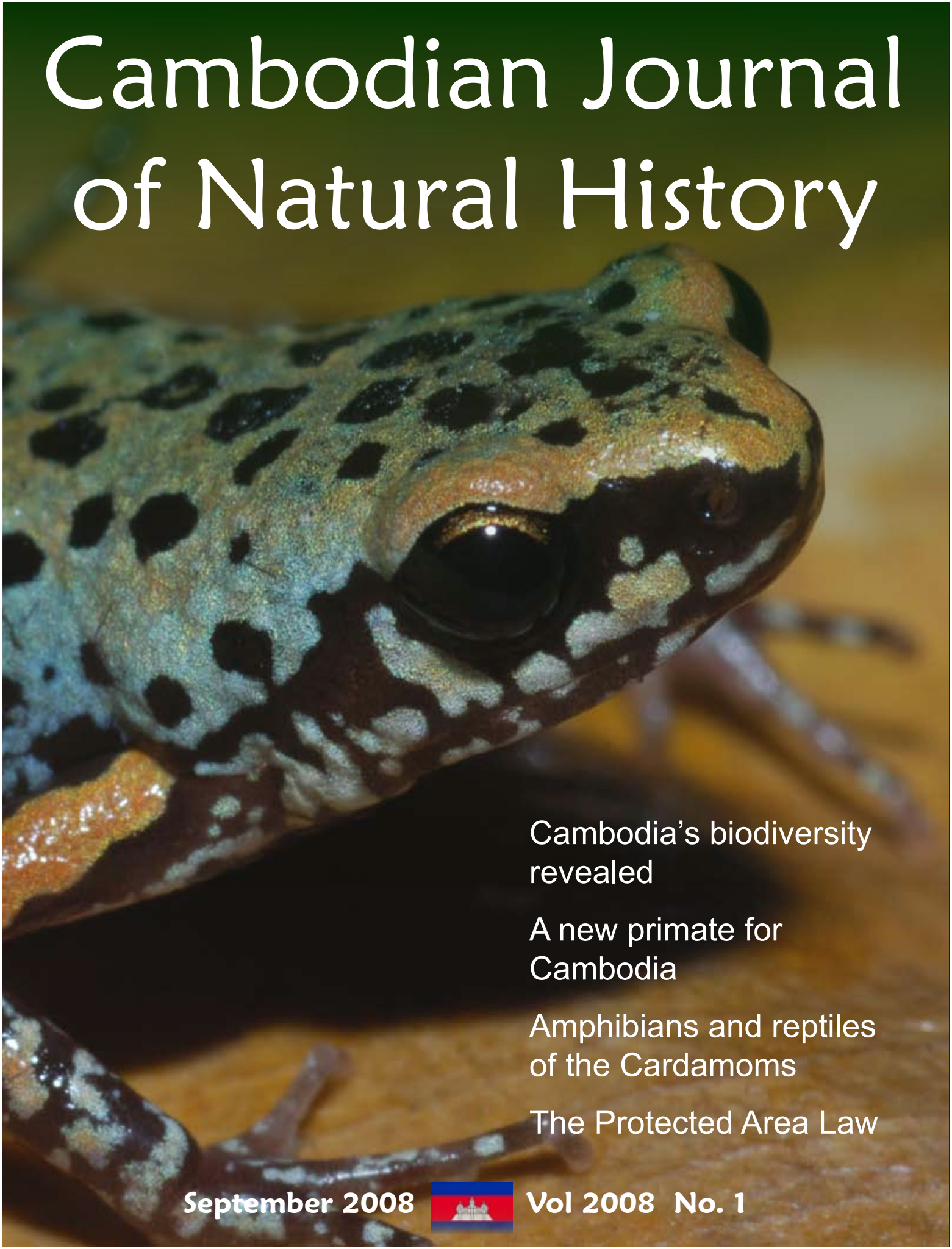
Cambodian Journal of Natural History



Cambodia's biodiversity revealed

A new primate for Cambodia

Amphibians and reptiles of the Cardamoms

The Protected Area Law

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Cover photo: (© L.L. Grismer) *Micryletta inornata*, commonly called the 'plain narrow-mouthed frog' or 'deli paddy frog', typically inhabits disturbed forested areas where it hides under fallen logs or rocks during the day. It breeds in small, still pools of water. In Cambodia, this beautiful frog has been found in the Cardamom Mountains, Bokor National Park (see Grismer *et al*., this volume) and limestone areas near Kampot. It is also native to India, Indonesia, Malaysia, Thailand, Vietnam, Laos and China.

Editorial - Cambodia's biodiversity revealed

Jenny C. Daltry

The past ten years have seen a revolution in our understanding of the status, ecology and management needs of Cambodia's biological diversity.

This rise in environmental knowledge can be charted by the number of species known to occur in Cambodia. In the 1997 '*Cambodia: A National Biodiversity Prospectus*', ecologist David Ashwell collated and summarized all of the available information on the country's natural resources. Nearly all of the 410 species of birds and 2,308 vascular plants he recorded had been found in surveys prior to the 1970s. The *Prospectus* also listed 132 mammals in Cambodia, but fewer than 100 species had actually been confirmed by 1997 - the rest were inferred from their presence in neighbouring countries. Ashwell made no attempt to assess the number of species of reptiles, amphibians or insects. Only a few years earlier, the World Conservation Monitoring Centre (WCMC, 1994) recorded 82 species of reptiles and 28 amphibians in Cambodia, but many of them were unconfirmed: a perusal of the available literature suggests that only nine species of amphibians had been verified in Cambodia by the late 1990s. WCMC (1994) also reported the number of freshwater fish species in Cambodia to be ">215". In comparison with neighbouring countries, all of these figures were suspiciously low. It was, as Ashwell (1997) observed, "clear that there are many more species yet to be discovered."

As predicted, the number of species known to inhabit Cambodia has shot upwards since the late 1990s, largely due to collaborative surveys by national and international scientists. The number of confirmed mammal species has reached 146 (UNEP-WCMC, 2008), with many of the latest additions being bats, rodents and other small mammals. To this figure can be added the red-shanked douc, *Pygathrix nemaeus* (Rawson & Roos, 2008 - this volume). 552 birds have been confirmed within Cambodia's borders, with a further 20 reported but unproven (F. Goes, pers. comm.). At least 474 species of native freshwater fishes have been positively confirmed, according to FishBase (Froese & Pauly, 2008), but several authorities put this figure at over 500 or even 1,000 species. Grismer *et al*. (2008 - this volume) list over 97 species of reptile in Southwest Cambodia alone. These include several new species records that should be added to the UNEP-WCMC (2008) database, which currently lists 165 reptiles nationwide. In 2008, a new guidebook will document at least 63 species of amphibians that have been collected in Cambodia, several of which still lack scientific names (Neang & Holden, in press). The number of known plants is also rising steadily, although many hundreds of specimens collected in recent years remain unidentified.

Published information on invertebrates remains even more scattered and incomplete. The UNEP-

Table 1 Number of species confirmed to be in Cambodia (see text for references)

	1990s	2008	Percentage increase
Mammals	c. 100	147	c. 47%
Birds	410	552	35%
Reptiles	82	>165	101%
Amphibians	28 (9)	63	125% (600%)
Freshwater fishes	>215	>474	120%
Butterflies and moths	31	>513	>1,555%
Vascular plants	2,308	(Not assessed)	-

WCMC database and older sources list only 31 butterflies and moths in Cambodia, but a 12-day survey in the Cardamom Mountains found 292 species belonging to one moth family, Pyraloidea, alone (Nuss, 2000) and an eight-day survey in 2006 collected 221 species of butterflies in one small part of Pursat province (M. Yago, University of Tokyo, pers. comm.). Readers of this journal may know of other, equally astonishing records.

While most of Cambodia's newly recorded species were previously known from neighbouring countries (e.g., Thomas *et al*., 2007), some have proved to be completely new to science, including a mite (Haitlinger, 2004), orchid (Liu & Chen, 2002), snake (Daltry & Wüster, 2002) and tree (Wilkie, 2007). A number of the new species are believed to be endemic, or unique, to Cambodia, including a recently discovered bat from Kirirom (Csorba & Bates, 2005), a new fish genus from the Tonle Sap (Motomura & Mukai, 2006) and a green-blooded tree frog from the Cardamom Mountains (Grismer *et al*., 2007).

The figures in Table 1 may be hotly disputed, but one thing is clear - the number of known species in Cambodia will continue to increase for the foreseeable future. This is partly because many areas are only just beginning to be explored for the first time. Of the 23 protected areas established in 1993, for example, ground-based surveys had been carried out in only four or five by 1997. In the intervening ten years, *all* of the protected areas have been visited by one or more biologists, and 15 or more have been subjected to baseline surveys of at least the birds and mammals. These statistics illustrate the tremendous progress that has been made during the past ten years, but there is still a very long way to go before Cambodia's biodiversity is fully documented and understood.

The rapidly growing body of research by Cambodian and international biologists is mirrored by burgeoning research in the fields of human livelihoods and natural resource consumption. While the bulk of this work has focused on fisheries, an increasing number of studies have been conducted on the use and management of forests and other terrestrial resources. Some examples of these can be downloaded from the MekongInfo website (www.mekonginfo.org). The social scientists have demonstrated that well over 8.5 million Cambodian people depend very heavily upon fisheries and forest resources for their daily consumption and during times of hardship. As McKenney & Prom (2002) put it: "Cambodia's natural resources not only provide a foundation for food security, income, and employment for most of the population, but also an essential 'safety net' for the rural poor". The diversity and quantity of species used by people in this country is breathtaking. For example, at least 300,000 tonnes of fish are taken out of Cambodian rivers and lakes every year (Nao & van Zalinge, 2000), and around 600 native plant species are collected for medicinal purposes (Walston & Ashwell, 2008).

Just as we are starting to realise how diverse and important Cambodia's biodiversity is, it is beginning to disappear. Unsustainable logging, hunting and fishing, land speculation and encroachment in protected areas and forests, alien invasive species, and the transformation of natural habitats by roads, plantations, mines, and hydroelectric dams are all taking their toll. Arguably the biggest challenge facing Cambodia today is finding a way to develop its economy and improve infrastructure without decimating the natural systems that more than half of its people depend on. Making the right choices will require an more rounded understanding of the diversity, status, distribution, ecology, threats, human use and management needs of Cambodia's incredible biological wealth.

The Editors hope that the *Cambodian Journal of Natural History* can play a useful role in this regard. The idea of launching a national environmental science journal sprang from the realisation that while there is a wide array of exciting research being carried out in Cambodia, very little of this work is being made available to other scientists or decision makers to share within the country. Notwithstanding the references cited below, many of the most important discoveries in the past decade can be found only in technical reports to donors

or published in expensive and often unattainable foreign journals. Even more data, from interviews, field observations and experimental studies, remain confined to personal notebooks and risk being lost forever.

The primary mission of this journal is therefore to encourage and enable more scientists in Cambodia to share their findings with a wider international and national audience, including many of the nation's leading advisers and decision-makers.

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Ongoing publication project: an annotated checklist of the birds of Cambodia

Frédéric Goes

Background

No comprehensive work on Cambodia's avifauna has been published since Thomas and Poole reviewed the 399 species that had been recorded before 1970 (in *Forktail* **19,** 103-127). After the country returned to peace in the mid-1990's, the amount of new information has grown exponentially. Today, there is an obvious need for a national checklist reference for the conservationists, ornithologists and increasing flocks of birdwatchers to Cambodia.

Scope

The book will cover the 552 species recorded to date, plus another 20+ unconfirmed, provisional or potential additions. Each species will be listed by their scientific, English, Khmer (plus transliteration) and French names. Species accounts will give information on status, abundance, distribution, habitat, breeding and conservation. An introduction will feature habitat and protected area maps and present the country's geography, habitats, ornithological history and coverage, as well as threats and conservation importance. The book should also include photos of particular species or habitats.

Moustached barbet *Megalaima incognita* (photo by Xavier Rufray).

Collared owlet *Glaucidium brodiei* (photo by Xavier Rufray).

Plea for contributors

The author would be grateful to any visiting or resident birders, bird tour guides, conservation organisations, or anyone else for sharing relevant information such as survey reports, trip accounts, observations, publications, etc. Photos of species, natural habitats or threats taken in Cambodia would be much appreciated and the photographers fully acknowledged. Finally, should any person or organisation be interested in contributing funds for this project, this would be most welcome because there is currently no funding secured to cover layout and printing costs. To contribute information and photographs, please write to: Frédéric Goes, e-mail fredbaksey@yahoo.com

A new primate species record for Cambodia: *Pygathrix nemaeus*

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Currently three species of douc (Genus: *Pygathrix*) are recognized; the black-shanked douc (*P. nigripes*), the grey-shanked douc (*P. cinerea*), and the red-shanked douc (*P. nemaeus*) (Groves, 2001; Roos & Nadler, 2001; Nadler *et al*., 2003; Roos, 2004). This genus is restricted to Indochina east of the Mekong River, with *P. nigripes* typically ascribed to occur in Cambodia and Southern Vietnam, *P. cinerea* in central Vietnam, and *P. nemaeus* in Laos (south of N18°40′) and central and north-central Vietnam (Fooden, 1996; Nadler *et al*., 2003). These species largely replace each other from south to north, but there are instances of local sympatry recorded and, in some areas, the species are thought to hybridise (Nadler *et al*., 2003).

Douc distribution records in Cambodia are very limited. To date, presence data have been published only for Snoul Wildlife Sanctuary (Walston *et al*., 2001), Phnom Prich Wildlife Sanctuary (Timmins & Ou, 2001), Mondulkiri Protected Forest (Long *et al*., 2000), and Lomphat Wildlife Sanctuary (Timmins & Men, 1998), while population data exist only for Seima Biodiversity Conservation Area (Pollard *et al*., 2007). All records for Cambodia to date have been *P. nigripes*. This short communication reports the first confirmed record of *P. nemaeus* for Cambodia plus evidence of sympatry between this species and *P. nigripes* from a Conservation International/ Forestry Administration research site in Voensei District, Ratanakiri Province.

In November 2006, one author (BR) clearly observed two black-shanked doucs (*P. nigripes*) in evergreen forest close to the Conservation International research base (N14°00′30.8″, E106°45′29.3″). The sighting was sufficient for a positive identification and individuals clearly displayed the blue faces with orange eye-rings characteristic of this species. One year later, on 19 November 2007, the same author observed an adult male, female and juvenile from a group of approximately 20 animals in evergreen forest only 3.55km from the previous sighting (N14°01′52.2″, E106°44′05.6″). These individuals were clearly not *P. nigripes*, and all showed the facial characteristics of *P. nemaeus*, having yellow and white faces with no trace of blue, long whiskers around the face and the characteristic upward sloping eyes of the species (Nadler, 1997). Due to poor viewing conditions at this time, no other definitive characters were observed, but faecal material was collected from 6-10 animals and sent to the German Primate Center for analysis.

DNA was extracted from the faecal samples and two mitochondrial fragments (hypervariable region I of the control region and the cytochrome b gene) as well as one autosomal (IRBP intron 3) and one Y chromosomal locus (DBY intron 5) were amplified and sequenced following methods described elsewhere (Roos & Nadler, 2001; Hellborg & Ellegren, 2003; Roos, 2004; Roos *et al*., 2007; Liu *et al*., 2008). Obtained sequences were compared to orthologous data from a large number of douc specimens at the database of the Indochinese Primate Conservation Genetics Project at the German Primate Center (Roos, 2008).

In the control region fragment, the three douc species differed by 6.6-13.7% from each other,

whereas variation within each species ranged from 0.0 to 6.4%. In the studied fragment of the cytochrome b gene, pairwise differences between species ranged from 2.6 to 8.7%, and individuals of the same species differed by 0.0 to 1.6% from each other. All of the specimens studied from Voensei District showed greatest pairwise similarity to *P. nemaeus* (control region: 0.0-3.1%, cytochrome b: 0.0-1.1%). In intron 3 of the IRBP gene, two species-specific polymorphic sites were detected. In all study specimens, only the nucleotides specific for *P. nemaeus* were observed. In intron 5 of the Y chromosomal DBY gene, three polymorphic sites were detected, which allowed discrimination between the three species. Among the samples analysed, three revealed an amplification of the gene, indicating they were from males. From the other samples, no PCR product could be generated, indicating they were from females. In the three sequenced PCR products, the three sites typical for *P. nemaeus* were detected. According to these genetic data, there was no indication that the tested specimens were of hybrid origin.

Since the genetic analysis was completed, a second sighting of a different group of doucs has been made. On 18 February 2008, a group of approximately 20 individuals was encountered at N14°01'32.4", E106°42'51.9" and photos were taken (Fig. 1). This group was located 5.09km from the group of *P. nigripes* encountered in 2006, and 2.29km from the previously observed group of *P. nemaeus.*

Morphologically, the individuals did not look like typical *P. nemaeus*. Most showed no trace of red on their legs, except for one adult male (Fig. 1) which had red feet. Instead, the shanks and thighs were black, which contrasted with the fairly uniform grey colouration of the body. The characteristic white 'gloves', which usually extend to the elbow and are often cited as a definitive character for *P. nemaeus* (Nadler *et al*., 2003), were either absent or greatly reduced, with only an inch or two of white on the outer wrist, but sometimes extending further up the inner arm (see Fig. 1). One adult male was however seen to have the white swirls at the lateral upper margins of the white sacral patch, as found in typical adult male *P. nemaeus* (Lippold, 1977). In general, it appears that males of the population show more *P. nemaeus* characters than females.

This same variation in characters has been observed in southernmost Laos, with individuals having dark legs with the extent of red limited to the feet and ankles (Timmins & Duckworth, 1999). It was also noted in one group that only the male showed red colouration higher than the ankles (Davidson *et al*., 1997). Based on these character aberrations, the authors suggested that the populations here may form part of a hybrid zone (Timmins & Duckworth, 1999). Based on the preliminary genetic assessment presented here, however, it now seems possible that the records in southernmost Laos are also *P. nemaeus*.

It is interesting to note that this variation of apparently key morphological characters has also been observed by the first author (BR) in a population of genetically-confirmed *P. cinerea* in Que Phuoc Commune, Quang Nam Province, Vietnam. Some individuals here displayed occasional red on their legs and feet and white on the wrists, contrary to the species descriptions (Nadler, 1997). Recently, Nadler (2008) reported that *P. nigripes* from Khanh Hoa Province, Vietnam show atypical white patches on the wrists and some individuals even have red on their legs. It therefore seems that these characters are not sufficiently fixed to be diagnostic, and that genetic material will be required to confirm species assignation in ambiguous cases.

Hence, there is much confusion about the distribution and occurrence of the various douc species and morphotypes in different regions. Accordingly, much more field and laboratory work, including further Y chromosomal and autosomal data, is necessary to fully understand and describe the link between species, fur colouration and distribution. Genetic data allow a clear discrimination between different local douc populations. Whether they are in agreement with morphotypes and taxonomic classification has to be settled and the possible influence of (introgressive) hybridisation events among species should be examined in further studies.

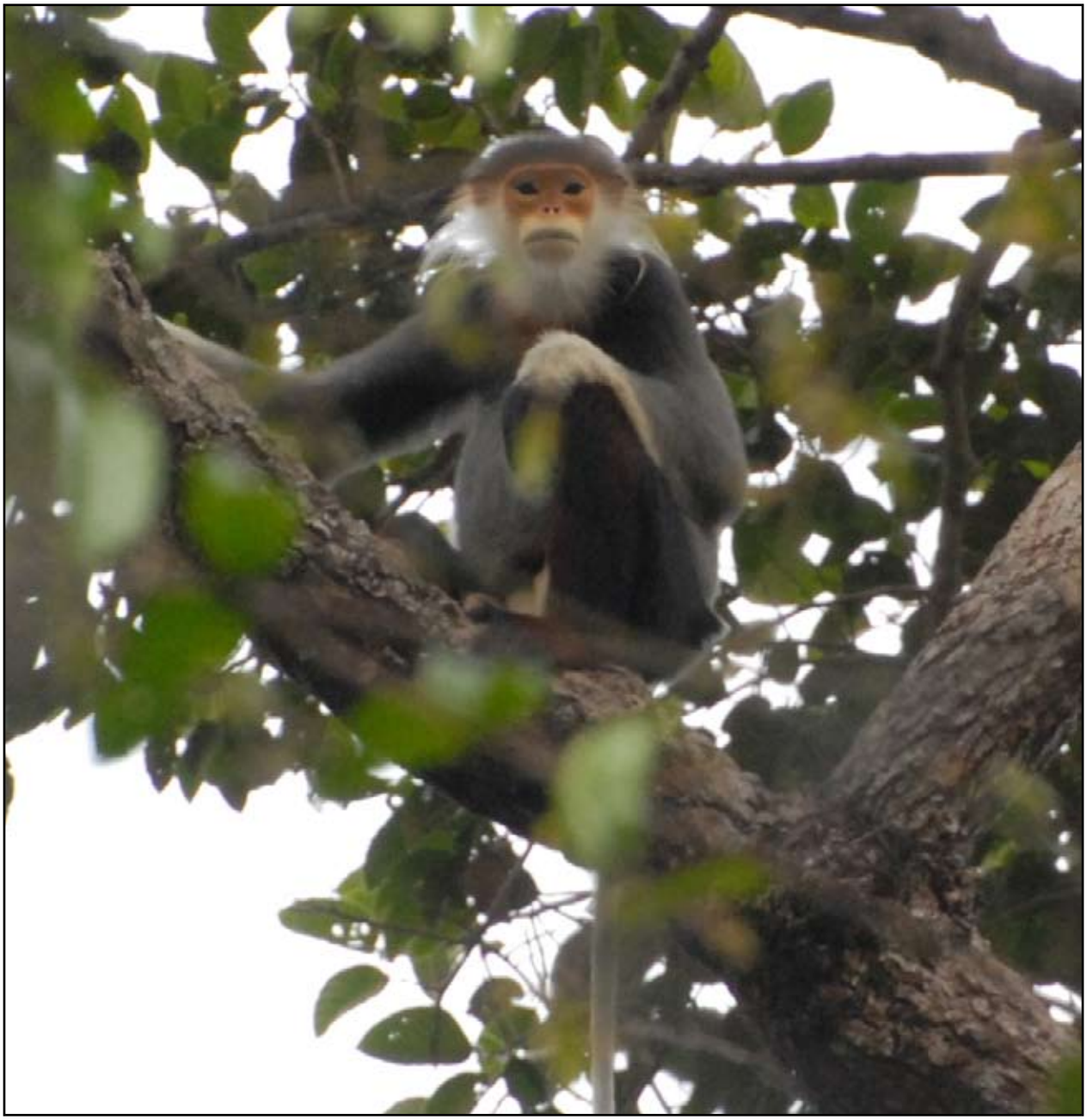

Fig. 1 An adult male *P. nemaeus* from the site. Note the relatively limited extent of white on the wrists, the black legs and red feet (photo by B. Rawson/CI).

Based on our current knowledge, it is highly likely that the studied specimens from Vonsei District represent pure *P. nemaeus* and are not the result of hybridisation.

Based on the southernmost record from Laos, which comes from Phou Halang (N14°25′, E106°57′) (Timmins & Duckworth, 1999), the record reported here represents a southerly range extension of only 50km. While this is not significant in itself, the genetic analysis presented here suggests that a contiguous population of the species probably exists between these points. This in turn raises the possibility that this area, together with the intervening Virachey National Park, may represent an important stronghold for the species, given the very low

Fig. 2 The moribund grey-shanked/ red-shanked douc F1 hybrid from Virachey National Park. This individual shows only a tuft of white hair on the outer wrists and some red on the lower legs (photo by A.J. Lynam/WCS/WWF).

human population (Save Cambodia's Wildlife, 2006) and apparently relatively low hunting pressures (Rawson, 2007; Conservation International, 2008).

Of additional interest to douc langur diversity and conservation in northeastern Cambodia is an unpublished record gathered during a camera trapping expedition in Virachey National Park. On 23 May 1999, a Wildlife Conservation Society team discovered a moribund douc langur in degraded deciduous dipterocarp forest in an area close to Veal Thom (N14°08'35", E107°02'19") (Antony J. Lynam/ WCS/WWF, in litt.), some 35km north east from the record discussed in this paper. Photos were taken (see Fig. 2) and a hair sample sent to the German Primate Center, which showed that the animal was a red-shanked douc (*P. nemaeus*) grey-shanked douc (*P. cinerea*) F1 hybrid. This record suggests that the third species of douc langur may also be present in Cambodia.

Until this can be confirmed, however, the number of species of non-human primates in Cambodia should be raised from ten to eleven, based on the new record of red-shanked douc presented here. The list of Cambodian primates now includes *Nycticebus pygmaeus*, *N. bengalensis*, *Macaca fascicularis*, *M. leonina*, *M. arctoides*, *Trachypithecus margarita*, *T. germaini*, *Pygathrix nigripes*, *P. nemaeus*, *Nomascus gabriellae* and *Hylobates pileatus*.

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About the Authors

BEN RAWSON is the Indo-Burma region primate specialist for Conservation International. He has been conducting research and conservation activities on primates in Cambodia and Vietnam for six years and has a special interest in the population status and ecology of both doucs and gibbons. He is also heavily involved with training students and protected area staff in primate research, and runs frequent primate conservation training courses in Vietnamese universities.

CHRISTIAN ROOS is a scientist at the German Primate Center and Head of the Indochinese Primate Conservation Genetics Project. For 15 years he has worked on the genetics of primates in general, but mainly on primates occurring in the Indochinese bioregion. His studies provide essential information on the evolution, taxonomy and distribution of these endangered primates. As Deputy Regional Coordinator of the IUCN/SSC Primate Specialist Group, Section Southeast Asia, he is directly involved in conservation actions in Asia.

Checklist of the amphibians and reptiles of the Cardamom region of southwestern Cambodia

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Abstract

An up-to-date checklist of the herpetofauna of the Cardamom region of southwestern Cambodia is provided which includes new records for one species of caecilian, one species of frog, two species of lizards, and seven species of snakes. These include an undescribed species of the caecilian *Ichthyophis* and the gecko *Cnemaspis* and a new record for Cambodia of the snake *Coelognathus flavolineatus*. The frog *Micryletta inornata* and the turtle *Cyclemys atripons* are reported for the first time from Bokor National Park, in the southeastern Cardamoms.

Keywords

Cambodia, Cardamom Mountains, amphibian, reptile, checklist.

Introduction

The Cardamom region of southwestern Cambodia, as defined here, is a rugged physiographic feature framing much of the northern margin of the Gulf of Thailand. This region actually begins in southeastern Thailand just beyond the Cambodian/ Thai border in the Khao Soi Dao Mountains and extends 225km to the southeast to the Elephant Mountains of Bokor National Park just east of Kampot Bay. From here this region emerges offshore as the island of Phu Quoc, Vietnam in the southeast and as several smaller islands flanking the southern shoreline of Cambodia and southeastern Thailand (Fig. 1). The conspicuous, well-sculpted topography of this region is composed of a series of isolated prominent peaks and plateaus along with their associated foothills that are separated from one another by low-lying open areas of varying terrain. In Cambodia, where this report is focused, the western peaks of Phnom Samkos and Phnom Tumpor compose what is termed here as the northwestern Cardamoms. These peaks reach 1,717m and 1,551m in elevation, respectively, and maintain regions of disturbed deciduous dipterocarp forest throughout their intervening areas and large tracts of lowland and evergreen hill forests along their slopes and upper elevations, respectively (Grismer, *et al*., 2008). They are separated from the upland regions of the central Cardamom mountains by a wide (~10km), low-lying valley running due south approximately 70km from just north of the village of O'Som, Pursat Province, to the southern coast in Koh Kong Province (Fig. 1).

The northeastern portion of the Cardamom region comprises an isolated mass of mountains and hills set in the flatlands of Kampong Speu Province and is referred to here as the northeastern Cardamoms. The highest peak, Phnom Aural,

reaches 1,780m in elevation and maintains significant tracts of deciduous, dipterocarp forests and pristine evergreen forests (Grismer *et al.*, 2007). The northeastern Cardamoms are situated due east of the central portion of the Cardamom Mountains and are separated from this massif by a narrow (~5km), low-lying valley extending northwest to southeast for approximately 29km (Fig. 1).

Between the northwestern and northeastern Cardamoms, lies the extensive central section of the Cardamom region referred to here as the central Cardamoms (Fig. 1). For the most part, this area is a high-elevation plateau reaching 1,400m in elevation and dominated by evergreen and pine forests infused with a network of grasslands. Its hilly slopes maintain significant tracts evergreen and deciduous forests with fast-flowing rocky streams.

Southeast of the central Cardamoms lies Kirirom National Park and Bokor National Park which collectively make up the mountainous southeastern portion of the Cardamom Region and are referred to here as the southeastern Cardamoms. Kirirom National Park is primarily a plateau reaching 903m in elevation straddling the provinces of Kampong Speu and Koh Kong. It is separated from the central Cardamoms by a wide (~10km), low-lying flat area beginning near the village of Choam in Kampong Speu Province and running southwest for approximately 60km to Sre Ambel in Koh Kong, Province. The bulk of the Kirirom Plateau is covered with a mosaic of grassland and a reticulated network of pine forests. The slopes of the plateau support and evergreen forest interspersed with tracts of mixed deciduous and bamboo forests. Directly southeast of the Kirirom Plateau is a conglomerate of hills and peaks which eventually grade into another plateau region referred to as the Elephant Mountains of Bokor National Park. Reaching an elevation of 1,087m, the floral composition of this range

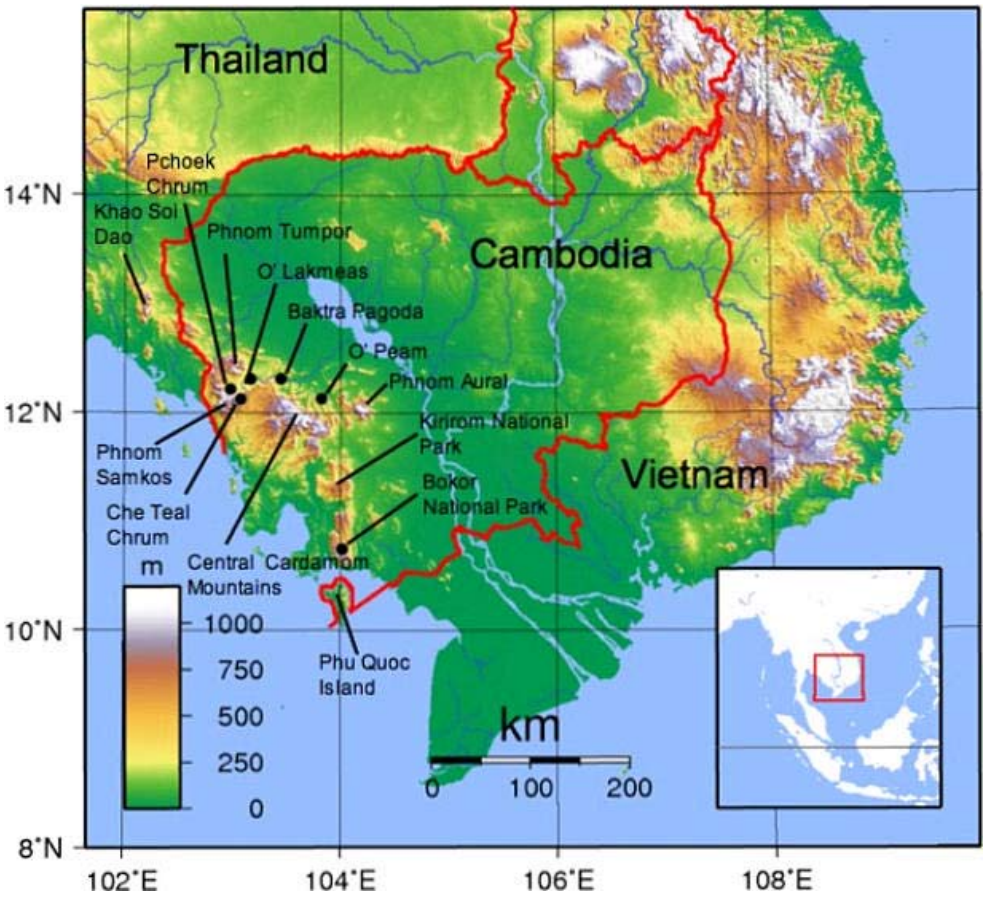

Fig. 1. Map of the Cardamom region of Cambodia showing the survey sites (black circles) and the separate mountain systems.

is greatly affected by continuous, onshore winds arising from the Gulf of Thailand which promote a mixture of grassland and heath forest (Stuart & Emmett, 2006) and shrouds the upper elevations of the Bokor Plateau in thick fog for much of the year. The slopes of the Elephant Mountains support tracts of primary evergreen forests and steep, fast-flowing, rocky streams.

A recent surge of field surveys in the Cardamom region of Cambodia have begun to reveal its extensive herpetofaunal diversity as well as its growing level of endemism (Grismer *et al*., 2007a,b, 2008a,b; Stuart & Emmett, 2006). To date, there is one caecilian, 40 frogs, 10 turtles, 35 lizards, 51 snakes and one crocodile confirmed for the Cardamom region, the vast majority of which have been reported from the mountainous areas. Because these mountainous areas exist as a series of fragmented, montane ecosystems with well-defined borders and different forest types, one cannot assume that a species found in one mountain range will extend continuously throughout this fragmented system into other mountain ranges. In fact, ongoing studies of the herpetofauna in the fragmented mountainous regions of the Malay Peninsula show that localized endemism is commonplace in such areas (Grismer, in prep.). For this reason, the herpetofauna of each mountain system are listed separately (Table 1). Previous surveys have overlooked much of the associated low-lying foothill areas flanking the separate mountain systems which we report on here. This is largely because these areas have been densely laced with land mines and only a small fraction of them have been recently cleared.

We also present the records from previous works that include the Cardamom region of Cambodia to provide a complete up-to-date checklist of the herpetofauna of the entire region (Table 1). Additional species records for areas of the Cardamom Region outside of Cambodia can be found in Bourret (1934, 1942), Smith (1931, 1935, 1943) and Taylor (1963, 1965, 1968) for Thailand, and to some extent Phu Quoc Island, Vietnam and Nguyen *et al*. (2005) and Dang *et al*. (2006) for Phu Quoc Island.

Methods

We conducted four brief field surveys in lowland habitats of the western areas surrounding the villages of Che Teal Chrum, Veal Veng District, Pursat Province (12°11.898'N, 103°06.931'E; 237m above sea level) and Pchoek Chrum, Veal Veng District, Pursat Province (12°14.341'N, 103°06.542'E; 273m a.s.l.) from 26–28 June; O'Lakmeas, Veal Veng District, Pursat Province (12°19.433'N, 103°30.605'E; 96m a.s.l.) from 29 June to 1 July; the Baktra Pagoda, Veal Veng District, Pursat Province (12°25.755'N, 103°51.819'E; 74m a.s.l.); and the base of Phnom Samkos at O'Peam, Veal Veng District, Pursat Province (12°12.435'N, 103°03.961'E; 271m a.s.l) from 10–14 November and 7–10 December 2007. We were denied access into many of the other lowland areas we believed had the most suitable habitat for high herpetological diversity (undisturbed forest with rocky streams and rocky hillsides) because on-location officials from the Cambodian Mine Action Centre (CMAC) considered them too dangerous. We were allowed access into areas where it was believed the locations of mine fields were known and where we could be guided successfully around them. An additional survey was conducted in the Elephant Mountains of the Bokor National Park, Kampot Province in the southeastern portion of the Cardamom region from 9–11 July 2007.

Specimens were collected by hand or with a blowpipe during all hours of the day and night. Representative samples of each species collected were photographed prior to preservation. Following euthanization, tissue samples of liver were taken and stored in 100% ethanol. Specimens were then preserved with 10% formalin and later transferred into 70% ethanol. Voucher material and tissue samples were deposited in the La Sierra University Herpetological Collection (LSUHC), Riverside, California, USA, unless noted otherwise. Voucher photographs were deposited in the La Sierra University Digital Photo Collection (LSUDPC).

Results

Presented below are the new records of species from the Cardamom region with taxonomic comments concerning other species.

Ichthyophiidae

Ichthyophis sp. (Fig. 2).

Material examined: Che Teal Chrum Village; LSUHC 8404–06, 8409; 27 June.

The presence of a distinct postanal tail places these four specimens in the family Ichthyophiidae; four rows of teeth (two upper, two lower) and the formation of a posteriorly directed, median, ventral angle formed by the primary and secondary folds which extend the length of the body place them in the genus *Ichthyophis* (Taylor, 1968). All are fully transformed; range from 242–375mm snout-vent length (SVL); have 360–383 primary and secondary folds curving very slightly forward dorsally; tentacular aperture low on upper lip, much closer to eye than nostril; eye distinct; body length 25–28 times body width; wide, yellow, lateral body stripe bifurcates at angle of jaw with a dorsal branch extending onto upper jaw and reaching eye in LSUHC 8406, but not in others, ventral branch extending onto lower jaw to level of tentacular aperture or slightly beyond it; remainder of body dark brown; no small, white asperites on tail.

Stuart *et al*. (2006) reported the first caecilian from Cambodia based on a specimen they identified as *Ichthyophis kohtaoensis* from Ta Veng, Ratanakiri Province. Those reported here differ from Stuart & Emmett's (2006) specimen and *I. kohtaoensis sensu* Taylor (1968) in being much larger (375mm SVL [LSUHC 8409] vs. 320mm) and lacking white asperites on the tail. However, given that there are several striped, putative species known from southeast Asia (Berry, 1975; Taylor, 1968; Manthey & Grossmann, 1997; Lim & Lim 1999; D. Gower, pers. comm., 2006) and because all have a conserved morphology, it is difficult to distinguish one species from another which has resulted in a confusing and unstable taxonomy (Gower *et al*., 2002). Until the completion of ongoing molecular analyses (D. Gower pers. comm., 2006), we believe assignment of this population to any species would be dubious.

All specimens were collected at 1000h beneath boards in grassy areas surrounding the village following days of heavy rain.

Microhylidae

Calluella guttulata (Blyth, 1855)

Material examined: O'Peam, LSUDPC 4065, 12 November.

This specimen was identified from a photograph (LSUDPC 4065) and the specimen remains uncatalogued with NT.

This species has been reported from the central Cardamoms at Thmar Baing (Stuart & Emmett, 2006) and this is the first report of this species from the northwestern Cardamoms.

Micryletta inornata (Boulenger, 1890)

Material examined: Ranger Station, Bokor National Park (10°34.750'N, 104°07.238'E), 37m a.s.l., LSUHC 8561; 9 July.

This specimen matches Parker's (1934) description having a distinct tympanum; well developed subarticuar tubercles; an inner, but no outer metatarsal tubercle; digits lacking webbing, expanded toe discs or clefts; and a greyish dorsum with large, black, lateral spots.

The specimen was collected at 0930h along a trail in disturbed lowland forest during a light rain. This species has been reported from elsewhere in the Cardamom region (Ohler *et al*., 2002; Stuart & Emmett, 2006) but this is the first record from the Bokor National Park.

Bataguridae

Cyclemys atripons Iverson and McCord 1997

Material examined: Popok Vil Waterfall, Bokor National Park, (10°39.429'N, 104°03.091'E), 925m a.s.l., LSUHC 8567; 7 July. O'Peam; LSUDPC 4066;

12 November. A juvenile from Popok Vil Waterfall, Bokor National Park, Kampot Province (55mm carapace length, 48.5mm carapace width, 49.1mm plastron length, 8.2mm head depth) matches the characterization of this species (Stuart & Platt, 2004) in having a yellow plasteron with densely pigmented bridges; an immaculate chin; and 12 dark and 11 light ventral neck stripes. Stuart & Platt (2004) noted that ventral neck stripes were more variable and this specimen exceeds the known range of both stripes by two.

An adult (LSUDPC 4066) from a shallow stream at O'Peam was identified, and released.

The taxonomic history of this species is not clear (Fritz *et al.*, 2001; Guicking *et al.*, 2002; Stuart & Platt, 2004) and its specific separation from *Cyclemys pulchrastriata* on the basis of morphology alone is dubious in the absence of locality data (Guicking *et al.*, 2002; Stuart & Platt, 2004). Fritz *et al.* (2008) and Stuart and Fritz (2008), however, demonstrated with genetic markers that *C. pulchrastriata* and *C. atripons* form two distinct lineages. Several specimens of *C. atripons* have been reported from the Koh Kong Province in the central Cardamoms (Stuart & Platt, 2004), but these are the first records from Bokor National Park and O'Peam.

LSUHC 8567 was found at 1100h in a small, water-filled, rocky depression (7cm x 6cm x 1cm), 3cm from the edge of a sheer, rock cliff approximately 40m in height bordering a large waterfall.

Agamidae

Draco indochinensis Smith 1928

The type locality of this species is the Bokor Mountains, Bokor National Park, of the southeastern Cardamoms (Smith, 1928). It has also been reported from hilly eastern Cambodia at O'Rang, Mondolkiri Province (Stuart *et al.*, 2006). It was overlooked in the checklist of Grismer *et al.* (2007a).

Pseudocalotes floweri (Boulenger, 1912)

Material examined: Bokor National Park (10°37.142'N, 104°05.218'E), 862m a.s.l., LSUHC 8572; 7 July.

Smith (1935) reported this species from "Bokor, Elephant Mnts, 3,000 feet" which would fall within the Bokor National Park. We collected a juvenile female (SVL 55mm) which corresponds to this species (Hallerman & McGuire, 2001) by lacking large postorbital and nuchal spines; having an exposed tympanum; no blue pigment lining the oral mucosa; having a red gular pouch; having dorsal scales larger than ventrals; having enlarged keels on the anterior edges of the subdigital lamellae of the third toe and the posterior edges being reduced; having keeled gular scales with a small, granular, gular sac; having four canthal scales between the nasal and anteriormost supranasal; 53 scales around midbody; and no white spotting on the elbows or knees.

This specimen was collected at 2300h during a rainstorm while it was sleeping 3.5m above the ground at the end of a thin, horizontal branch in evergreen forest. This species was not reported from Bokor National Park by Grismer *et al.* (2007a).

Gekkonidae

Cnemaspis sp. (Fig. 3).

Material examined: O'Lakmeas Village, LSUHC 8478, 8485, 30 June 2007; LSUHC 8515–17, 1 July.

Grismer *et al.* (2007a) reported *Cnemaspis chanthaburiensis* from Phnom Samkos in the northwestern Cardamoms. Reported here is a series of five adult specimens (three females [SVL 49.0–56.1mm] and two males [SVL 50.0–53.9mm]) which cannot be ascribed to any of the known southeast Asian species (Grismer & Ngo, 2007; Chan & Grismer, 2008; Grismer & Chan, 2008; Grismer *et al.*, 2008) based on them having scales of the anterior portion of the forearm keeled; smooth ventral scales; one or two precloacal pores in males; no femoral pores; no rows of linearly arranged tubercles on flanks; having paravertebral and lateral longitudinal rows of caudal tubercles; smooth subcaudals with an enlarged median row; two or three cloacal tubercles; no large, shield-like subtibial scales; enlarged submetatarsal scales beneath the first metatarsal; and a dull-white, thin, chevron-shaped collar. This

Fig. 2 *Ichthyophis* sp. from Che Teal Chrum (photo by LLG).

Fig. 3 *Cnemaspis* sp. from O'Lakmeas (photo by LLG).

Fig. 4 *Eutropis longicaudatus* from O'Lakmeas (photo by LLG).

Fig. 5 *Coelognathus flavolineatus* from O'Peam (photo by NT).

Fig. 6 *Oligodon* sp. from O'Lakmeas (photo by LLG).

Fig. 7 *Oligodon fasciolatus* from O'Lakmeas (photo by LLG).

Fig. 8 *Naja siamensis* from Pchoek Chrum (photo by LLG).

population is being described as a new species (Grismer *et al*., in prep.).

All specimens were collected between 2000 and 2300h along a rocky ridge atop a low hill in dry deciduous forest mix with stands of bamboo. Specimens were seen on large, vertical faces and in small caves. This population occurs 47.3km northeast of the Phnom Samkos population of *Cnemaspis chanthaburiensis.*

Scincidae

Eutropis longicaudatus (Hallowell, 1857) (Fig. 4).

Material examined: O'Lakmeas Village, LSUHC 8480, 30 June.

One adult male (SVL 101mm) corresponds to Taylor's (1963) description in having dorsal scales with two or three low, smooth keels; a scaly lower eyelid lacking a transparent disc; postnasal and supranasal scales; medial contact of the prefrontals; well developed limbs with foot reaching palm when legs are adpressed; and a wide, dark brown, lateral stripe bordered above and below by a white line. It differs from Taylor's (1963) description in having 32 scales around midbody as opposed to 26–30.

This specimen was collected at 1100h while basking on a pile of wood along a dirt road. Although *Eutropis longicaudatus* has a wide distribution throughout Indochina and the Malay Peninsula (Taylor, 1963), this is the first report of this species from the Cardamom region of Cambodia.

Colubridae

Boiga siamensis Nootpand 1971

Material examined: O'Lakmeas Village, LSUHC 8502, 8527, 6 June and 1 July, respectively.

Two adult females (SVL 1,050mm and 1,250mm) are in moderate accordance with Kroon's (1973) original diagnosis in have 23 dorsal scale rows at midbody; 270–280 ventrals (247–270 in Kroon, 1973); 90–126 divided subcaudals (116–129 in Kroon, 1973); eight supralabials with the third, fourth, and fifth entering the orbit; one preocular not contact-

ing the frontal; two postoculars; two (LSUHC 8527 and Kroon, 1973) or three (LSUHC 8502) anterior temporals; 12 or 13 infralabials; enlarged vertebral scales; and an entire anal plate.

Both specimens were collected between 2000 and 2200h. LSUHC 8502 was found 1m above the ground on a branch in a degraded secondary dry deciduous forest and LSUHC 8527 was found 2m above the ground in a tree alongside a small stream.

This species was originally described as *Boiga ocellata* Kroon, 1973 but was shown to be a junior synonym of *B. siamensis* Nootpand 1971 by Pauwels *et al.* (2005). This species represents a new record for the northwestern Cardamoms.

Coelognathus flavolineatus (Schlegel, 1837) (Fig. 5).

Material examined: O'Peam, LSUHC 8693–94, 12 November.

Two adults males (SVL 1,314mm and 1,210mm) match Smith's (1943) and Taylor's (1965) description having a large loreal; sixth labial contacting eye and temporal scales; dorsal scales on posterior two-thirds of body strongly keeled; 19 dorsal scale rows at midbody; dark suborbital spots; no dark, transverse nuchal band; black, dorsolateral stripes anteriorly. Posterior part of body and tail black.

Both specimens were collected at night while crawling across open ground along a stream bank in lowland evergreen forest. This Malayan species ranges north into central Thailand (Schulz, 1996) and has been reported from central Vietnam (Szyndlar & Nguyen, 1996). Although this is the first record of *Coelognathus flavolineatus* for Cambodia, it is not unexpected.

Dryocalamus davisonii (Blanford, 1878)

Material examined: O'Lakmeas Village, LSUHC 8479, 6 June.

A subadult female (SVL 578mm) is in accordance with Smith's (1943) description and that of specimens from the central and southeastern Cardamoms (Stuart & Emmett, 2006) in having 13 rows of smooth, dorsal scales at midbody; no preocular; loreal in broad contact with eye; one postocular; 30 dark brown interspaces on body (elongate anteriorly and shortened posteriorly) separated by 29 cream-coloured bands; and 22 dark caudal bands (19–21 in Stuart & Emmett, 2006).

The specimen was collected at 2200h, 2m above the ground during its head-down descent of the trunk of a small tree alongside a small stream. Although this species has been reported from the central and southeastern Cardamoms (Stuart & Emmett, 2006), this is the first report from the northwestern Cardamoms.

Lycodon laoensis Günther 1864

Material examined: O'Lakmeas Village, LSUHC 8481, 6 June.

An adult female matches the diagnosis of this species as presented by Daltry & Wüster (2002:500) in having 185 ventrals; 66 divided subcaudals; a divided anal plate; a single preocular and loreal; loreal not contacting eye, but contacting internasal; two postoculars; two anterior temporals; 10 supralabials (nine reported by Daltry & Wüster, 2002); 18 light bands on body (19–36 reported in Daltry & Wüster, 2002); and 17 rows of smooth dorsal scale rows at midbody.

This specimen was collected at 2000h while crawling on a stream bank 3m from the water's edge. Although this species has been reported from the central and northeastern Cardamoms (Swan & Daltry, 2002), this is the first report from the northwestern Cardamoms.

Oligodon sp. (Fig. 6).

Material examined: O'Lakmeas Village, LSUHC 8534; 1 July.

This specimen was collected at 1100h while crawling along the edge of a rocky stream. It has been previously reported from Che Teal Chrum Village (Grismer *et al.*, 2008a).

Oligodon fasciolatus (Günther, 1864) (Fig. 7).

Material examined: O'Lakmeas Village, LSUHC 8482; 30 June.

Table 1 Checklist of the herpetofauna of the Cardamom region of southwestern Cambodia.

	Northwest	Central	Northeast	Southeast
CAECILIANS				
Ichthyopidae				
Ichthyophis sp.	12	10		
FROGS				
Megophryidae			2,7	
Leptolalax sp.				
Megophrys auralensis Ohler, Swan & Daltry 2002		3	2,7	
Bufonidae				
Bufo macrotis Boulenger 1887	2	2,3,6,8	2,10	
Bufo melanostictus Schneider 1799	2	2,3,6	2,7,10	
Ingerophrynus parvus Boulenger 1887	2	8		
Microhylidae				
Calluella guttulata (Blyth 1855)	12	3		
Kalophrynus interlineatus (Blyth 1855)	11	2,3,7	2	
Kaloula pulchra Gray 1831	2	2,6,8	2,7,10	
Microhyla annamensis Smith 1923	2	2		
Microhyla berdmorei (Blyth 1856)	2,11	2		13
Microhyla butleri Boulenger 1900	2	2,3,6	2,7,10	
Microhyla fissipes (Duméril, Bibron & Duméril 1841)	2	2		
Microhyla heymonsi Vogt 1911	2	2,3,6	2,7,10	14
Microhyla pulchra (Hallowell 1861)	2	2,3	2,7,10	
Micryletta inornata (Boulenger 1890)	2	3		12
Ranidae				
Fejervarya cancrivora (Gravenhorst 1829)			10	
Fejervarya limnocharis (Gravenhorst 1829)	1,2	2,6,8	2,7	
Hoplobatrachus chinensis (Osbeck 1756)	2	6	2,7	
Limnonectes gyldenstolpei (Anderson 1916)	1,2			
Limnonectes kohchangae (Smith 1922)	2	2,3,8	2,7,10	3
Occidozyga lima (Gravenhorst 1829)	2	3	2,7,10	
Occidozyga martensii Peters 1867	2	2,3,6,8	2,7,10	
Paa fasciculispina (Inger 1970)	2	3	2,7,11	
Rana erythraea (Schlegel 1837)		2,3,6,8	2,7	3
Rana faber Ohler, Swan & Daltry 2002	2,11	2,3,6	2,7	3

Numbers refer to references for the areas indicated: 1 = Daltry & Chheang (2000); 2 = Ohler *et al*. (2002); 3 = Stuart & Emmett (2006); 4 = Stuart & Platt (2004); 5 = seen but not vouchered; 6 = Long *et al*. (2001); 7 = Swan & Daltry (2002); 8 = Daltry & Traeholt (2003); 9 = Chuaynkern *et al.* (2004); 10 = Grismer *et al.* (2007a); 11 = Grismer *et al*. (2008a); 12 = this report; 13 = Smith (1916); 14 = Bourret (1942); 15 = Platt *et al.* (2003); 16 = Tirant (1884); 17 = Paive (1904); 18 = Smith (1931); 19 = Smith (1935); 20 = Smith (1928); 21 = Müster (1983); 22 = Peters (1971); 23 = Saint Girons (1972); 24 = Smith (1943); 25 = Bourret (1934); 26 = Malhotra *et al.* (2004).

	Northwest	Central	Northeast	Southeast
Rana macrodactyla (Günther 1859)		2,6		
Rana milleti Smith 1921	11	3	9	
Rana mortenseni Boulenger 1903	2,11	2,6	2,7	3
Rana taipehensis van Denburgh 1909	2	2		
Rhacophoridae				
Chiromantis doriae Boulenger 1893		2,6		
Chiromantis nongkhorensis (Cochran 1927)	11	3	10	3
Chiromantis samkosensis Grismer, Neang, Chav & Holden 2007	11			
Chiromantis vittatus (Cochran 1927)	2	3,6	2,7	
Philautus cardamonus Ohler, Swan & Daltry 2002	2,11			
Philautus parvulus (Boulenger 1893)		1	2,7,10	3
Polypedates cf. leucomystax (Gravenhorst 1829)	11	2	2,7,10	
Rhacophorus bipunctatus Ahl 1927	11	3	2,7,10	
Rhacophorus bisacculus Taylor 1962	2,11	3		3
Theloderma asperum (Boulenger 1886)			2,7	
Theloderma stellatum Taylor 1962		3		
TURTLES				
Bataguridae				
Batagur baska (Gray 1831 "1830–35")		4,15,16,17		
Cuora amboinensis (Daudin 1802)	1	1,4	7,10	
Cyclemys atripons Iverson & McCord 1997	12	1,4,7		12
Heosemys grandis (Gray 1860)		4,18		
Malayemys subtrijuga (Schlegel & Miller 1844)		4		
Siebenrockiella crassicollis (Gray 1831)		4		
Testudinidae				
Indotestudo elongata (Blyth 1853)		1,4,6,18	9,10	
Manouria impressa (Günther 1882)	1	1		
Trionychidae				
Amyda cartilaginea (Boddaert 1770)	1,4	1,8	7	
Pelochelys cantori Gray 1864		1		
CROCODYLIA				
Crocodylidae				
Crocodylus siamensis (Müller 1838)	11	1,6,8		
SQUAMATA (LIZARDS)				
Agamidae				
Acanthosaura cf. *crucigera* Boulenger 1885	1	3,8	9,10	3,19
Calotes emma Gray 1845	1	1,3,6,8	7	
Calotes mystaceus Duméril & Bibron 1837	1	1,8	7	3
Calotes versicolor (Daudin 1802)	1	3,6,8	7,10	3

	Northwest	Central	Northeast	Southeast
Draco indochinensis Smith 1928				12,20,21
Draco maculatus (Gray 1845)	1	3,8	7,10	3
Draco taeniopterus Günther 1861	1	3	7,10	
Physignathus cocincinus Cuvier 1829	1,10	1,3,6	7,10	3
Pseudocalotes floweri (Boulenger 1912)				12,19
Gekkonidae				
Cnemaspis chanthaburiensis Bauer & Das 1996	11			
Cnemaspis sp.	12			
Cyrtodactylus intermedius (Smith 1917)	1	3	7,10	3,19
Dixonius siamensis (Boulenger 1898)	1	1,6	10	
Gekko gecko (Linnaeus 1758)	1	3,6	7,10	
Gehyra mutilata (Wiegmann 1834)	12		10	
Hemidactylus frenatus Duméril & Bibron 1836	1	1	7,10	12
Hemidactylus platyurus (Schneider 1792)	11		10	
Hemiphyllodactylus cf. *yunnanensis* (Boulenger 1903)	11			
Ptychozoon lionotum Annadale 1905		3		3
Lacertidae				
Takydromus sexlineatus Daudin 1802	11	3		
Scincidae				
Eutropis longicaudatus (Hallowell 1857)	12			
Eutropis macularius (Blyth 1853)	1	3,6,8	7,10	
Eutropis multifasciatus (Kuhl 1820)	12	1,3,6,8	10	
Lipinia vittigera (Boulenger 1894)	1	1,3,6	7,10	3
Lygosoma bowringii (Günther 1864)	1	3	7,10	3
Lygosoma quadrupes (Linnaeus 1766)	1			
Scincella melanosticta (Boulenger 1887)	1	1,3,6,8	10	3
Scincella rufocaudata (Darevsky & Nguyen 1983)		3		
Scincella sp.	11			
Sphenomorphus indicus (Gray 1853)	1	8	7,11	
Sphenomorphus maculatus (Blyth 1853)	1	3,6	7,11	3
Sphenomorphus stellatum (Boulenger 1900)		3		
Leiolepididae				
Leiolepis belliana (Gray 1827)	22		5,7	
Varanidae				
Varanus nebulosus Gray 1831	1		7	
Varanus salvator Laurenti 1768	1	1,6	7	
SQUAMATA (SNAKES)				
Typhlopidae				
Ramphotyphlops braminus (Daudin 1803)	1	23		
Typhlops diardii Schlegel 1839	11	1,6		

	Northwest	Central	Northeast	Southeast
Typhlops muelleri Schlegel 1839		3		
Xenopeltidae				
Xenopeltis concolor Reinwardt in Boie 1827		3		3
Pythonidae				
Python reticulatus Schneider 1801	11			
Colubridae				
Ahaetulla nasuta (Lacépede 1789)	1,10			
Ahaetulla prasina (Reinwart in Boie 1827)	1	1,3,6,23	7	12
Amphiesma boulengeri (Gressitt 1937)	1,11	3	10	23,24
Boiga cyanea (Duméril, Bibron & Duméril 1854)	11	3,23		3
Boiga dendrophila (Boie 1827)		3		3
Boiga multomaculata (Boie 1827)		3	7	3
Boiga siamensis Nootpand 1971	12	3		
Chrysopelea ornata (Shaw 1802)	1	3	10	3
Coelognathus flavolineatus (Schlegel 1837)	12			
Coelognathus radiatus (Boie 1827)		1,6	25	23
Dendrelaphis pictus Gmelin (1789)	1	23	7	
Dendrelaphis subocularis (Boulenger 1888)			10	
Dryocalamus davisonii (Blanford 1878)	12	3		3
Dryophiops rubescens (Gray in Gray & Hardwicke 1835)			1	
Enhydris bocourti (Jan 1865)		3		25
Enhydris plumbea (Boie 1827)	11	1,6,8		24
Gonyosoma oxycephalum (Boie 1827)		1,3		
Homalopsis buccata (Linnaeus 1758)	1	1,3,6,23		3,25
Lycodon cardamomensis Daltry & Wüster 2002	1			
Lycodon laoensis Günther 1864	12		7	
Oligodon barroni (Smith 1916)	1			
Oligodon sp.	11,12			
Oligodon fasciolatus (Günther 1864)	12	23		
Oligodon inornatus (Boulenger 1914)	1	3		
Oreophis porphyraceus (Cantor 1839)	1			
Orthriophis taeniurus (Cope 1861)	1			
Pareas carinatus (Boie 1828)		1,3,8		3,23
Pareas margaritophorous (Jan, 1866)	11	3	10	
Psammodynastes pulverulentus (Boie 1827)	1	1,3,6,8,23	10	12,23
Ptyas korros (Schlegel 1837)	1	8,23	7	
Ptyas mucosus (Linnaeus 1758)	10			
Rhabdophis chrysargos (Schlegel 1837)	1	1,3,6,23	10	
Rhabdophis nigrocinctus (Blyth 1856)	1	3	10	
Rhabdophis subminiatus (Schlegel 1837)	1	1,6	7	23

	Northwest	Central	Northeast	Southeast
Sibynophis collaris (Gray 1853)	1			
Xenochrophis flavipunctatus (Hallowell 1860)	1	1,6	7	
Xenochrophis trianguligerus (Boie 1827)		3		
Elapidae				
Bungarus candidus (Linnaeus 1758)	1	1,6		23
Bungarus fasciatus (Schneider 1801)	1	10,23		
Naja kaouthia Lesson 1831	1			
Naja siamensis Laurenti 1768	12			
Ophiophagus hannah (Cantor 1836)	1			
Viperidae				
Calloselasma rhodostoma (Boie 1827)	10	3,23	7	
Cryptelytrops albolabris (Gray 1842)	1	3,23	7,10	25
Cryptelytrops macrops (Kramer 1997)	1	3	7	3
Viridovipera vogeli (David, Vidal & Pauwels 2001)	1,26	3	7,10	26

An adult female (SVL 550mm) matches Werner's (1925) description and Saint Girons' (1972) expanded description of *Oligodon cyclurus smithi*. Wagner (1975) however, demonstrated in an unpublished thesis, that *O. c. smithi* and *O. c. superfluens* were junior synonyms of *Oligodon fasciolatus* (Günther, 1864). Although not published, this taxonomy was followed by Pauwels *et al.* (2003) and is followed here as well. LSUHC 8482 has a single, large loreal; two pre- and postoculars; eight supralabials and nine infralabials; 21 midbody dorsal scale rows; 162 ventrals; and 52 subcaudals. It differs from *O. fasciolatus* (*sensu* Saint Girons, 1972; Taylor, 1965) in having 10 as opposed to 14–17 ovoid, brown, dorsal blotches edged in black.

This specimen was collected at 1200h while crossing a trail 20m from a rocky stream. This species is widespread throughout Indochina and its first report here from the Cardamom region is not unexpected.

Psammodynastes pulverulentus (Boie, 1827)

Material examined: Popok Vil Waterfall, Bokor National Park, Kampot Province (10°39.429'N, 104°03.091'E), 925m a.s.l. LSUHC 8568; 7 July.

An adult male (SVL 294mm) agrees with Smith's (1943) and Taylor's (1965) description in having the third maxillary tooth enlarged, followed by a diastema with the last series of maxillary teeth being fang-like and grooved; canthus sharply angular; frontal narrow; nostril in a single nasal scale; 17 dorsal scale rows at midbody; 60 ventrals; 54 divided subcaudals; and anal plate entire.

The specimen was collected at 1100h while crossing a dirt road running through a grassy field near the Popok Vil Waterfall. Although this species is widely distributed throughout the Cardamom region, this is the first record for Bokor National Park.

Elapidae

Naja siamensis Laurenti 1768 (Fig. 8).

Material examined: Pchoek Chrum, LSUHC 8408; 26 June.

A juvenile female (SVL 270mm) matches the modified diagnosis of Wüster & Thorpe (1994) in having a slightly elongate frontal scale with a pointed posterior margin; a single cuneate scale between the fourth and fifth supralabials on each side; 169 ventrals and 21 subcaudals; 21 midbody

dorsal scale rows; V-shaped hood marking; and a dull as opposed to shiny overall appearance of scales.

This specimen was found coiled beneath a board along the side of a dirt road running through degraded dry deciduous forest following an afternoon rain. This species is widely distributed throughout Indochina (Wüster & Thorpe, 1994) and its first recorded occurrence here in the Cardamom region is not surprising.

Discussion

The discovery of *Icthyophis* sp., *Calluella guttalata, Cyclemys atripons, Boiga siamensis, Dryocalamus davisonii,* and *Lycodon laoensis* in the northwestern Cardamom region is not unexpected given that they have been previously reported from other areas in the Cardamom Mountains (Daltry & Chheang, 2000; Swan & Daltry, 2002; Stuart & Platt, 2004; Stuart & Emmett, 2006; Grismer *et al.*, 2007). Much the same is true for *Eutropis longicaudatus, Coelognathus flavolineatus, Oligodon fasciolatus* and *Naja siamensis* which are widespread throughout Indochina (Taylor, 1963; Saint Girons, 1972; Wagner, 1975; Wüster & Thorpe, 1994; Schulz, 1996; Szyndlar & Nguyen, 1996; Pauwels *et al.*, 2003) but are reported here for the first time in the Cardamom region. Additionally, this is the first report of *Coelognathus flavolineatus* for Cambodia. Also widespread throughout the Cardamom region are *Micryletta inornata, Cyclemys atripons*, and *Psammodynastes pulverulentus,* but are reported here for the first time from the Bokor National Park.

Most surprising is the new species of *Cnemaspis* from a lowland, rocky area in a heavily degraded dry deciduous forest only 47.3km northeast of *C. chanthaburiensis* from the northeastern foot of Phnom Samkos (Grismer *et al.*, 2008a). This, and the other discoveries underscore the unexplored nature of these lowland areas despite their highly degraded nature. With the clearing of additional mine fields in these areas allowing access to more biological surveys, it is expected that additional new records and new species will be found.

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The Protected Area Law of Cambodia: A legal evaluation

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Abstract

This article presents the recently adopted Protected Area (PA) Law of Cambodia. After outlining the history of the law and its position in the general framework of environmental laws in the country, the different chapters of the PA Law are presented and their essential contents detailed. Next, the text evaluates the PA Law not only by analysing its compliance with international legal guidelines for legislature concerning protected areas, but also by scrutinizing some flaws and omissions that could have been improved during the process of discussion. The analysis concludes that the PA Law corresponds with current international legal principles in this field and, despite some details that need further interpretation, it successfully implements these principles in the national legislature. It is an appropriate tool for regulating the management of protected areas and focuses on improving the conservation of biodiversity, while also taking into account the interests of indigenous ethnic minorities and the need for transparency. Finally, an overview of the political environment will point out possible implementation problems and provide ideas about the interdependencies between the legal and the political aspects that will determine the future application of Cambodia's PA Law.

Keywords

Cambodia, protected areas, legislation, zoning, ethnic minorities.

Introduction

Cambodia is a country of amazing natural wealth and beauty. To protect and maintain its biological diversity, protected areas were strongly promoted under the monarchy from 1953 to 1970 with the establishment of six national parks and wildlife sanctuaries covering about 12 percent of Cambodia. After the devastations of the Khmer Rouge period and the decade of stagnation during the years of a Vietnam-controlled government in Cambodia, it was only in 1993 that measures to protect the natural environment were renewed. His Majesty King Norodom Sihanouk introduced a royal decree in 1993 that designated 23 protected areas, covering about 3.3 million hectares (18.3 percent of the total land area). In the decade since 1998, after adding a growing number of fish sanctuaries and protected forest areas, the environmental conservation areas have risen to a total of 32. Thus, the current level of territory set aside for conservation is at 26.3 percent (Gillison, 2007a), among the highest national figures in the world.

A map of the protected area system is available at www.mekong-protected-areas.org/cambodia/maps/pas.gif (or see page 41 of this journal for a recent update - *Editor*).

History of the Protected Area Law

Legal measures until 2001

Cambodia joined several international treaties focusing on environmental protection during the last decade. The Convention on Wetlands, signed in Ramsar, Iran in 1971 for the protection and wise

use of wetlands, came into force in Cambodia in 1999. Today, three areas in the country have been established as Ramsar Sites.

In 1991, the country accepted the UNESCO World Heritage Convention, first signed in Paris in 1972, to preserve its cultural and natural heritage for future generations.

Most importantly, in 1995, Cambodia signed the Convention on Biological Diversity (CBD), devised at the 1992 Rio Earth Summit, and ratified the Convention on 17 September 2003. Its main principles are the basis for many provisions of the current PA Law which will be outlined in the section 'Evaluation of the Protected Area Law' below.

Also on 17 September 2003, Cambodia ratified a supplementary agreement to the CBD known as the Cartagena Protocol on Biosafety, which dated from 2000. This seeks to protect biological diversity from the potential risks posed by living modified organisms (or genetically modified organisms), resulting from modern biotechnology. In particular, it establishes a Biosafety Clearing-House to facilitate the exchange of information on these organisms and to assist countries to implement the protocol. After being ratified by the necessary minimum of 50 countries, the Cartagena Protocol came in to force on 11 September 2003. To date, 143 parties have signed this treaty.

At the level of national legislature, the 1996 Law on Environmental Protection and Natural Resources Management (LEPNRM) provided the basic legal framework for the operations of the Ministry of Environment (MoE), which is responsible for the supervision and management of the environment throughout Cambodia. Subsequent laws have brought conservation functions to a range of sectoral agencies, particularly the Ministry of Agriculture, Forestry and Fisheries (MAFF). The objectives of the 1996 environmental law were to protect, manage and enhance the environment and promote socioeconomic development in a sustainable way. MoE was given responsibility for environmental action planning and protected area management. Nonetheless, the law did not explicitly mention protected areas. Article 8 of the LEPNRM mentioned several 'natural resources' that have to be protected, but allows 'natural protected areas' to be determined by royal decree. Despite this shortcoming, the LEPNRM provided the umbrella for follow-up sectoral laws, sub-decrees and regulations. In the National Environmental Action Plan for 1998-2002 and the National Biodiversity Strategy and Action Plan of 2002, the need to prepare and implement management plans for protected areas and to integrate them into the government's broader police framework for environmental management was emphasized.

Development of the Protected Area Law 2001-2008

Nonetheless, until recently there was no comprehensive law for the special issue of management of protected areas. In 2001, a Protected Area Law Secretary was set up at the Ministry of Environment with international legal assistance. A Task Force for the development of the Protected Area Law was set up with representatives from five ministries and four non-governmental organizations related to protected area management: World Wide Fund for Nature (WWF), Wildlife Conservation Society (WCS), United Nations Development Programme (UNDP), and the NGO Forum of Cambodia. Two Task Force Meetings were held in 2002 as well as a training workshop. The first draft version of the Protected Area Law in English was submitted to the Department of Nature Conservation and Protection at the Ministry of Environment by late February 2002.

To ensure that the Protected Area Law would be applicable and acceptable to protected area beneficiaries and affected communities and individuals, five provincial cluster consultation workshops on the Protected Area Law were carried out in 2002. About 300 participants from 20 provinces and municipalities attended, representing key civil and armed provincial departments, governors, community representatives at commune and district level in and adjacent to protected areas, and NGOs.

From early 2002, the Protected Area Law underwent an extensive review process. Two draft versions were circulated in Khmer and English to relevant non-governmental and international organizations within and outside the country for comments. In addition to a series of in-house reviews, the draft law was reviewed several times by the Council of Ministers, and in meetings between key Ministries involved in the management of natural resources, particularly MAFF. The Ministry of Justice also contributed to the review process.

During the 1 September 2005 plenary meeting of the Council of Ministers, 10 articles of the draft Protected Area Law were amended and the rest of the law was approved (details of the procedure are available at www.bpamp.org.kh/Main/bpamp_pal.html). This draft was forwarded to the 3rd Commission of the National Assembly (Commission for Economy, Planning, Investment, Agriculture, Rural Development, Environment and Water Resources) in July 2007. The discussion in the Commission included an expert hearing with NGO representatives on 1 November 2007. After being submitted to debate in the National Assembly, the draft law was approved with minor changes on 27 December 27 2007, during the 7th session of its 3rd legislature. It was promulgated by Royal Kram NS/RKM/0208/007 on 15 February 2008.

This law applies to all 23 protected areas under the control of the Ministry of Environment, as designated in 1993. It does not apply to the more recently created protected forests and landscapes that are under the control of the MAFF and managed by the Forestry and Fisheries Administrations.

It is notable that, as a 'companion piece' to the PA Law, the Law on Biosafety was passed recently to implement the Cartagena Protocol into the national legislation in December 2007. Thus, a more comprehensive framework of Cambodian environmental laws is well underway.

International framework as a background to the Protected Area Law

In recent decades, protected area governance has generally been in the exclusive jurisdiction of individual states. By their nature they are subject to national governance arrangements which stem from national sovereignty over land and seas. This 'domestic' focus has changed during the course of international debates about the future of the global environment and challenges to environmental policy, so that protected area governance can now be seen in the larger canvas of an emerging international law regime. National measures are increasingly reinforced by evolving principles of international environmental law and customary law (Jeffery, 2003). Today, international environmental law governance is provided by a complex body - and interaction - of hard and soft law, which also applies to protected areas.

Of particular importance in this development was the adoption of the Convention on Biological Diversity at the 1992 United Nations Conference on the Environment and Development in Rio de Janeiro. This has since been ratified by over 180 countries and contains provisions related to protected areas that play a vital role in preserving biodiversity. This document, which commits all State Parties to establish systems of protected areas to conserve in situ biodiversity, remains the most influential legally-binding instrument for protected areas and has placed protected areas in the wider context of sustainable development, ecosystem management and sustainable use.

Cambodia's PA Law is a legal tool intended to implement the CBD in Cambodia's national legislation. The following analysis presents:

- An outline of the structure of the PA Law;
- An analysis of the compliance between the PA Law and the international principles ruling national legal frameworks for protected areas;
- An overview of flawed and problematic provisions that could determine future legal discussion concerning the PA Law.

Content of the Protected Area Law

Chapter 1 ("General Provisions") defines the objective of the PA Law as to ensure the management, conservation of biodiversity, and sustainable use of natural resources in protected areas (Article 1). Protected areas are defined in an appendix, integrated into the law via Article 3, that complies with the generally acknowledged definition provided by the IUCN: "an area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means" (see Jeffery, 2003).

Chapter 2 ("Responsible Institutions") establishes the Nature Protection and Conservation Administration (NPCA) as a secretariat of the Ministry of Environment with full responsibility for the management of protected areas. The duties of NPCA must respect the rights of local communities and indigenous ethnic minorities, as well as the rights of the public in decision-making on sustainable management (Article 4). This supreme authority serves as a coordinating interface between the government and all administration levels. Articles 5 and 6 outline the duties of this authority and the rights and duties of their officials, focusing on the development of strategic plans and the enforcement of the PA Law, as well as promoting education and providing the dissemination of information to the public.

Chapter 3 ("Establishment and Modification of Protected Areas") provides a categorization of protected areas into eight different categories (National Park, Wildlife Sanctuary, Protected Landscape, Multiple Use Area, Ramsar Site, Biosphere Reserve, Natural Heritage Site and Marine Park) in Article 7. These categories are detailed in the appendix according to current internationally acknowledged definitions. This chapter also determines the criteria and proceedings for establishing or modifying a protected area (Article 8) and the responsibility of the Royal Government of Cambodia for establishing and modifying any such area (Articles 9 and 10). In practice, however, these categorizations are not exactly adhered to, and most protected areas in Cambodia are managed as an amalgam of multiple categories.

Chapter 4 ("Zoning") can be considered the core chapter of the law because it describes the zoning systems for all protected areas in Article 11. In the 'Core Zone' of high conservation values, including threatened species and fragile ecosystems, access is prohibited except for NPCA officials and scientific researchers with permission from the MoE. In the 'Conservation Zone', which is also an area of high conservation value, access is restricted except for small-scale community uses to support ethnic minorities' livelihood, albeit under strict control. In the 'Sustainable Use Zone', the conservation of the protected area is combined with high economic values, thus allowing development and investment activities controlled by the Government. This provision is problematic, as will be explained later in this analysis. Finally, the 'Community Zone' is a management area for the socioeconomic development of local communities and indigenous ethnic minorities. Articles 12 and 13 detail the criteria for zoning and the modification of boundaries of each zoning system. The NPCA is assigned to conduct research and management zoning in accordance with guidelines issues by the MoE (Article 14).

Chapter 5 ("National Strategic and Active Plan for Protected Area Management") obliges the MoE to develop a Strategic Management Plan that is compatible with other existing national plans for the protection of biodiversity, and details the basic content of this plan (Articles 15 and 16). The Plan must be evaluated and eventually revised every five years (Article 17). Implementation of the Strategic Management Plan is conducted by the NPCA, which will also develop individual action plans for each protected area (Article 18) according to a catalogue of essential standards delineated in Article 19. These standards include descriptions of allowed and prohibited activities, an obligatory agreement for a participatory process with the protected area community, and the necessity of a management

plan for possible ecotourism as well as an assessment of budget requirements and funding.

Chapter 6 ("Involvement and Access Rights of Local Communities and Indigenous Ethnic Minority Communities") can be regarded as another central part of the law because it clearly states the rights of local communities and ethnic minorities . It acknowledges their access to traditional uses and local customs as well as traditional uses of natural resources on a family-scale in the sustainable use zone and the conservation zone (Articles 21 and 22). Uses of natural resources outside a family-scale are restricted to the sustainable use zone.

Moreover, this chapter provides a legal tool for a decentralization of management, as Articles 23 to 28 detail the concept of 'community protected areas'. It allocates the management of these areas to local communities and indigenous ethnic minorities living within or adjacent to a protected area under an agreement with the NPCA. The community has the obligation to conduct their management in strict accordance with the management plan (Chapter 5) and to respect provisions in the agreement with the NPCA; restricting agricultural activities or clearing of forests. Article 23 states that sustainability of natural resources must be ensured in the community protected areas. The local community has to cooperate with local authorities, establish regulations (Article 26), and develop a natural resources management plan that must be reviewed at least every three years (Article 28).

Finally, it is remarkable that national and international NGOs are explicitly invited to support the establishment and implementation of community protected areas (Article 27).

Chapter 7 ("Education, Dissemination, Rehabilitation, Improvement and Funding of Protected Areas") extends the involvement in the protection of nature and its resources to other relevant groups of society including monks, children and civil servants (Article 29). Article 30 demands the development of extensive programmes for education and dissemination of information with the objective of raising public awareness on the value of protected areas and promoting participation.

Funding to support the rehabilitation of degraded areas and improve protected areas and biodiversity is supposed to come from several sources, as detailed in Article 33 - the most important factors being the national budget, entrance and service fees, and international donor support. This is to be channelled through a 'Protected Areas Fund' (Article 32), the responsibility for which lies with the Ministry of Environment and the Ministry of Economy and Finance. Article 34 allocates the financial means to a certain number of activities that are to be conducted in protected areas and to the administrative personnel on different levels.

Chapter 8 ("Permit and Prohibition and Environmental and Social Impacts Assessment") centres on activities that are prohibited in protected areas. In particular, clearing forest land and construction work are strictly forbidden in the core zone and the conservation zone. For these be carried out in the other zones, the approval of the Government is needed (Article 36). Article 41 provides a list of practices that are harmful to the protection of biodiversity and are therefore forbidden, e.g., collecting timber, fishing, catching animals and trading wildlife. Article 42 prohibits all activities for processing natural resources, including their by-products. There are special rules for taking plant seeds or certain species of animals in or out of protected areas: these can be permitted only on the basis of specific scientific research and evaluation by the NPCA and the MoE (Articles 38 and 39).

An 'Environmental and Social Impact Assessment' is required for any proposal for development activities within or adjacent to protected areas, and this is to be submitted to the MoE.

The most questionable article (Article 37) concerns special rules for military, which appear to be quite vague. This issue will be discussed in more depth later of this essay concerning problematic aspects of the PA Law.

Chapter 9 ("Law Enforcement and Procedures to resolve Offences") defines natural resource offences as criminal acts and authorizes officials of the NPCA to act as 'judicial police officers' with the right to investigate, prevent and crack down on such offences in accordance with the law of criminal procedures that has recently come into force (Article 45). Articles 46 to 51 detail the process of investigation and crime prevention, including the handling of evidence and cooperation with local authorities and armed forces. Article 52 explains the complaints procedure against decisions made by the NPCA and opens the way for judicial process if the complaints procedure is unsuccessful.

Finally, Chapter 10 ("Natural Resource Offenses and Penalties") provides a detailed list of fines for violations against regulations for protecting the natural habitat and for prohibited activities in protected areas. Imposing transaction fines or restoration damages, as well as terminating permit agreements, shall be in the responsibility of the NPCA. In the case of a refusal by the offender or a presumed offender, a court proceeding on the offence is to be filed (Article 53). Article 54 details subjective aspects concerning the offender that have to be taken into account by the authority in fixing the amount of a transaction fine. Articles 56 to 63 contain lists of violations that are classified as natural resources offences, ranging from first to fourth grade, with respective punishments. Finally, Article 64 refers to offenders in the positions of administration, inspection or environment officers: if found to be negligent or careless, these officers can either be prosecuted or face administrative punishment.

Chapter 11 ("Final Provisions") mainly states that the law shall be declared immediately effective after signing (27 December 2007).

Evaluation of the Protected Area Law

The PA Law in the international legal context

Convention on Biological Diversity

As mentioned before, the PA Law has to comply with the Convention on Biological Diversity (CBD) as well as with the additional international rules developed during the last fifteen years. The CBD still plays a significant role as a guideline for national legislature aimed at preserving biodiversity by establishing and maintaining protected areas. The convention requires that each country has a relatively comprehensive biodiversity conservation programme. The programme must favour in situ to ex-situ conservation and integrate the conservation and sustainable use of biological resources into national decision-making (Brodansky *et al*., 2007).

The key regulation in the CBD is Article 8 which requires contracting states to, among others: (a) Establish a system of protected areas whereas special measures need to be taken to conserve biological diversity; (b) Develop, where necessary, guidelines for the selection, establishment and management of protected areas or areas where special measures need to be taken to conserve biological diversity; (d) Promote the protection of ecosystems, natural habitats and the maintenance of viable populations of species in natural surroundings; and (e) Promote environmentally sound and sustainable development in areas adjacent to protected areas with a view to furthering protection of these areas.

These requirements are reflected in the PA Law as follows: (a) The necessity of the management of existing protected areas and conserving biodiversity is made clear in Article 1; (b) Guidelines for selecting and establishing protected areas are outlined in Articles 8 and 9 and detailed in Articles 11, 12 and 13. Guidelines for managing these areas are detailed in Chapter 5; (d) This principle is mainly reflected in the establishment of 'core zones' and 'conservation zones'. These zones are not to be accessed except with special permission

from the NPCA. Small-scale community users and local ethnic minorities' livelihood will be contained and controlled with regard to their possible negative impacts on biodiversity; (e) The management of adjacent areas is not specifically detailed, but it can be argued that the guidelines for the 'community zone' are the equivalent of this principle. On the other hand, it could also be argued that the internal integrity of protected areas in Cambodia has already been damaged by established settlements or alternative land-uses, thus making the conservation zone and the sustainable-use zone, not the community zone, the equivalent of buffer zones to the adjacent non-protected areas. Nonetheless, Article 11 could have been amended by certain limitations on zones adjacent to the protected area as a whole to avoid uncontrolled and potentially harmful activities at the very edge of the protected area, thus providing a kind of buffer zone from areas being used for commercial and industrial purposes. This aspect was brought up in the review of the draft law, but was not reflected in the final version.

Emerging new principles

Because protected area governance can increasingly be seen in the larger canvas of an emerging international law regime, leading commentators and scholars have attempted to identify further key principles shaping global environmental and developmental instruments (Jeffery, 2003). Not all of the principles developed in recent years are legally binding yet, but they are starting to generate a significant impact on international environmental law (Jeffery, 2003). Increasingly, more ambitious principles will have to be regarded when conceiving national environmental laws. Among these principles, three can be singled out that have been reflected in drafting the Cambodian PA Law:

First, against the background of the rising importance of good governance and decentralization in developing states, public participation and access to information will exert an additional demand upon management systems (Jeffery, 2003). This principle is reflecting in the PA Law mainly in Article 5, No. 5, which states that the NPCA shall promote education and dissemination of information to the public to facilitate participation in the conservation of natural resources. Moreover, Article 4, paragraph 4, guarantees the rights of local communities, indigenous ethnic minorities and the public to participate in decision-making on sustainable management. Article 21 encourages communities, minorities and the civil society to provide and access information relevant to the protected area management. Finally, Article 29 even obliges different groups of Cambodian society to actively participate in the protection and conservation of nature, while Article 30 demands extensive programmes for education and dissemination. These obligations even go beyond the basic demands for participation and information and seem suitable to help create an awareness among the population of the needs and the importance of conservational measures for the country's natural resources.

Second, legal and political calls for more participatory approaches include the challenge to give indigenous and local community rights real meaning (Jeffery, 2003, page 35). The rights of communities and ethnic minorities are explicitly acknowledged in Article 22, which recognizes certain rights of communities and ethnic minorities and respect customary practices in the conservation zone and sustainable use zone according to Article 11, No. 3 and 4. An announced Prakas of the MoE (Article 22, paragraph 2) should describe relevant guidelines in detail as soon as possible to avoid misunderstandings about the range of activities that are allowed for these ethnic minorities and communities. An oversight on these guidelines and their implementation is a necessary measure in the mid-term.

Third, an essential feature of the modern governance of protected areas and of a decentralized approach is collaborative management by multiple stakeholders and indigenous comanagement regimes (Jeffery, 2003). By promoting community protected areas in Chapter 6, the PA Law recognizes this tool as a valuable management regime. On the other hand, mixed responsibilities have

been substituted by the supreme authority of the NPCA that can be regarded as a 'one-stop' government authority, functioning as an interface between executive and administration that is complemented by management units on different levels. This management structure appears to be quite cohesive and points into the future. It remains to be seen if this supreme authority will be inappropriately challenged by contesting claims for jurisdiction from local authorizes, such as provinces, districts and communes, or by other government organs like the Ministry of Industry, Mines and Energy or the Royal Cambodian Armed Forces.

General evaluation

In regard to the principles of the CBD - as well as recent developments in international law that have been much discussed, but not yet codified in an international covenant ruling environment and development - the PA Law can be considered a remarkable achievement. It provides a manageable legal framework for effective protection of biodiversity and sustainable treatment of natural habitats. The commitment of international experts and NGOs seems to have been a decisive influence in designing a law that generally takes into account the basic environmental needs to protect biodiversity and the interests of local communities and indigenous people.

Problematic Aspects of the Protected Area Law

Nevertheless, certain provisions of the PA Law are not completely satisfactory and leave room for discussion and future judicial interpretation. The following chapter singles out some problematic aspects.

General Clauses

Article 11, No. 3, allows development and investment activities in the sustainable use zone, after consultations with relevant ministries and institutions, local authorities and local communities. This clause is very broad, and it should have been ensured that these investment activities do not in any way interfere with the clear objectives of the law as stated in Article 1. A look at the specifications of sustainable use zones in the annex lexicon triggers causes of concern. According to the lexicon, they even include the establishment of hydro-electricity and mining: large-scale activities that can be regarded as very unorthodox interpretations of the "contributions to local community and indigenous ethnic minority livelihoods", which are the benchmark for permissible activities. A proposition to amend the provision by substituting a reference to "the accordance with relevant laws and procedures" with a reference to the strict regime of the objectives of the law as stated in Article 1, did not gain acceptance in the final debates on the law.

The limitations on possible activities are not clear enough for the community zone either. Article 11, No. 4, mentions residential lands, paddy fields and field gardens, but decisions about the extent of residential areas, the size of buildings and the construction of roads are left to the Royal Government of Cambodia. Article 19, No. 2, entitles the MoE to prescribe general guidelines for the allowed and prohibited activities in different zones by issuing a Prakas for individual action plans. Unfortunately, the lack of clarity in Article 11, No. 3, allows this future Prakas such a broad scope for establishing guidelines of permitted activities that it might conflict with the core objectives of the PA Law; thus giving rise to speculation that this might have been deliberately intended.

Article 13 permits the modification of zone boundaries if this "complies with the policies and strategies of the Royal Government of Cambodia." In contrast to a possible modification of boundaries based on scientific research (Article 13), this provision appears too general. Although the Royal Government of Cambodia has proved to be aware of the need to establish protected areas and to manage them carefully in the past, this provision could theoretically be misunderstood so as to allow varying policies and strategies to re-evaluate and potentially undermine the importance of the conservation and protection of nature as underlined in

Article 1. On the other hand, it could be argued that this clause authorizes the government to enforce the protection of biodiversity even further. Many conservationists underline the need for flexibility to take account of changing human demography, wildlife distribution and the impacts on habitats brought about by climate change. In such cases, any necessary modification should only be brought about with the endorsement of the MoE and following a strict process of consultation with conservation experts, communities and similar stakeholders. Anyhow, Article 13 opens the door for political influence that exceeds the jurisdiction of the MoE over the management of protected areas laid down in Article 4, paragraph 1.

Article 37 outlines rules for military activities in protected areas, prohibiting all military exercises, training and camping in the core and conservation zones except for "national security and defence needs". It could be argued that most, if not all, of these activities could be declared as being conducted for security and defence needs. Moreover, the establishment of military bases is not prohibited, but can be proposed to the Royal Government in joint studies by the MoE and the Armed Forces. Military activities in the sustainable and community zones need the approval of the MoE, but criteria for such an approval are not given or announced. All these regulations are open to interpretation and leave a loophole for a possible exertion of political influence.

Further Aspects

Chapter 2 explains the establishment of the NPCA, its duties and the personal rights and duties of the conservation agency's officials. No mention is made of the officials' qualifications, educational background or technical expertise, or the possible representation of different interests in the management board. An announced Prakas of the MoE is to detail rights and duties of the conservation agency's officials, but not personal qualifications or abilities.

In the list of officials' duties in Article 6, the central duties of regularly inspecting posts and markers and putting up signs for the purpose of monitoring the boundaries of protected areas are not mentioned. These must be subsumed under the general provision that the officials have to "regularly patrol and control" national resource offences of all kinds, as long as a detailed Prakas by the MoE on this issue has not been released.

Article 8, No. 4, only briefly mentions the issue of land use in the proposed areas. Because the topic of land use and land ownership is of remarkable importance in Cambodia, this sub-sector could have been refined. A possible way would have been an additional criterion for the development of the National Protected Area Strategic Management Plan in Article 16, demanding an assessment of landowners' interests that is similar to the provision in Article 8, No. 4. Another way to include rightful landowners into the process could have been their deliberate integration in Article 18, paragraph 2 that demands the involvement of "stakeholders" in the process of developing individual action plans for protected areas.

In general, the question of land ownership is one of the most critical issues in current Cambodian society and has not been paid sufficiently detailed attention in the regulations of the PA Law. The vague statement in Article 11, paragraph 2, that the issuing of land titles or the permission to use land in a community zone demands prior agreement from the MoE in accordance with the Land Law, might lead to confusion and arbitrary ministerial decisions.

In this context, the missing aspect of possible compensatory measures could also have been incorporated by amending a paragraph that reads: "Compensatory measures that are deemed necessary in order to transfer properties or land during the process of establishing a new protected area must be described". This could also happen in a sub-decree that is not announced in the relevant chapter.

In this context, Article 26, paragraph 3, announces a sub-decree concerning the allocation of more farmland to local communities and indigenous

ethnic minorities. As this is also a question of land ownership and land use, the sub-decree must be conceived soon to avoid a legal gap between the protection of nature and the economical needs of communities and minorities. This issue would have been more correctly dealt with under those articles dealing with the zoning process, specifically the detailing of community zones because these are the only zones in which farming should be allowed to take place.

There is an inconsistency between Article 11, No. 2, paragraph 3, of the PA Law and the explanations to be found in the annexed lexicon. While the article restricts "use of non-timber forest products to support local ethnic minorities' livelihood" in the conservation zone, the definition of the conservation zone in the annex states the necessity of strict monitoring of the use of "forest by-products for livelihood by the local community and indigenous ethnic minorities", thus including all local communities who have had customary use to do so. It remains unclear if the range of application of Article 11, No. 2, paragraph 3, has to be interpreted in a broader or in a more limited sense.

Articles 15 to 17 describe criteria for the National Protected Area Strategic Management Plan (NPASMP) without explicitly demanding publication of the plan. Article 17, paragraph 2, mentions the need for public notice of the process of preparing and revising the plan. In the interest of transparency, the legal interpretation of this provision should point to an obligation of the MoE to make the NPASMP and future amendments to the plan available to the public.

Article 19 regulates the guidelines for developing an action plan, including a demand for a detailed description of the activities allowed within each zone. In the interests of both the needs of ethnic minority communities and a clearer embodiment in the PA Law, an additional point could have been added demanding individual descriptions of indigenous lifestyles in each action plan and outlining activities associated with them. Likewise, Article 44 states that an Environmental and Social Impact Assessment must contribute to minimizing adverse impacts on the environment. Possible adverse impacts on the indigenous population could have been added here. As it is, the general consideration of the ethnic minorities stated in Article 22 must serve as an interpretative guideline for such purposes.

Finally, in the list of offences (Articles 57 to 62), some possible offences have been omitted that could have easily been included. Possible additional prohibited activities might be:

- Construction of any kind. While Article 36 prohibits "clearances and bulldozing… for the purposes of building all types of public infrastructures", which include the majority of possible activities such as road construction or the erecting poles for telecommunication purposes, no exclusively private activities such as building shacks or storing facilities are explicitly mentioned (the only exception are burning kilns: Article 58, No. 1);
- Traffic circulation with vehicles of any kind, particularly off-road transport;
- Sailing with boats, canoes, etc.;
- Placement of data and advertising boards, signs and posters;
- Sports activities outside of clearly designed places;
- Non-military flights with balloons, delta planes etc.

Because these activities are not filed to appropriate grades of offences, the framework for punishment regarding these activities will have to be left to the courts.

In general, the whole of Chapter 10 ("Natural Resource Offenses and Penalties") is poorly executed and confusing. The following examples illustrate the lack of diligence:

- Article 56 states that offences are of first, second, third and fourth grade and establishes different penalty frames for each grade. While Article

57 mentions offences categorized as grade one, grades have not been assigned to the offences in Articles 58 and 59. Because Articles 60 to 62 define offences of the second, third and fourth grade, it can only be logically concluded that the offences of Articles 58 and 59 belong to the first category.

- In Article 59, a necessary framework for the amounts of transaction fines has been omitted for no obvious reasons.
- Unlike in the other articles, there is no regulation in Article 57 of how repeat or multiple offenders committing offences of the first grade, that are punished by written warning only, should be treated. There is no guideline clarifying whether this offender should receive multiple written warnings, be fined or be confronted with court proceeding.
- Furthermore, it is unclear which offences can be handled by MoE staff and for which offences a court proceeding is mandatory. Probably the line can be drawn between offences of the first grade and those of second to fourth grades that can be punished by imprisonment, because MoE staff certainly lack the competence to impose prison sentences.

Outlook and Political Context

Despite a generally positive evaluation of the PA Law, it remains to be questioned whether the political will to enforce all regulations will prevail.

In particular, the regulations on zoning that prohibit activities in the core zone and conservation zone (except for strictly monitored activities in the conservation zone in the interest of needs of the indigenous population) should be enforced. Recent public speculation, voiced by government officials, about the possibility of future mining activities even in core zones have raised concerns about the clear commitment to implementing the crucial regulations of the law. In an interview on 12 September 2007, touching on the issue of possible industrial activities in protected areas, Environment Minister Mok Mareth stated that when developing the protected area system in 1993 "we didn't know all the potential of our natural resources, our richness. So we need to have the exploration" (Gillison, 2007a). At a 2004 workshop, ministry officials and conservation NGOs found that mining was already occurring in nine protected areas and threatening 13 more. Since then, the government had lifted the general prohibition of mining in protected areas and had invited companies to explore them for minerals (Gillison, 2007a).

The Minister's statement prompted criticism from NGOs about the possibility of "the government seeing economic development as a priority and conservation second", as Seng Teak, country director of WWF, remarked, saying that certain core zones must be protected because the viability of other ecosystems depends on them: "You can't touch that area from a biodiversity point of view" (Gillison, 2007a). In December 2007, representatives of six large conservation NGOs in Cambodia met with the Environment Minister over his comments to discuss increasing pressure on biodiversity from activities such as road development, mining, agricultural concessions and exploration (Gillison, 2007b).

In consequence, it seems obvious that the strict implementation of the PA Law's regulations is the cornerstone for efficient protection of nature in Cambodia, particularly because ministries other than the MoE might also meddle with PA Law issues, e.g., by lobbying for concessions in protected areas, which are not legally excluded in the provisions of the law. The bias from considering the possible gains from extractions versus the benefits from keeping natural reserves (including the opportunities of communities to make money from ecotourism) is mainly a political question that exceeds the legal aspect. Without a swift implementation of zoning regulations, questionable decisions on the part of the Government remain possible.

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Figure Herd of gaur *Bos frontalis*, in Phnom Aural Wildlife Sanctuary, October 2007 (photo by Jeremy Holden/ FFI)

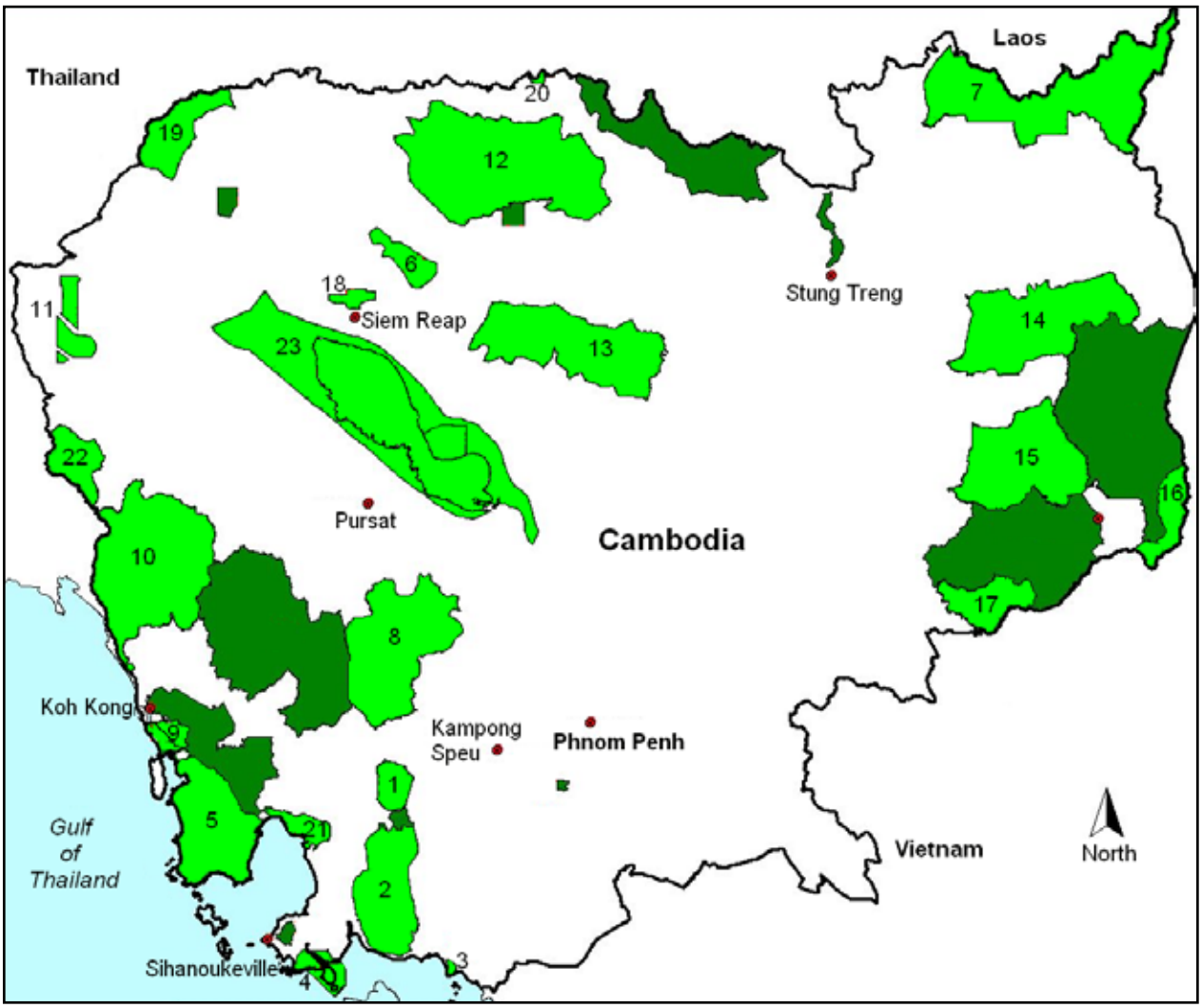

Figure Areas under state protection in Cambodia

Protected Areas under Ministry of Environment:

National Parks

1 Kirirom
2 Bokor
3 Kep
4 Ream
5 Botum-Sakor
6 Phnom Kulen
7 Virachey

Wildlife Sanctuaries

8 Phnom Aural
9 Peam Krasop
10 Phnom Samkos
11 Roniem Daun Sam
12 Kulen-Promtep
13 Beng Per
14 Lomphat
15 Phnom Prich
16 Phnom Lam Nyr
17 Snoul

Protected Landscapes

18 Angkot
19 Banteay Chmar
20 Preah Vihear

Multiple Use Areas

21 Dong Peng
22 Samlaut
23 Tonle Sap

Areas protected under other government authorities

Instructions for Authors

Purpose and Scope

The *Cambodian Journal of Natural History* is a free journal that is published biannually by the Centre for Biodiversity Conservation at the Royal University of Phnom Penh. The Centre for Biodiversity Conservation is a non-profit making unit, dedicated to training Cambodian biologists and the study and conservation of Cambodia's biodiversity.

The *Cambodian Journal of Natural History* publishes original work by:

- Cambodian or foreign scientists on any aspect of Cambodian natural history, including fauna, flora, habitats, management policy and use of natural resources.
- Cambodian scientists on studies of natural history in any part of the world.

The Journal especially welcomes material that enhances understanding of conservation needs and has the potential to improve conservation management in Cambodia.

The primary language of the Journal is English. Authors are, however, encouraged to provide a Khmer translation of their abstract.

Readership

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Full Papers (1,000-7,000 words) and Short Communications (200-1,000 words) are invited on topics relevant to the Journal's focus, including:

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- Research on the status or ecology of habitats.
- Checklists of species, whether nationally or for a specific area.
- Discoveries of new species records or range extensions.
- Reviews of conservation policy and legislation in Cambodia.
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- The nature and results of conservation initiatives, including case studies.
- Research on the sustainable use of wild species.
- Abstracts of student theses (Short Communications only).

The Journal will not accept formal descriptions of new species, subspecies or other taxa.

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- All of the authors have read the submitted manuscript and agreed to its submission, and
- All research was conducted with the necessary approval and permit from the appropriate authorities.

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All manuscripts will be subject to rigorous peer review by a minimum of two qualified review-

ers. Authors are welcome to suggest appropriate reviewers.

Proofs will be sent to authors as a portable document format (PDF) file attached to an e-mail note. Acrobat Reader can be downloaded free of charge from <www.adobe.com> to view PDF files. Corrected proofs should be returned to the Editor within three days of receipt. Minor corrections can be communicated by e-mail.

The Editorial Team welcomes contributions to other sections of the journal, as follows:

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Concise reports (<300 words) on news of general interest to the study and management of Cambodia's biodiversity. News reports may include, for example:

- Announcements of new initiatives; for example, the launch of new projects, conferences or funding opportunities.
- Announcements of important new reports or other publications related to Cambodian biodiversity.
- Summaries of important news from an authoritative published source; for example, new Cambodian species described in other journals, a new research technique, or a recent development in conservation.

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Authors should consult examples in this volume for general style. Full papers follow a similar style to those in *Oryx – The International Journal of Conservation*. Contributions should be in English, with UK English spelling (if in doubt, Microsoft Word and similar software should be set to check spelling and grammar for "English (UK)" language). Manuscripts should be double-spaced. Submissions can be in 'doc, 'rtf' or 'wpd' format, preferably as one file attached to one covering email. The cover page should contain the title and full mailing address, e-mail address and address of the Lead Author and all additional authors. All pages should be numbered consecutively, and the order of the sections of the manuscript should be: cover page, main text, short biography of each author, tables, figures and plates.

Title: A succinct description of the work, in no more than 20 words.

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MacArthur, R.H. & Wilson, E.O. (1967) *The Theory of Island Biogeography*. Princeton University Press, Princeton, USA.

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Sun H. (2000) *Status of the tiger and its conservation in Cambodia*. MSc thesis, University of Minnesota, Minneapolis, USA.

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