Preliminary Report
Virachey National Park RAP 2007
Cambodia

1 -15 October 2007
Rapid Assessment Program
Conservation International - Cambodia

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So many species...so little time
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The Leon and Toby Cooperman Family Foundation

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Acknowledgements:
This RAP survey and report were made possible through generous financial support from the Toby and Leon Cooperman Foundation and Cambodia's Ministry of Environment.

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Top: Katydid from Virachey NP
Middle: Odorous frog (*Odorrana* sp.) common alongside streams in Virachey NP
Bottom: A hill stream in Virachey NP – home to turtles, pythons and rare freshwater fishes
Background: Dhole in Veal Thom, Virachey NP

Introduction

There is a paucity of information on the biodiversity of Southeast Asia. In Cambodia, years of conflict and subsequent security issues have hindered fieldwork, and few surveys have been conducted in the last half century. The lack of systematically collected data for the country severely limits effective conservation, as there still remains uncertainty as to where priority key biodiversity areas are located. We are still unsure which Cambodian species are most threatened with extinction. An increased understanding of the presence and distribution of most faunal species, along with an assessment of their immediate threats, is urgently needed to guide effective conservation action.

The recent improvement in the political situation has provided the opportunity to conduct field surveys across most of Cambodia. Unidentified species and new country records for Cambodia are now being found fairly frequently. For example, recent surveys of the Cardamom Mountains in southwest Cambodia identified almost a dozen new species to science and many new country records. This survey aimed to fill an important biological information gap for one of Cambodia's most unique protected areas, Virachey National Park. This site is potentially one of Cambodia's most biologically diverse protected areas based on known habitat diversity and elevation ranges, and for those same reasons it is likely to contain a wide range of globally threatened and undescribed species. It was highlighted in a recent gap analysis of Cambodia's protected area network to be one of the country's highest priority sites for biological surveying. There are no people living in Virachey National Park, and its montane forests cover an extremely large area. These forests and associated rivers are in pristine condition, and the entire forested area is vast and extends significantly into Laos and Vietnam. In addition, the area is extremely inhospitable to people, and rangers frequently patrol the few existing access routes.

The basic biological justification for the creation of Virachey National Park lies in the character of its major forest formation, the diversity of its flora, and the role these habitats are predicted to play in hosting a wide array of fauna. Previous surveys in contiguous, unprotected forests outside of Virachey National Park and in the border areas back in the 1990s found evidence that charismatic, globally threatened megafauna such as tigers, elephants and gaur were present, as well as rare primates such as the Yellow-cheeked Gibbon, Silver Langur and Douc Langur. However, there have been no surveys in the area since the 1990s, and most of these previously surveyed areas outside of Virachey National Park are now severely impacted by hunting and logging. Our rationale for surveying deep within National Park was to survey the biodiversity within the central section of the protected area to assess whether the aforementioned, and other, globally threatened species also occur within the core areas of the National Park.

Virachey National Park contains a variety of natural habitats (e.g. bamboo, pine forest, semi-evergreen rainforest, dry dipterocarp forest) depending on altitude, aspect, history, geology, and hydrology. The most abundant formation is tropical evergreen rainforest, much of which appears to be in primary condition. Virachey National Park massif contains a range of mountains that reach over 1400 m in altitude to the east, and over 1,500 m towards the Laos border. These high elevation sites are far from any footpaths or villages, and have never been surveyed. This remoteness has protected the area, yet it has also prevented biological assessments since it requires 5-7 days of hiking through evergreen rainforest just to reach the proposed survey site.

Between October 1-15, 2007, a team of local and international scientists, led by Conservation International (CI), conducted a biodiversity survey of Virachey National Park. Focusing on amphibians, reptiles (especially turtles), large mammals (especially bears), small mammals, freshwater fishes, and invertebrates, the team consisted of Mr. Neang Thy (reptiles and amphibians, Government Counterpart, MOE), Dr. Jodi Rowley (amphibians, CI), Dr. Bryan Stuart (reptiles and amphibians, Museum of Vertebrate Zoology, USA), Mr. Stephane De Greef (ants), Mr. Heng Naven (freshwater fishes), Mr. Som Sitha (tortoises and freshwater turtles), Mr. Hay Dalino (bears), Ms. Sett Sophak (bears), Dr. Piotr Naskrecki (insects, CI) and staff of Virachey National Park. The biological research focused on selected sites within central and eastern Virachey National Park, because the areas are relatively un-fragmented and are large enough to easily accommodate viable populations of large animals.

Surveys during the course of the RAP expedition were based from one primary campsite and elevation of the surveyed areas ranged from around 600-1,000 m. The survey site consisted of a large area of high elevation grassland surrounded by hill evergreen forest, bamboo forest, open marshland, and hill streams. The weather conditions were cool (15-23 º C) and damp, with occasional heavy rain. Coordinates for specific sample sites are given within the relevant taxonomic chapters. During 11 days just prior to the main RAP survey, CI-Cambodia's national research team conducted studies following a transect along a small river, from 150 m elevation up to tributary hill streams at elevations of over 900 m. The approximate coordinates of this surveyed area were between 107º11'00"E 14º6'00"N and 107º22'00"E 14º18'00"N. The surveyed habitats were lowland evergreen forest, riparian forest, dry deciduous forest, and montane stream habitats. The weather was cool and damp as it was towards the end of the wet season, entering the cool season.

The team flew via helicopter into Virachey National Park from the provincial capital, Banlung, and surveyed throughout the area for 15 days. The objective of the survey was to gain a better understanding of the biological importance of Virachey National Park and highlight its importance for biological conservation both in Cambodia and globally. The RAP survey will lead to the production of a detailed report for the Ministry of the Environment. This report will help the ministry to raise funds to protect and conserve the unique biodiversity of Virachey National Park.

Camp site location in Virachey National Park.

Summary of Preliminary RAP Results

The surveyed areas were found to contain an extremely high diversity and abundance of species. At least 30 ant species, 19 katydid species, 37 fish species, 35 reptile species, 26 amphibian species, and 15 mammal species were recorded during this survey, including direct observations of several large mammal species (e.g., Sambar deer, wild dog, wild cattle) and recent tracks and signs of other mammals (bears, clouded leopards). Many of these mammals are considered globally threatened.

Ants. At least 30 species were present, in addition to many unidentified Ponerinae, Myrmicinae, and Dolichoderinae.A major discovery was a colony of *Gesomyrmex* (possibly *G. tobiasi*) found in the vicinity of the camp. This genus is in the tribe *Gesomyrmicini* and its closest and only living relative genus is *Santschiella* from Africa with a single known species, *G. kohli.* The colony may be *G. tobiasi* and hence a range extension and a significant increase in the numbers of specimens known of this species, or an entirely new species of *Gesomyrmex*. Considering this find, and the ecological isolation of the study area, a number of new species of ants are expected among the collected specimens. Most of the species will be new records for Cambodia, as only 22 species from 6 genera are currently listed as present in this country.

Fishes. At least 37 fish species were recorded during this survey, of which at least 10 appear to be new records for Cambodia. Two of the fish specimens, *Acanthocobitis* sp. and *Devario* sp., are potentially undescribed species. None of the species are classified as globally threatened on the IUCN Red List, but this is solely due to the fact that these fishes have not yet been assessed by IUCN. Based on fish distribution records for Vietnam and Laos, several of the fish species found during this RAP survey appear to be restricted to high elevation hill streams and will therefore likely trigger Vulnerable (VU) status on the IUCN Red List based on their small global area of occupancy.

The rivers and hill streams of Virachey National Park appeared to be in excellent condition, with no signs of pollution and virtually no signs of human impact. There appeared to be healthy populations of freshwater invertebrates in all rivers and streams, which also contained large numbers of freshwater crabs, shrimps and snails.

Amphibians and Reptiles. We recorded approximately 26 amphibian and 35 reptile species, a number of which may be new to science and several others which have never previously been recorded from Cambodia. On the basis of this survey, National Park represents an area of extremely high amphibian and reptile diversity within Cambodia, and a relatively high diversity regionally. Many of the species found in the park by the team have never previously been recorded elsewhere in Cambodia, making the park of significant herpetological conservation importance for the country.

The Asiatic Softshell Turtle *Amyda cartilaginea*, Asian Giant Pond Turtle *Heosemys grandis*, and Impressed Tortoise *Manouria impressa* are all classified as Vulnerable by IUCN. None of the recorded amphibians are currently classified as globally threatened. However, this is because too few data exist for these amphibian species to be properly classified at this time. There are six probable new country records in the collection:

1) Horned Tree Lizard *Acanthosaura* sp.
2) Keelback (snake) *Amphiesma* sp.
3) Wolf Snake *Lycodon* sp.
4) Horned Frog *Ophryophryne* sp.
5) Bushfrog *Philautus* sp.
6) Frog *Taylorana* sp.

Three species appear to represent new species to science, pending the results of a taxonomic study that is currently underway:

1) Slender-toed Gecko *Crytodactylus* sp.
2) Water Skink *Tropidophorus* sp.
3) Bushfrog *Leptolalax* sp.

Mammals. The overall diversity and species composition of large mammal species within the Virachey National Park is representative of lowland and hill evergreen forests in Cambodia. There was a relatively abundant prey base and clear evidence of the presence of apex predatory mammals such as the Asian Wild Dog. Tracks and signs of large mammals were abundant indicating that the impacts of hunting and forest loss on the large mammal populations in the mountains are fairly low. Fewer snares or hunting camps were encountered than in other similar habitats in Cambodia. Wildlife was relatively easy to view, indicating that there was relatively little hunting with guns. Bear signs were abundant and indicated that both Asiatic Black Bear and Malayan Sun Bear were present.

The RAP survey recorded one Endangered mammal, the Dhole *Cuon alpinus*. While fewer than 2,500 Dhole are thought to remain in the wild, the RAP team observed a total of at least 15 Dhole, highlighting the crucial importance of Virachey National Park for the conservation of this species. Five other large mammals were recorded which are classified by IUCN as globally threatened: the Gaur *Bos gaurus* (VU), Yellow-Cheeked Gibbon *Nomascus sabriellae* (VU), Stump-tailed Macaque *Macaca arctoides* (VU), Asiatic Black Bear *Ursus thibetanus* (VU) and Malayan Sun Bear *Helarctos malayanus* (VU). Tracks of otters along the rivers and hill streams appear to be from the Asian Small-clawed Otter *Aeonyx cinerea (*Near Threatened, NT), which the IUCN Otter Specialist Group recommends reclassifying as Endangered due to hunting for the fur trade. The presence of these globally threatened species indicates a relatively undisturbed ecosystem, with little hunting pressure. Additionally, at least two species from the genus *Crocidura* are likely to represent new country records and may even be undescribed species.

Preliminary Conservation Recommendations

This rapid biodiversity assessment has highlighted the outstanding national, regional and global importance of Virachey National Park for wildlife conservation and protection. It is expected that this report will be a useful tool for research planning and management, and will draw both national and international attention to the importance of maintaining the rare and unusual wildlife for perpetuity in Virachey National Park

The results of this RAP show that Virachey National Park is a highly significant area for protecting populations of globally threatened turtles such as the Vulnerable Impressed tortoise, Giant Asian pond turtle and Asiatic softshell turtle. Much of the herpetofauna of Virachey National Park is very distinct from the herpetofauna of montane habitats west of the Mekong River, and therefore Virachey National Park adds significant value to the Cambodian protected area network by protecting a herpetofauna that is not found elsewhere in the country. In addition, Virachey also contains potentially undescribed reptiles and amphibians, i.e. species which have not been recorded anywhere else in the world. Until the distribution and status of these species is better known, Virachey National Park will remain the only known locality of these species and is therefore of exceptionally high importance for reptile and amphibian conservation within the region.

This RAP survey clearly shows that Virachey National Park is important for the conservation of many large mammal species. The presence of large packs of Dhole and the low numbers of snares indicates that the area potentially also provides suitable prey abundance for other large predatory mammals such as the Clouded Leopard, IndoChinese Tiger and Asian Golden Cat.

Since the completion of the RAP survey, the Cambodian government has released a development blueprint for Cambodia highlighting plans for three hydroelectric dams within Virachey National Park. Two of these dams will have significant negative impacts on the lower sections of the surveyed river system, and the third is proposed to be located in the upper sections of the river. It is likely that this dam in the upper reaches of the river will have serious impacts on the freshwater flora and fauna, and that an important area of habitat for globally threatened and restricted range species will be lost. Based on our RAP results and because the dam will only generate an extremely low megawatt output, CI-Cambodia will continue to argue for the upper dam to be removed from the hydroelectric plans for the country. If the dam is built, we will argue for significant financial compensation to the Ministry of Environment, to be used for protection of the remaining intact river systems in Virachey National Park.

We strongly recommend that the river system to the west of the proposed dams be systematically surveyed to confirm the presence of the same species highlighted in this RAP report, and then we recommend that it be included in the core zone for conservation in Virachey National Park. The valley to the west of the proposed dams contains a very large intact river system that has multiple tributaries, a watershed covering over 60,000 ha, and headwaters at over 1,300 m elevation. This will ensure that Virachey's globally threatened and restricted range turtles, freshwater fish and amphibians are adequately protected.

Conduct a series of intensive camera-trap surveys in suitable sites throughout Virachey National Park. Park rangers state that rare cat species still occur in the National Park, but since there are plans to zone the park in the near future, it is important to incorporate a detailed biological layer into the management plans for the site that focuses on the most threatened or irreplaceable species, to ensure that suitable habitat areas for these species are included within the core zone.

Assess the distribution and status of the Asian Small-clawed Otter in Virachey National Park. This rare otter has not been found anywhere else in Cambodia, so it is important to locate and secure a viable population within a protected area. The otter is an apex freshwater predator, so its presence can be used as a coarse indicator of freshwater ecosystem health. It is likely that the rivers of Virachey National Park are globally important for freshwater conservation and should be highlighted as core areas for conservation, so this otter species could serve as a flagship species for conservation of this crucial habitat.

Conduct a survey aiming to confirm the rumours of Douc Langurs, to identify them to species (there are at least three different Douc Langur species, all globally threatened), and then to assess the importance of the population for global conservation of the species. Rangers stated that Douc Langurs are present in Virachey National Park. These primates are extremely rare – the Grey-shanked Douc is on the Global List of the 25 Primates in Peril, and the Red-shanked Douc Langur is classified as Endangered.

Maintain high levels of enforcement within the park by park rangers. Although relatively few snares were found, there are borders both with Laos and with Vietnam, so the risk of cross-boundary poaching is fairly high.

Conduct additional, detailed surveys of the freshwater fishes of Virachey National Park. We recommend a second survey that focuses on hill streams above approximately 800 m elevation, as this is where the largest concentration of restricted range fish species are most likely to occur. We also recommend that voucher specimens are exported to Dr. Maurice Kottelat to expand the existing collection of Cambodian fish fauna.

Aerial view of Virachey National Park.

Veal Thom grassland in Virachey National Park.

RAP team, Virachey National Park, 2007.

1. ANT SURVEY

Preliminary Report for the RAP survey in Virachey National Park, Cambodia

Stéphane De Greef

Introduction

Even though their role in ecosystems is essential, the ants of Cambodia are poorly known: as of 2007, only 22 species from 6 genera are listed as present in the country. In 2002, Conservation International (CI) conducted a Rapid Assessment Program (RAP) survey in southwest Cambodia to evaluate the diversity of plants, vertebrates and ants. From October 1-15 2007, a second RAP survey to evaluate the diversity of ants (among other taxa) was conducted in Ratanakiri Province, in northeast Cambodia. This preliminary report gives an overview of the myrmecological aspects of the 2007 RAP survey.

Methods and Description of Study Site

Methods

Ants were found by direct observation of foragers on the ground and vegetation, or through the use of specific tools including a "Davis Sifter" (a screened pan used to quickly sift leaf litter and separate out ants) and a beating sheet (a one-square-meter sheet of white nylon used to collect ants that fall from plants as the plants are shaken using a stick). Twigs were regularly inspected for nests, while a UV light trap was installed at night to collect winged adults. Whenever possible, the nest was located and all different types of workers, larvae, nymphs and the queen were included in the sample. Some specimens were kept alive for a few days to be photographed, but most were directly transferred with a paper ID label into Sarstedt vials (www.sarstedt.com/pdf/katalog/en/S_061.pdf) filled with 95% alcohol. For each vial, usually containing specimens from a single species, the following information was recorded: date, name of collector, latitude and longitude, country, province, district, location, vegetation type and observations on behavior/identification.

Description of study site

Country:	Cambodia
Province:	Ratanakiri
District:	Veunsai
Common name:	Virachey National Park
Camp location:	N 14°12'29.34" E 107° 0'16.56" (WGS 84)

Virachey National Park is located in the northeast corner of Cambodia, near the borders with Laos and Vietnam. It is the largest national park in Cambodia, and one of the least accessible, due to the absence of roads, hilly relief and countless streams.

The base camp was located at an elevation of 660 m, in the middle of a grassland area locally called "Phnom Veal Thom". This grassland area, of around 10 km², is surrounded on every side by evergreen forest. Most of the grassland burns every year, creating difficult conditions for

many faunal and floral species. Therefore, the research on ants focused on an area of evergreen forest located in the middle of the grassland, the most probable refuge for the ants in time of fire.

Preliminary Results

General impression

At first glance, the grassland is a relatively poor environment, with a very limited flora and annual fires. The most interesting places for ants were the areas where shrubs and trees have settled, creating a refuge area during the fires, either under a thick leaf litter, or high in the trees. We surveyed these areas and in two weeks, 178 vials of specimens were collected. Out of these, at least 30 species were present. Identification *in situ* allows us to compile an initial list of genera and species as follows:

Anochetus sp.
Anoplolepis gracilipes
Camponotus spp.
Cataulacus spp.
Crematogaster spp.
Diacomma sp.
Gesomyrmex sp.
Leptogenys spp.
Odontomachus sp.
Oecophylla smaragdina
Pachycondyla sp.
Paratrechina longicornis
Pheidole spp.
Pheidologeton spp.
Polyrhachis spp.
Pyramica sp.
Strumigenys sp.
Tetraponera sp.

The collection also contained many unidentified Ponerinae, Myrmicinae, and Dolichoderinae.

Interesting species

A major discovery was a colony of *Gesomyrmex* (possibly *G. tobiasi*) found in the vicinity of the camp. Some workers were initially found foraging around the camp area, and were baited with live termites and mosquitoes. After a few hours the nest was found inside a branch of 5 cm diameter, the entrance being a tiny hole of 1 mm diameter. The branch was cut open, delivering dozens of workers of very different sizes, along with larvae and nymphs. Another colony was located nearby and left undisturbed, for further study on their behavior. A large part of the *Gesomyrmex* colony was collected, including dozens of workers of all sizes, the queen, larvae, and nymphs.

This genus is in the tribe *Gesomyrmicini* and its closest and only living relative genus is *Santschiella* from Africa with a single known species, *G. kohli. Gesomyrmex* was first described from a fossil species and there are now three fossil species and six valid extant species. A new species of *Gesomyrmex*, *G. tobiasi* was described in 2004 by Dubovikoff from a single queen found in Hoa Binh Province (800 km away from the nest found during this RAP survey). In 1949, Cole published the last note on this genus. "*The population of their nests is small, and they live in small branches of trees. Members of this genus are very rare and ancient forms.*" Considering this, the colony may be *G. tobiasi* and hence a range extension and a significant increase in the numbers of specimens known of this species, or an entirely new species of *Gesomyrmex*.

Considering this find, and the ecological isolation of the study area, a number of new species of ants are expected among the collected specimens. Most of the species will be new records for Cambodia, as only 22 species from 6 genera are currently listed as present in this country.

Gesomyrmex worker found during the RAP survey.

2. KATYDID SURVEY

Preliminary checklist of katydids (Orthoptera: Tettigoniiae) recorded during the RAP survey in Virachey National Park, Cambodia

Piotr Naskrecki, Conservation International, Invertebrate Diversity Initiative

Site 1: Virachey National Park, Veal Thom base camp, N 14º12'30.3", E 107º00'16.1" (WGS 84), elev. 665 m (1-15 October 2007)
Site 2: Virachey National Park, Stream no. 2, N 14º11.3'35.7", E 106º59'46.0" (WGS 84), elev. 640 m (2-3 October 2007)
Site 3: Virachey National Park, northern grassland, N 14º13'05.9", E 107º00'37.5" (WGS 84), elev. 584 m (9 October 2007)

	Species name	**Site 1**	**Site 2**	**Site 3**
1	*Ducetia* sp. 1	x		
2	*Ducetia* sp. 2	x		
3	*Ducetia* sp. 3	x		
4	*Conocephalus bambusanus*	x		
5	*Macroxiphus* sp. 1	x		
6	*Pseudorhynchus* sp. 1	x		x
7	*Pseudorhynchus* sp. 2			x
8	*Phyllomimus* sp. 1	x		
9	*Phyllomimus* sp. 2		x	
10	*Mecopoda elongata*	x		
11	*Xiphidiola* sp. 1	x		
12	*Deflorita* sp. 1	x		
13	*Pyrgocorypha* sp. 1	x		
14	*Anelytra* sp. 1	x		x
15	*Sathrophyllia* sp. 1	x		
16	*Elimaea* sp. 1	x		
17	*Hexacentrus* sp. 1	x		
18	*Undet.* Phaneropterinae		x	
19	*Hemigyrus tonkinensis*		x	
	TOTAL	**15**	**3**	**3**

3. FISH SURVEY

Preliminary Report for the RAP survey in Virachey National Park, Cambodia

Voen Seila, Fisheries Administration, Cambodia
David Emmett, Conservation International, Indoburma Program

Introduction

Fish constitute a key functional component of the freshwater ecosystem. They maintain the health of the ecosystem by regulating nutrient levels, they form a crucial component of the prey base in the freshwater realm, and they contain a very large proportion of all freshwater predators within a given ecosystem. They occupy a wide variety of niches and feed on a wide variety of food sources. Many species are highly sensitive to changes to the freshwater ecosystem such as changes in water quality, pH or temperature, or to alterations to flow regimes. Therefore, fish diversity, species composition and abundance are key elements to monitor when assessing ecosystem health.

The freshwater fishes of Southeast Asia are very poorly studied, yet limited surveys that have been conducted show an extremely high number of fish species. The Mekong River is known to contain almost 2,000 species; a number comparable to the Amazon River in a watershed about one-fifth of the size. Probably the most understudied freshwater habitats in Cambodia are the hill streams. Efforts have focused on the Mekong River, the Tonle Sap Lake and the fishes that occur in rice paddies. Virtually no fish surveys have ever been conducted in medium- to high-elevation rivers and streams.

The freshwater ecosystems in Southeast Asia are highly threatened by many human activities such as conversion of standing wetlands to agriculture (mainly rice paddies), pollution, dredging of sand for building purposes, over-fishing, harmful fishing practices (e.g., electro-fishing dynamite fishing), hydroelectric dams, and alteration of flow regimes.

This RAP survey aimed to study hill streams in Virachey National Park as they have never been surveyed by scientists. No voucher specimens exist from any hill streams in Cambodia, so a second aim was to start a formal collection of fish specimens in an international institution. A third aim was to identify indicator fish species that would be used by Virachey National Park staff as coarse indicators of freshwater health.

Brief Methods and Study Sites

Scooping nets (round shape, diameter of scooping net: 30 cm, mosquito net mesh) were used to collect small fish in clear water and from under rocks in shallow water at day and at night. At night, fish are less active than by day, making them much easier to collect.

Fishing nets (mesh sizes 2 cm, 5 cm, and 7 cm) were used during the day and at night to catch fish. All nets were deployed in slow, shallow water in the evening and we checked the nets both during the night and in the early morning.

We made collections of small bottom-dwelling species such as loaches by hand in rocky areas and very small streams.

Dr. Maurice Kottelat, President of the European Ichthyological Society and author of *The Field Guide to the Fishes of Vietnam* and *The Field Guide to the Fishes of Laos*, identified all fish voucher specimens.

General Impressions / Results for Each Site and Overall

At least 37 fish species were recorded during this survey (Table 3.1), of which at least 10 appear to be new records for Cambodia. Two of the fish specimens, *Acanthocobitis* sp. and *Devario* sp., appear to be undescribed species. None of the species are classified as globally threatened on the IUCN Red List, but this is solely due to the fact that these fishes have not yet been assessed by IUCN. Based on fish distribution records for Vietnam and Laos, several of the fish species found during this RAP survey appear to be restricted to high elevation hill streams and will therefore likely trigger Vulnerable status on the IUCN Red List based on their small global area of occupancy.

The rivers and hill streams of Virachey National Park appeared to be in excellent condition, with no signs of pollution and virtually no signs of human impact. The rivers were clear with sand and rocky substrates. The hill streams were predominantly rocky with deep sandy pools. Smaller lowland streams held a rich aquatic flora and an abundance of invertebrates. There appeared to be healthy populations of freshwater invertebrates in all rivers and streams, which also contained large numbers of freshwater crabs, shrimps and snails. As shown in the reptile and amphibian section of this report, the rivers and streams also harbored an abundance of undescribed or rare amphibians, water snakes, an undescribed water skink species, and rare IndoChinese Water Dragons. Therefore, based on the presence of an abundance of globally threatened and restricted range fish and aquatic herpetofauna, it is clear that the rivers and streams and their associated riparian forests stand out as the highest priority habitat for conservation in Virachey National Park.

All fish voucher specimens were sent to Dr. Murice Kottelat in Switzerland, where they have formed the first international fish collection from the hill streams of Cambodia.

Interesting Species or Genera

At this time, at least 10 of the species recorded are unidentified pending comparisons with specimens from the mountains of southern Laos and central Vietnam. It is likely that when the taxonomy is complete, the collection will contain other new country records.

The collection contains two species from the genus *Tor* – *T. tambroides* and *T. tambra*. Fishes from this genus are forest-dependent, by which it is meant that they only occur in unpolluted rivers and streams with intact riparian forest. They are very sensitive to water temperature increases or pH changes. They are also large fish, and thus are negatively impacted by overfishing. Their presence in Virachey National Park therefore indicates a healthy freshwater

ecosystem, excellent riparian forest, and low threat levels. These species are therefore ideal coarse monitors of freshwater ecosystem health in the rivers of Virachey National Park.

Conservation Recommendations

It is crucial that additional, detailed surveys of the freshwater fishes of Virachey National Park be conducted. We recommend a second survey that focuses on hill streams above approximately 800 m elevation, as this is where the largest concentration of restricted range fish species are most likely to occur. We also recommend that voucher specimens are exported to Dr. Maurice Kottelat to expand the existing collection of Cambodian fish fauna.

Since the completion of the RAP survey, the Cambodian government has released a development blueprint for Cambodia highlighting plans for three hydroelectric dams within Virachey National Park. Two of these dams will have significant negative impacts on the lower sections of the surveyed river system, and the third is proposed to be located in the upper sections of the river. It is likely that this dam in the upper reaches of the river will have serious impacts on the freshwater flora and fauna, and that an important area of habitat for globally threatened and restricted range species will be lost. The results of this RAP survey have been used to inform the Japan International Cooperation Agency (JICA) and the Cambodia Ministry of Industry, Mines and Energy in their EIA of the site. Based on our RAP results and because the dam will only generate an extremely low megawatt output, CI-Cambodia will continue to argue for the upper dam to be removed from the hydroelectric plans for the country. If the dam is built, we will argue for significant financial compensation to the Ministry of Environment, to be used for protection of the remaining river systems in Virachey National Park.

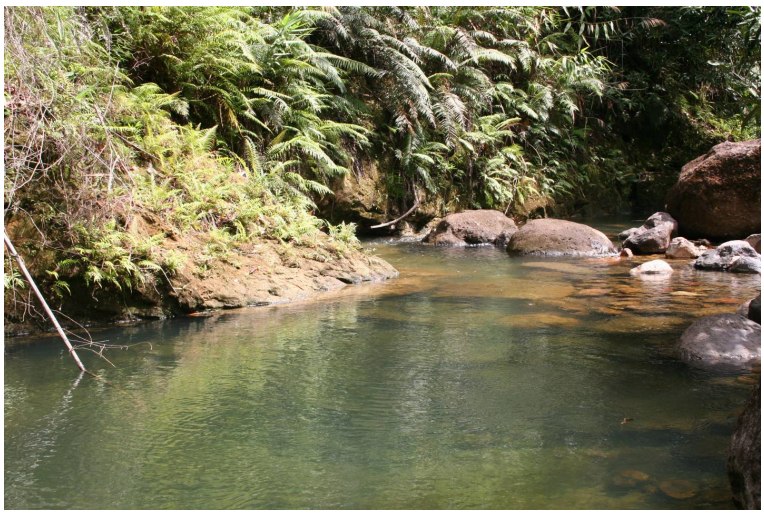
The valley to the west of the proposed dams contains a very large intact river system that has multiple tributaries, a watershed covering over 60,000 ha, and headwaters at over 1,300 m elevation. We strongly recommend that this river system be systematically surveyed to confirm the presence of the same species highlighted in this RAP report, and then we recommend that it be included in the core zone for conservation in Virachey National Park. This will ensure that Virachey National Park's globally threatened and restricted range freshwater fish and amphibians are adequately protected.

Table 3.1. Fishes recorded during the RAP survey of Virachey National Park, Cambodia

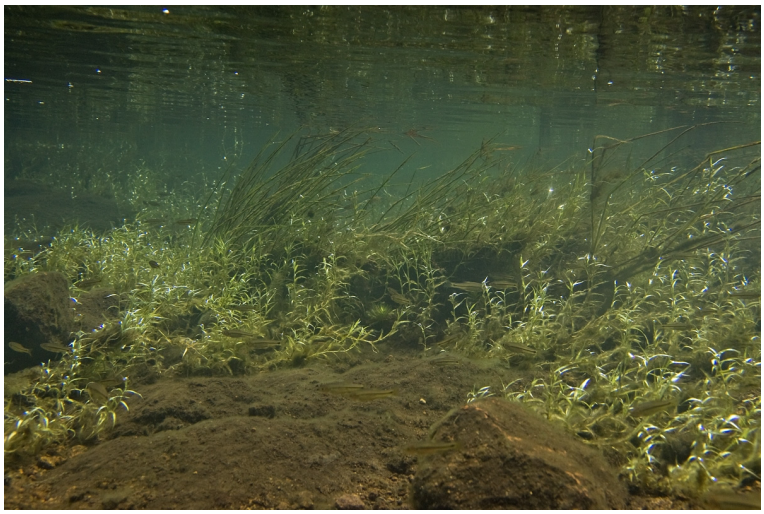
N°	Scientific name
1	*Mystacoleucus atridorsalis*
2	*Puntius rhombeus*
3	*Rasbora paviana*
4	*Hemibagrus spilopterus*
5	*Pristolepis fasciata*
6	*Cyclocheilichthys armatus*
7	*Osteochilus hasselti*
8	*Xenentodon* sp.

9	*Poropuntius normani*
10	*Tor tambroides*
11	*Channa striata*
12	*Hampala macrolepidota*
13	*Poropuntius laoensis*
14	*Garra* cf. *cyrano*
15	*Garra cambodgiensis*
16	*Tor tambra*
17	*Acanthocobitis* sp. n.
18	*Schistura* sp.
19	*Devario* sp. n.
20	*Channa gachua*
21	*Papuligobius* sp.
22	*Neolissochilus blanci*
23	*Annamia normani*
24	*Schistura* sp.
25	*Onychostoma meridionalis*
26	*Glyptothorax* sp.
27	*Gyrinocheilus aymonieri*
28	*Raiamas guittatus*
29	*Parambassis siamensis*
30	*Baltora* sp.
31	*Homaloptera* cf. *yunnanensis*
32	*Mystus singaringan*
33	*Barbonymus altus*
34	*Kryptopterus minor*
35	*Osphronemus exodon*
36	*Mystacoleucus greenwoodi*
37	*Glyptothorax* cf. *laosensis*

Freshwater fishes found in streams near Veal Thom.



The montane streams consist of pools and riffles in evergreen forest and are home to restricted range fish species that have not previously been recorded in Cambodia.



Hill stream, viewed below the surface.

4. REPTILE AND AMPHIBIAN SURVEY

Preliminary Report for the RAP survey in Virachey National Park, Cambodia

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Bryan Stuart, Museum of Vertebrate Zoology, University of California, Berkeley, USA

Introduction

The Indo-Burma region represents an area of high amphibian and reptile diversity and increasing human pressure, but is also an area of limited knowledge regarding the true species diversity, distribution and status of many species, particularly amphibians and reptiles. This is especially true in Cambodia, where scientific research and conservation efforts have been hampered by previous civil conflict. Prior to 2000, very few surveys for amphibians or reptiles had been conducted in Cambodia. The absence of information on Cambodia's amphibians is reflected in the Global Amphibian Assessment (2004), which lists 135 species for Vietnam (34 endemic), 129 species for Thailand (9 endemic), 65 species for Laos (3 endemic), but only 43 species (3 endemic) for Cambodia. The apparent lower diversity in Cambodia compared to neighboring countries is merely a reflection of how little survey work has been done in the region.

Reptiles and amphibians are widely distributed globally and play an important role within an ecosystem; many species (especially frogs) form an important prey base, while other species (such as snakes) perform key roles as predators. They are prominent vertebrate groups both in aquatic and terrestrial habitats. Many genera display remarkable levels of speciation and some species have become highly adapted to very specific habitats, microhabitats or altitudes. Many amphibians and reptiles are highly sensitive to habitat conversion or environmental change, whereas some species thrive under such conditions, allowing for selected species to be monitored in order to provide an indication of environmental changes. Also, a significant number of reptile and amphibian species are globally threatened by harvesting for food or medicine and can therefore be used to monitor these threats. For these reasons, they are important taxa to study and monitor from a conservation perspective. Also, their abundance within a given habitat or site often allows for a rapid yet quantitative assessment of the herpetological diversity of a site with relative ease. Yet herpetological research in Cambodia has been sporadic and the literature describing the Cambodian herpetofauna is incomplete. Amphibians and reptiles are two of the least studied animal groups in the country. Many regions of the country are still to be explored.

In addition to their ecological importance, reptiles and amphibians are also well represented in local folklore and superstitions. In Cambodia, they play a considerable role in local religions, particularly within the Buddhist society. Snakes, crocodiles and turtles in particular have high significance in Buddhist mythology, and are often represented in idols, carvings, and paintings in temples. Live turtles and tortoises are kept in some temples. However, the protection afforded to reptiles and amphibians by religious association is often negated by the harvesting of selected species (particularly turtles, monitor lizards and frogs) for food or medicinal purposes, the killing of snakes as a precaution against venomous species, and the loss of habitat for conversion to agriculture.

Amphibians are of particular conservation concern, as they are one of the most highly threatened groups of animals. One-third of all amphibian species are listed as globally threatened (IUCN) and almost half known to be experiencing population declines, making amphibians more highly threatened and in faster decline than either birds or mammals. Currently, populations of almost half of the amphibian species in Asia are thought to be declining, though there is not enough information to assess why or how rapidly these declines are taking place. In addition, almost one-third of Indo-Burma's amphibian species are listed as Data Deficient (IUCN), reflecting the overall lack of information regarding the distribution, basic biology, and conservation status of amphibians in the region. This lack of baseline population information presents another serious challenge to understanding if and how large-scale amphibian declines and extinctions are occurring in Asia.

In addition, many amphibian declines around the world are attributed to the amphibian disease chytridiomycosis, caused by the pathogen *Batrachochytrium dendrobatidis* (Bd). To date, Bd has been identified from wild amphibians on all continents where they exist, with the exception of Asia. However, rather than indicating that Bd is not present, this absence represents an almost complete lack of survey effort in the region; we do not know if chytridiomycosis is present in any amphibians native to Asia.

Brief Methods and Study Sites

Virachey National Park is located in the north-eastern corner of Cambodia, bordered in the north by Lao PDR and in the east by Vietnam. The park covers more than 300,000 ha of hilly, forested land, and reaches elevations of around 1500 m. Surveys in Virachey National Park were conducted as part of a RAP expedition in October 2007. Amphibians and reptiles were surveyed by Jodi Rowley, Conservation International, Bryan Stuart, Museum of Vertebrate Zoology, University of California, Berkeley, and Neang Thy, Flora and Fauna International.

The herpetofauna of Virachey National Park was investigated primarily through active searching of suitable habitats, and via pitfall trapping. We searched for reptiles and amphibians under rocks and logs, inside rotten wood, in holes, in leaf litter and topsoil, under moss and bark, in vegetation and hollow trees, and in streams, ponds and marshes. Searches were conducted both during the day and at night at all sites. Pitfall trapping involved positioning a drift fence made of plastic sheeting (50 m long, 70 cm high) through a suitable area of habitat, with the bottom 10cm of the plastic sheeting buried to form a barrier to animals. We then buried bucket pitfall traps (30 cm top diameter, 35 cm deep) so that the top was flush with the ground. These buckets were positioned at 10 m intervals along the drift fence and at each end, with the plastic sheeting bisecting the top of each bucket. Pitfalls were checked for amphibians and reptiles at least twice per day.

The team took recordings of calling frogs, documented macro- and micro-habitat data for each species, and collected scientific specimens and genetic material. They also swabbed the skin of many amphibians, so that we can determine whether or not amphibians at the site were infected with the potentially fatal pathogen, Bd.

Site 1, a mid-elevation river to the east of the National Park, was surveyed across an elevation range of 200-1,000 m. The surveyed habitats at this site consisted of dry deciduous forest, lowland evergreen forest, hill evergreen forest, rivers and hill streams. One pitfall trap array was placed in evergreen forest beside a hill stream at 500 m altitude.

Site 2, at Veal Thom (14°12'29"N, 107° 0'16"E) was surveyed across an elevation range of 544-706 m. The main camp for the survey was located on a large grassland within the forest called Veal Thom, but surveys for amphibians and reptiles focused on surrounding hill evergreen, mixed evergreen and deciduous forest. A single pitfall trap array was placed in mixed forest adjacent to grassland.

General Impressions / Results for Each Site and Overall

This survey recorded approximately 26 amphibian and 35 reptile species (Table 4.1), a number of which may be new to science and several others which have never previously been recorded from Cambodia before. Voucher specimens have been deposited at the Museum of Vertebrate Zoology (Berkeley, USA). The records will be published in the scientific literature in greater detail, including descriptions, measurements, and detailed localities for each specimen.

On the basis of this amphibian and reptile survey, Virachey National Park represents an area of extremely high amphibian and reptile diversity within Cambodia, and a relatively high diversity regionally. The survey found over 50% of all amphibian species recorded for all of Cambodia in the 2004 Global Amphibian Assessment. Many of the species found in the park by the team appear to be found nowhere else in Cambodia, making the park of significant herpetological conservation importance for the country.

Three of the reptile species found in Virachey National Park are classified as globally threatened (IUCN 2006). The Asiatic softshell turtle *Amyda cartilaginea*, Asian giant pond turtle *Heosemys grandis*, and Impressed tortoise *Manouria impressa* are all classified as Vulnerable. None of the amphibians that were collected are currently classified as globally threatened. However, this is because too few data exist for these amphibian species to be properly classified at this time.

Interesting Species or Genera

There are six probable new country records in the collection. These are:

1) A Horned Tree Lizard *Acanthosaura* sp.
2) A Keelback (snake) *Amphiesma* sp.
3) A Wolf Snake *Lycodon* sp.
4) A Horned Frog *Ophryophryne* sp.
5) A Bushfrog *Philautus* sp.
6) A frog *Taylorana* sp.

There are three probable new species in the collection. These three appear to represent new species to science, pending the results of a taxonomic study that is currently underway. They are:

1) A Slender-toed Gecko *Crytodactylus* sp.

2) A Water Skink *Tropidophorus* sp.
3) A Bushfrog *Leptolalax* sp.

The following species are interesting due to their globally threatened or trade-threatened status:

Impressed tortoise *Manouria impressa*
IUCN Status: Vulnerable
One live adult Impressed tortoise was found during the RAP survey, in bamboo forest within evergreen forest at around 800 m elevation. This rare tortoise lives in montane forest and feeds predominantly on fungi. It has only recently been found in Cambodia, in the Cardamom Mountains of southwest Cambodia, so it is extremely important that this species is now also confirmed to occur in Virachey National Park. Based on the habitat preference of this species, the range of this rare tortoise could cover the entire montane region of Virachey National Park. This area may therefore contain a globally significant population of Impressed tortoises.

Giant Asian pond turtle *Heosemys grandis*
IUCN Status: Vulnerable
This species had been tentatively confirmed to occur in northeast Cambodia based on ranger confiscation reports and market surveys. We found shell fragments (the carapace and plastron) of a small *H. grandis* at the new ranger outpost. It had apparently been captured in the nearby stream either by local police or rangers, and then eaten. The shell was measured and photographed. The presence of this shell indicates that the species occurs in lowland to mid-altitude streams, and also that it may be threatened in some areas through collection for food.

Asiatic softshell turtle *Amyda cartilaginea*
IUCN Status: Vulnerable
This aquatic turtle appears to be fairly common and widespread in Virachey National Park. Even on this short trip, several softshells were observed in the hill streams and larger rivers that abound in eastern Virachey. A large adult softshell was observed in a large river. It was feeding on fish that were trapped in the team's fishing net. Two sub-adult softshells were also observed in deep pools in smaller streams. However, the rangers mentioned that the species is also harvested by Vietnamese poachers for food.

This species is collected in fairly high numbers across the region, always for food. The species can actually tolerate low levels of sustainable exploitation due to its ecology - it matures at a relatively early age and produces many eggs each year. However, the collection of many adult softshell turtles will rapidly destroy local populations.

Reticulated python *Python reticulatus*
This python has CITES II status due to its popularity both in the skin trade and the pet trade. This python species has suffered population crashes in many areas due to over-collection. However, it appears to be fairly common in Virachey National Park. Two sub-adult pythons (each approximately 1 m in length) were observed beside rivers in two different localities at Site 1.

Conservation Recommendations

The results of this RAP show that Virachey National Park is a highly significant area for protecting populations of globally threatened turtles such as the Vulnerable Impressed tortoise, Giant Asian pond turtle and Asiatic softshell turtle.

The montane forests and streams in Virachey National Park contain a wide variety of amphibian and reptile species. From the collection we made of 26 amphibian and 35 reptile species, only 8 amphibian species and 20 reptile species have been recorded from the Cardamom Mountains of southwest Cambodia (the only other montane area in Cambodia). This shows that much of the herpetofauna of Virachey National Park is very distinct from the herpetofauna of montane habitats west of the Mekong River, and therefore Virachey National Park adds significant value to the Cambodian protected area network by protecting a herpetofauna that is not found elsewhere in the country.

In addition, Virachey also contains potentially undescribed reptiles and amphibians, i.e. species which have not been recorded anywhere else in the world. Until the distribution and status of these species is better known, Virachey National Park will remain the only known locality of these species and is therefore of exceptionally high importance for reptile and amphibian conservation within the region. The results of this reptile and amphibian survey indicate a wealth of biodiversity and new species, and we can now state that Virachey is one of Cambodia's most important protected areas for herpetological conservation due to the globally threatened or apparently irreplaceable value of several species within its herpetofauna.

Acknowledgements

We thank the park staff and rangers of Virachey National Park for their support and enthusiasm, especially to Keo for his tireless support in the field and his important contribution to the collections. Most thanks go to Neang Thy for his support both in the field and in facilitating the permissions for exportation of specimens for formal identification. The results and photographs from this survey will support the Ministry of Environment and will aid Thy in his efforts to produce Cambodia’s first Field Guide to the Amphibians of Cambodia – an effort we applaud and wholeheartedly support.

Table 4.1. Amphibians and reptiles from Virachey National Park, Cambodia

Species	Site 1	Site 2
AMPHIBIANS (26 species)		
Bufonidae		
Bufo galeatus	x	x
Microhyildae		
Calluella guttulata	x	
Kalophrynus interlineatus	x	x
Microhyla berdmorei	x	
Microhyla butleri	x	
Microhyla heymonsi	x	
Ranidae		
Hoplobatrachus rugulosus		x
Limnonectes dabanus		x
Limnonectes kuhlii	x	x
Limnonectes sp.	x	x
Occidozyga martensii	x	
Odorrana banaorum/morafkai	x	x
Rana cf. *milleti*	x	
Rana nigrovittata	x	
Rana erythraea	x	
Taylorana sp. 1	x	x
Taylorana sp. 2		x
Megophryidae		
Leptobrachium mouhoti	x	x
Leptolax sp. 1	x	x
Leptolax sp. 2	x	x
Megophrys major	x	
Ophryophryne sp. 1		x
Ophryophryne sp. 2		x
Rhacophoridae		
Philautus sp.	x	
Polypedates leucomystax	x	x
Rhacophorus annamensis	x	
REPTILES (35 species)		
Boidae		
*Python reticulatus**	x	
Colubridae		
Amphiesma sp.		x
Boiga cyanea	x	
Dinodon septentrionale		x
Enhydris plumbea	x	x
Homalopsis nigroventralis	x	
Lycodon sp.		x
Pareas sp.		x
Psammodynastes pulverulentus	x	
Rhabdophis chrysargos		x

Rhabdophis subminiatus	x	x
Xenochrophis flavipunctatus		x
Elapidae		
Bungarus candidus		x
Bungarus fasciatus	x	
Viperidae		
Trimeresurus albolabris		x
Trimeresurus macrops		x
Trimeresurus sp.	x	
Agamidae		
Acanthosaura coronota	x	
Acanthosaura sp.	x	x
Calotes versicolor	x	x
Draco sp.	x	
Physignathus cocincinus	x	
Lacertidae		
Takydromus sexlineatus	x	x
Scincidae		
Lygosoma bowringii	x	
Mabuya macularia		x
Mabuya multifasciata		x
Scincella sp.	x	x
Sphenomorphus sp.	x	
Tropidophorus sp.	x	x
Gekkonidae		
Cyrtodactylus sp.	x	x
Dixonius siamensis		x
Bataguridae		
*Heosemys grandis**	x	
Geoemydidae		
Cyclemys oldhami		x
Testudinidae		
*Manouria impressa**		x
Trionychidae		
*Amyda cartilaginea**	x	

* Not collected as voucher specimens

An Endangered Impressed Tortoise *Manouria impressa* observed during the RAP survey. (photo: Jodi Rowley)

Green tree viper (*Trimeresurus albolabris*) found during survey.

Undescribed gecko caught in Virachey NP during the RAP survey.

5. MAMMAL SURVEY

Preliminary Report for the RAP survey in Virachey National Park, Cambodia

David Emmett, Conservation International, Indo-Burma Program

Introduction

Mammals play a key role within an ecosystem. Small mammals are important seed dispersers and also function to maintain invertebrate populations, while they themselves are a crucial prey base for many carnivorous mammals, reptiles and birds. Ungulates are essential both to maintain the floral integrity of an area and to form the prey base for large carnivorous mammals. These large carnivorous mammals play a key role in maintaining the faunal balance in ecosystems, and are apex predators both in the terrestrial realm (e.g., tigers, clouded leopards) and in the freshwater realm (e.g., otters).

Many mammal species are susceptible to habitat loss and hunting. In addition, many mammal species in Southeast Asia, such as bears, tigers, pangolins and otters, are targeted for the wildlife trade. For these reasons, mammals are important indicators both of ecosystem health and of threats to biodiversity, and hence they were a focal taxon for this RAP survey.

Brief Methods and Study Sites

Large Mammals

Opportunistic observations were made during the survey, both by day and at night.
Track and sign surveys were conducted along transects to look for bear signs, especially scratch marks on trees.
Interviews were carried out with the Virachey National Park rangers and porters. Two Virachey National Park rangers and six porters were interviewed.

Small mammals

Snap-traps and live traps (aluminum box traps 9 x 10 x 32 cm): were employed to capture insectivores and rodents. The traps were baited with a mix of dried fish/beef, shrimp, peanut butter, and set in areas which showed signs of small mammal activity (e.g. hollows under trees, in rocky areas, near holes). The traps were set in the afternoon and checked in the morning. Three different sites and elevations were surveyed.
Mist-nets were set along the forest edge and across flight-paths in an attempt to capture bats. They were opened at dusk and kept open until there were no more signs of activity from the bats. Nets were opened at three different sites and elevations to capture bats.
Pitfall traps were used to target small mammals such as mice and shrews. They consisted of plastic buckets 30 cm deep buried into the ground at 10 m intervals, intersected by a 50-m-long plastic drift fence. Pitfalls were checked twice daily; in the early morning and late evening.

General Impressions / Results for Each Site and Overall

The overall diversity and species composition of large mammal species within the altitudinal range and habitats surveyed in Virachey National Park were representative of lowland and hill

evergreen forests in Cambodia (Table 5.1). There was a relatively abundant prey base which consisted predominantly of wild pigs *Sus scrofa*, Red Muntjac *Muntiacus muntjac* and Sambar Deer *Cervus unicolor*, and clear evidence of the presence of apex predatory mammals such as the Asian Wild Dog.

Tracks and signs of large mammals were abundant. Several different localities showed signs of plentiful numbers of Sambar Deer and wild pigs. Animal footpaths crisscrossed most open areas. Three Sambar Deer were observed crossing a stream at N 14° 14' 56", E 107° 21' 12" (WGS 84), elevation 165 m. One Red Muntjac was heard on the Ho Chi Minh trail in evergreen forest, and there were many signs of Red Muntjac in the open grassland of Veal Thom. This indicates that the impacts of hunting and forest loss on the large mammal populations in the mountains are fairly low. Fewer snares or hunting camps were encountered than in other similar areas in Cambodia (e.g., the Cardamom Mountains, Bokor National Park). Wildlife was relatively easy to view, indicating that there was relatively little hunting with guns. Bear signs were abundant, and measurements taken of the spaces between the scratches indicated that both Asiatic Black Bear and Malayan Sun Bear were present. These bear species are highly threatened by hunting for the medicinal trade (gall bladders) and pet trade (adults are killed and cubs are captured).

Cat tracks (probably leopard cat *Prionailurus bengalensis*,) were found around most wetland areas. This species is common throughout Cambodia.

Interesting Species or Genera

The RAP survey recorded six large mammals which are classified by IUCN as globally threatened: the Gaur *Bos gaurus*, Yellow-Cheeked Gibbon *Nomascus sabriellae,* Stump-tailed Macaque *Macaca arctoides,* Dhole *Cuon alpinus*, Asiatic Black Bear *Ursus thibetanus* and Malayan Sun Bear *Helarctos malayanus*.

Listed below are descriptions of globally threatened or potentially undescribed mammals that were either confirmed or tentatively recorded during this RAP survey:

Dhole *Cuon alpinus*
IUCN Status: Endangered

The Dhole is classified as Endangered and fewer than 2,500 are thought to remain in the wild. There are fewer Dhole in the wild than tigers. Rangers stated that this species is widespread throughout the park and the team observed a pack of approximately 10 Dhole, highlighting the crucial importance of Virachey National Park for the conservation of this rare dog.

Malayan Sun Bear *Helarctos malayanus* and Asiatic Black Bear *Ursus thibetanus*
IUCN Status: Vulnerable

The team observed many signs of Malayan Sun Bears and Asiatic Black Bears – both are highly trade-threatened species that have recently been ranked as Vulnerable on the IUCN Red List due to high hunting pressure. Preliminary analyses of transect results indicate that Virachey National Park may have one of the highest densities of bears in Cambodia.

Gaur *Bos gaurus*
IUCN Status: Vulnerable

The team recorded many tracks and signs of wild cattle that were attributed to the Gaur *Bos gaurus* by the ranger team due to their size and the habitat where they were found. Many signs and dung of Gaur were found in hill evergreen forest around 900 m. The Gaur is a rare species of wild cattle that is now restricted to mountain pastures in Southeast Asia due to hunting pressure.

Yellow-cheeked Gibbon *Nomascus sabriellae*
IUCN Status: Vulnerable
Yellow-cheeked Gibbons call in the early morning. These calls were heard by team-members in evergreen forest at all survey sites. The species appeared to be widespread throughout Virachey National Park in a wide range of elevations, from lowland forest at 150 m asl to montane forest above 800 m asl. It is provisionally listed by the IUCN Primate SSG as Endangered due to continued and increasing levels of habitat loss and direct persecution. It is also possible that the gibbon species may be *Nomascus sika* (also provisionally listed as Endangered) as this genus has recently undergone revision.

Stump-tailed Macaque *Macaca arctoides*
IUCN Status: Vulnerable
One adult Stump-tailed Macaque was clearly observed by a team-member in evergreen forest near the Ho Chi Minh road at N 14° 17’ 34”, E 107° 21’ 52” (WGS 84), elevation 260 m. This species is threatened by habitat loss and collection for the pharmaceutical trade.

Asian Small-clawed Otter *Aeonyx cinerea*
IUCN Status: Near Threatened
There were tracks of otters along the rivers and hill streams of Virachey National Park. In particular, many tracks of otters were found in one area (N 14° 4’ 54”, E 107° 10’ 8” (WGS 84), 130 m), along a large river. Based on their size, we tentatively identified the otters as the Asian Small-clawed Otter, which the IUCN Otter Specialist Group recommended uplisting on the Red List at a recent colloquium in South Korea in 2007. It is threatened due to hunting for the fur trade, so it is a priority species for conservation in Virachey National Park. Small-clawed otters were also stated by Virachey National Park rangers to be found in large pools along the river near the ranger outpost at N 14° 16’ 44”, E 107° 22’ 6” (WGS 84), 230 m. Two small-clawed otter skins were also observed for sale in Banlung Market after the survey had been completed.

Shrew *Crocidura* sp.
Eleven shrews representing at least two species from the genus *Crocidura* were caught in pitfall traps in hill evergreen forest, and voucher specimens were collected. Specimens have been exported to the Harrison Institute in the UK for formal identification. It is likely that they represent new country records and they may even be undescribed species, as the only *Crocidura* recorded from Cambodia are from the isolated Cardamom Mountains massif in Southwest Cambodia.

Conservation Recommendations
This RAP survey clearly shows that Virachey National Park is important for the conservation of many large mammal species. The presence of large packs of Dhole, which require a very large prey base, indicates that the area potentially also provides suitable prey abundance for other large predatory mammals such as the Clouded Leopard, IndoChinese Tiger and Asian Golden Cat.

These cats are mainly threatened by snares, but few snares were observed during the survey and the presence of many other mammals that are also impacted by snares indicates that this threat is minimal at the survey sites. Park rangers state that rare cat species still occur in the National Park, so we recommend that a series of camera-trap surveys be conducted in suitable sites throughout the National Park. There are plans to zone the park in the near future, so it is important to incorporate a detailed biological layer into the management plans for the site that focuses on the most threatened or irreplaceable species, to ensure that suitable habitat areas for these species are included within the core zone.

Focused study should also assess the distribution and status of the Asian Small-clawed Otter in Virachey. This rare otter has not been found anywhere else in Cambodia, so it is important to locate and secure a viable population within a protected area. The otter is an apex freshwater predator, so its presence can be used as a coarse indicator of freshwater ecosystem health. It is likely that the rivers of Virachey National Park are globally important for freshwater conservation and should be highlighted as core areas for conservation, so this otter species could serve as a flagship species for conservation of this crucial habitat.

Rangers stated that Douc Langurs are present in Virachey. These primates are extremely rare – the Grey-shanked Douc is on the Global List of the 25 Primates in Peril, and the Red-shanked Douc Langur is classified as Endangered. We recommend that a survey is conducted aiming to confirm the rumours of Douc Langurs, to identify them to species (there are at least three different Douc Langur species, all globally threatened), and then to assess the importance of the population for global conservation of the species.

Although relatively few snares were found, it is important that the park rangers maintain high levels of enforcement within the park. There are borders both with Laos and with Vietnam, so the risk of cross-boundary poaching is fairly high. The remoteness of the site and lack of infrastructure currently protects the biodiversity, but this may change as development plans for Ratanakiri Province include road and infrastructure development in and around the national park.

Tree with bear claw marks observed during Virachey RAP survey.

Table 5.1. Mammals recorded during the 2007 RAP survey of Virachey National Park, Cambodia

Mammal species	Scientific name	Evidence	Comments
Yellow-cheeked Gibbon	*Nomascus sabriellae*	Heard	Four groups, elevations from 150-850 m
Stump-tailed Macaque	*Macaca arctoibes*	Observed	One, elevation around 300m
Bears	*Helarctos malayanus* *Ursus thibetanus*	Scratch marks	Abundant signs
Gaur	*Bos gaurus*	Track, dung	Elevation up to almost 1,000 masl
Red Muntjac	*Muntiacus muntjak*	Tracks and call	Common
Sambar Deer	*Cervus unicolor*	Tracks, observed	Two females and one male were observed
Small-clawed Otter	*Aeonyx cinerea*	Tracks	Needs to be confirmed
Dhole	*Cuon alpinus*	Observed, tracks	Important site for conservation of the species
Wild Boar	*Sus scrofa*	Tracks	Common
Giant Squirrel	*Ratufa affinis*	Observed	Large flying squirrel, often hunted
Leopard Cat	*Prionailurus bengalensis*	Tracks	Common
Northern Tree Shrew	*Tupaia belangeri*	Observed	Three tree shrews on tree, elevation 370 masl
Berdmore's Squirrel	*Menetes bedmorei*	Observed	One squirrel, elevation around 560 m
Shrews	*Crocidura* spp.	Captured	At least two different species based on tail length and morphology
Bats	*Rhinolophus* sp. *Myotis* sp.	Captured	Low trapping effort for bats – many more species predicted