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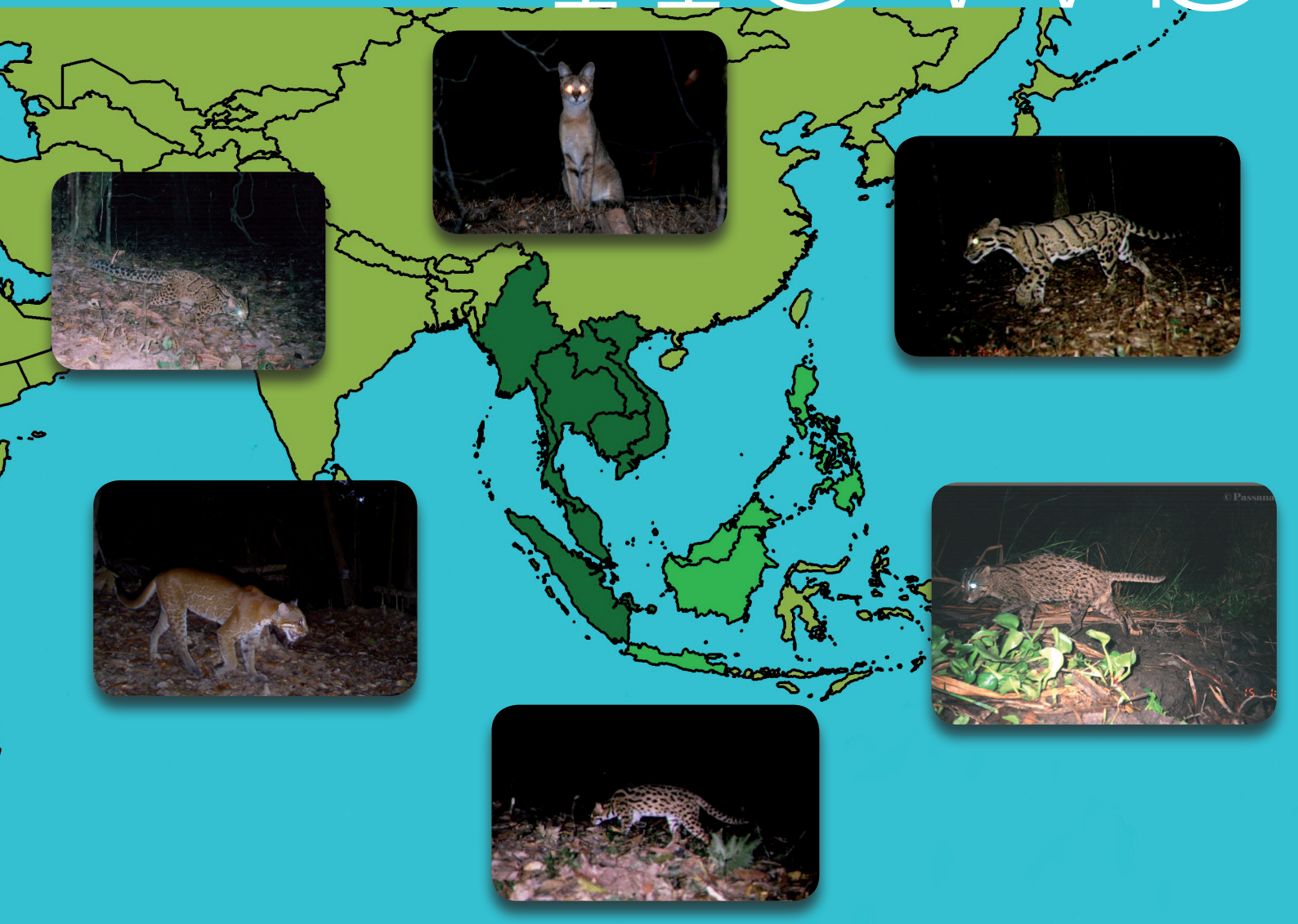
CAT news

Non-*Panthera* cats in South-east Asia



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CAT SPECIALIST GROUP

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Original contributions and short notes about wild cats are welcome **Send contributions and observations to ch.breitenmoser@kora.ch.**

Guidelines for authors are available at www.catsg.org/catnews

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Cover Photo: Non-*Panthera* cats of South-east Asia:
From top centre clock-wise
jungle cat (Photo K. Shekhar)
clouded leopard (WCS Thailand Prg)
fishing cat (P. Cutter)
leopard cat (WCS Malaysia Prg)
Asiatic golden cat (WCS Malaysia Prg)
marbled cat (K. Jenks)

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Non-*Panthera* cats in Nakai-Nam Theun National Protected Area, Lao PDR

Small and medium-sized wild cat species (2 - 20 kg, non-*Panthera* species) in Laos remain little known. So far, four species are known to occur in the country: Least Concern leopard cat *Prionailurus bengalensis*, Near Threatened Asiatic golden cat *Catopuma temminckii*, Vulnerable marbled cat *Pardofelis marmorata* and Vulnerable mainland clouded leopard *Neofelis nebulosa*. Although all four were confirmed in the Nakai-Nam Theun National Protected Area NNT NPA during a camera-trap survey of 20,452 camera trap-days, from March 2006 to January 2011, only 21 images were captured of these species. In contrast, all these species were found with much lower survey efforts in NNT NPA in the 1990s and continue to be readily camera-trapped in other evergreen forest sites in South-east Asia. In combination, these factors indicate that the present low encounter rate is likely to represent recently reduced density in NNT NPA. Although the area supports over 3,000 km² of largely little-encroached forest, hunting pressure from Lao and mostly Vietnamese poachers is probably responsible for the vanishing populations of these now-rare species in the area. This is a consequence of the remarkable amount of non-selective ground snares used throughout most of the area, a situation typical for most forest areas in Laos and Viet-nam. Because of its size and habitat condition, NNT NPA should be one of the most important areas in the country and the region for the conservation of small carnivore species including wild cats, but this importance is rapidly eroding. Therefore, action is urgently needed to control illegal hunting in the area for the conservation of non-*Panthera* wild cat species.

Table 1. Camera-trapping survey effort in Nakai Nam Theun NPA from 2006 to 2011. * survey blocks in which cats (non-*Panthera*) were recorded; [a] faulty cameras are excluded; for (9) in 2009, only data from three cameras were available from the database, although more were deployed. [b] Includes test, unidentified, photos with no objects, wildlife and human photos. CTD=camera trap days.

Area (# on map)	time period	Total cameras[a]	CTD	Total photos taken[b]
Khamkeut - Nam San (1)	Mar-May 06	49	2,233	1,109 *
Nam On - Boualapha (2)	Oct-Nov 06	49	1,406	357 *
Nam On - Gnomalath (3)	Dec 06-Feb 07	49	1,754	344
Khamkeut - Thong Pae (4)	Mar-May 07	48	2,181	721 *
Nam Chae - Makfeuang (5)	Nov 07-Jan 08	50	2,359	624 *
Nam Chae - Navang (6)	Jan-Mar 08	47	1,894	601 *
Phou Vang - Houay Nam Heuy (7)	Apr-Aug 08	32	1,719	1,013
Thong Khouang/Xet (8)	Nov 08-Jan 09	24	1,242	344 *
Nam Mon - Thong Kacheng (9)	Mar-May 09	3	186	1,222
Nam Theun - reservoir (10)	Nov-Dec 09	40	1,676	585 *
Nam Mon - Thong Kacheng (9)	Mar-May 10	45	2,450	2,219 *
Khamkeut - Nam San (1)	Dec 10-Jan 11	33	1,352	126
Total	**Mar 06-Jan 11**	**469**	**20,452**	**9,265**

Wildlife surveys across many parts of the Lao People's Democratic Republic (Lao PDR or Laos) in the 1990s improved knowledge of the country's wildlife status and distribution (Duckworth et al. 1999). However, information on wild cats firmly identified to species was scarce, mainly due to the difficulty of detecting these inconspicuous animals with the general wildlife survey methods used at the time (direct opportunistic day-time and night-time observation). Most information collected purportedly about cats is from signs (tracks and scats, both difficult to identify at species level by visual inspection, and sometimes even to identify as Felidae), interview reports from villagers (which similarly cannot be confirmed at species level for small cats and are often demonstrably unreliable) and/or live or dead animals found in markets or villages (for which the exact, and often even the general, source locality is uncertain). Field sightings did occur for some species in the 1990s (Duckworth 1996, 1997, 1998, Showler et al. 1998, Duckworth et al. 2005, 2010), but direct field sightings by competent faunal surveyors in the 2000s were extremely rare, with the exception of leopard cat. In addition, very limited camera-trapping in the 1990s, which did not target small carnivores, yielded two camera-trap photographs of non-*Panthera* cats (one each of golden cat and clouded leopard) (WCS 1997).

Automatically triggered cameras-traps have been increasingly used in the past two decades to survey cats worldwide (Karanth 1995, Karanth & Nichols 1998, Yasuda 2004, Maffei et al. 2004, Kawanishi & Sunquist 2004, Soisalo & Cavalcanti 2006, Heilbrun et al. 2006, Jackson et al. 2006, Shek et al. 2007, Tobler et al. 2008, Royle et al. 2009, Lynam et al. 2009). The use of camera-traps has led to local records of various Lao species poorly known across their small world ranges, e.g. saola *Pseudoryx nghetinhensis* (Robichaud & Stuart 1999, Hardcastle et al. 2004), large-antlered muntjac *Muntiacus vuquangensis* (Dersu 2008, Johnson & Johnston 2007, Duckworth et al. 2010, Rasphone 2010), Annamite striped rabbit *Nesolagus timminsi* (Surridge et al. 1999, Johnson & Johnston 2007, Duckworth et al. 2010), and Owston's civet *Chrotogale owstoni* (Johnson et al. 2006, Sivilay et al. 2011). Conservation projects in Laos started using camera-traps in the late 1990s in a few forest areas, with larger-scale deployment in the 2000s to attempt population monitoring and to inform conservation management, e.g. in Nam Et-

Phou Louey NPA (Johnson et al. 2006, 2009), Nakai-Nam Theun NPA (WCS 1997, Robichaud & Stuart 1999, Johnson & Johnston 2007, WMPA unpubl. data), or Laving-Laveun Provincial PA (Duckworth et al. 2010).

Laos may hold up to eight wild cat (Felidae) species, with status according to the IUCN Red List of Threatened Species (IUCN 2012): Least Concern LC leopard cat, Near Threatened NT Asiatic golden cat, Vulnerable VU marbled cat, VU clouded leopard, Endangered EN tiger *Panthera tigris* and NT leopard *Panthera pardus* are all confirmed. The occurrence of EN fishing cat *Prionailurus viverrinus* and LC jungle cat *Felis chaus* remains unconfirmed by specimens or photographs, although at least the latter is highly likely to occur, or to have done so until recently, and its occurrence in the country has not been seriously questioned (Duckworth et al. 2005, 2010). Data on small and medium-sized cat species (up to 20 kg, non-*Panthera*) are scarce and their national status has been classified as either 'At Risk' or 'Little Known' in Laos, except for leopard cat, which in the 1990s was clearly widespread and common (Duckworth et al. 1999). Little information has been obtained since the 1990s; records with credible species-level identification and known locality come only from camera-traps, and only rarely in most of the few areas thus surveyed, except Nam Et Phou Louey NPA with a large number of records (Johnson et al. 2006, 2009). The small number of recent records of non-*Panthera* cat species in Laos certainly reflects at least partly the scarcity of field surveys after 1999, but there is also the disconcerting possibility that it may reflect a substantial decline in abundance of these animals in the country's forests.

Nakai-Nam Theun National Protected Area NNT NPA in east-central Laos was found to hold six cat species in 1996–1997 (WCS 1997, Duckworth 1998), supplemented by plausible reports of fishing cat and jungle cat in nearby areas (Duckworth et al. 2005, 2010). In 2005, relating to the imminent construction of a hydroelectric power dam at the edge of the NPA, a Lao government institution (the Nam Theun 2 Watershed Management Protection Authority, or WMPA) was created to manage, protect and monitor biodiversity in the area, and reduce poverty among local human residents. Part of WMPA's mandate has been to monitor the area's wildlife systematically via transect and camera-trap surveys (NT2 WMPA 2005).

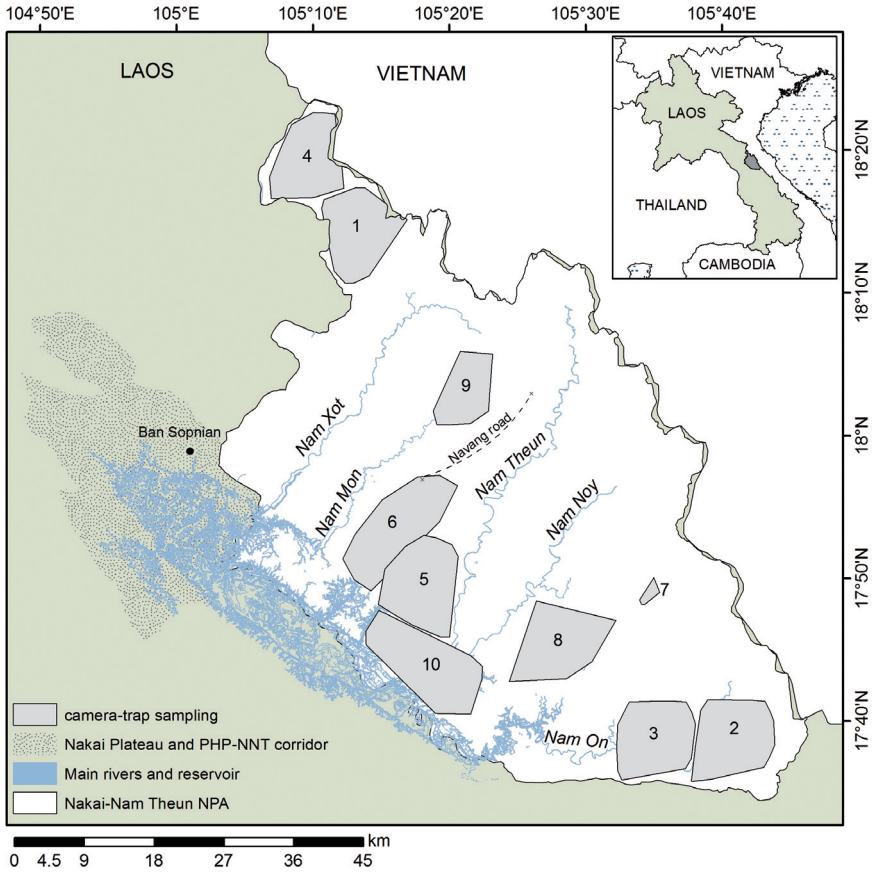

Fig. 1. 1. Camera-trap sampling areas in Nakai-Nam Theun NPA in 2006-2011. The Nakai Plateau and Phou Hinpoun–Nakai-Nam Theun NPAs corridor (PHP-NNT), Ban (=village) Sopnian and Navang road, from which records are also reviewed (Table 4), are indicated on the map. Numbers for each area indicate chronological order of sampling (c.f. Table 1): 1: Khamkeut - Nam San; 2: Nam On – Boualapha; 3: Nam On – Gnomalath; 4: Khamkeut - Thong Pae; 5: Nam Chae – Makfeuang; 6: Nam Chae – Navang; 7: Phou Vang - Houay Nam Heuy; 8: Thong Khouang/Xet; 9: Nam Mon – Thong Kacheng; 10: Nam Theun – reservoir.

Although the area is one of the largest blocks of contiguous evergreen/semi-evergreen forest in mainland South-east Asia outside Myanmar, it suffers from high levels of illegal, commercial hunting typical of much of Laos and Vietnam. Ground snares, usually made from wire, are widely used in NNT NPA; most seem to be set by cross-border Vietnamese poachers (Coudrat 2012). The low cost and effort combined with a relatively high catch render the use of snares attractive to hunters in many regions of the world (Noss 1998, Fa & Yuste 2001). Ground snares are non-selective and wasteful, with high proportion of caught animals lost to scavengers, predators or decomposition (Noss 1998). Snares are typically made out of wires set along man-made or natural animal trails (Noss 1998, Newton et al. 2008, Coudrat 2012). In NNT NPA, thousands can be collected on a single few-day field trip at one site, and the remains of trapped animals are often encountered (Johnston & Saengphavanh 2006, W. G. Robichaud, pers. comm. 2011, Coudrat 2012). Therefore, the current status of cats in NNT NPA is particularly informative about the regional risks they may face from hunting.

This paper presents the records of non-*Panthera* cat species from the camera-trap surveys in NNT NPA from 2006 to 2011, and reviews other records between the 1990s and present day from NNT NPA and adjacent Nakai Plateau and corridor area. This information will help evaluate the state of these species' populations in this little-degraded and legally protected large forest block in Laos.

Methods

Nakai-Nam Theun National Protected Area (Fig. 1) is about 4,000 km^2 (including recent extensions) with altitudes ranging from 500 to >2,200 m. Around 80% of the area remains covered in forest (Robichaud et al. 2009). It is dominated by old growth, mainly undisturbed dry-evergreen forest, with other localised habitat including pine/semi-evergreen and

upper-mountain and wet-evergreen forest (Timmins & Evans 1996). Thirty-one villages (with ca. 6000 people, NT2 WMPA 2005) are located within the NPA with an average population growth rate that has been estimated at 3.8% (Chamberlin 1997). Each village is allocated subsistence-use forest areas, where residents are allowed to harvest non-timber forest products, including some common wildlife species, according the Wildlife and Aquatic Law and Forestry Law (National Assembly Lao PDR 2007a; 2007b). The area shares an international border with Vietnam of ca. 160 km, about one-third of which is contiguous with a national park on the Vietnamese side (Vu Quang National Park). The remaining adjacent land in Vietnam is unprotected.

Camera trap data were obtained from systematic surveys during 2006 to 2011 conducted in NNT NPA by staff of Nam Theun 2 Watershed Management and Protection Authority NT2 WMPA with technical assistance from the Wildlife Conservation Society WCS from 2006 to 2008. The sampling program was designed by WCS, which also provided training to NPA staff for the long-term implementation of the program (Johnson et al. 2005, Johnson & Johnston 2007). From March 2006 to January 2011, camera traps were set in 10 survey blocks (Table 1, Fig. 1), selected to represent the different habitats within NNT NPA and to monitor the status of ground animal populations as an indicator of the impact of management interventions (Johnson & Johnston 2007). Up to 50 passive infrared film or digital camera traps were set by a team of four to five people per survey block (one camera per location), with cameras placed ca. 1 km apart. Cameras were positioned on trees at a height of ca. 45 cm (targeted for large mammals),

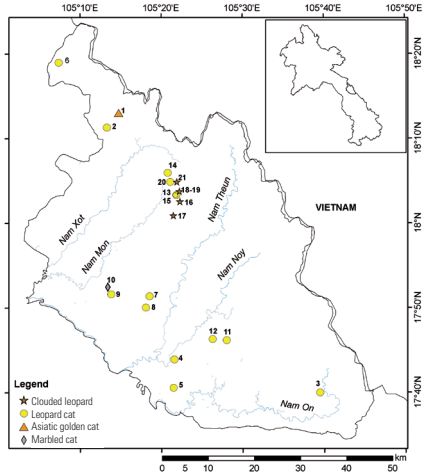

Fig. 2. Locations of photo records of cat species within Nakai Nam Theun NPA during the 2006-2011 survey period.

Table 3. Number of sites, photo records, altitude and times of cat species recorded in NNT NPA during 2006-2011 camera-trapping survey.

Species	# survey blocks where recorded (N=10)	# trap-sites (N=469)	# 'independent' photos	time range
Leopard cat	8	14	14	17:11 h - 00:30 h + 12:28 h
Clouded leopard	1	4	5	19:39 h - 05:56 h
Asiatic golden cat	1	1	1	18:09 h
Marbled cat	1	1	1	10:46 h

beside animal trails or small streams, and/or at other arbitrary open understory locations. No lures or bait were used. Each camera was programmed to operate 24 hours a day and to take photos at 20-second intervals when triggered by a passing animal. Most of the cameras (96.8%) had a maximum capacity of 36 film photos (®CamTrakker), therefore survey effort ceased when 36 photos had been taken. The remaining cameras were digital with a capacity of >600 photos (®Reconyx), which was never exceeded before removal of the camera. Survey effort for each camera was calculated from the day it was set to the day of the last photo taken (for the 36 photos capacity-cameras, when full), or the day of camera removal (for the >600 photos capacity-cameras and 36 photos capacity-cameras when not full). Total survey effort (in camera trap days, CTD) is the sum of days cameras were operational, for all cameras. Data from faulty cameras (i.e. cameras for which only the first test-photo was taken, and were found to have stopped functioning when collected) were excluded from analysis. For each camera, available data included geographic coordinates (datum, Indian Thailand, initially recorded as UTM) elevation (m a.s.l. taken with Garmin GPS60 or Garmin 12 units; though it is not known how regularly these were calibrated) and the date and time of each photo.

Of all the photos taken (N=9,265; including tests, unidentified photos with no apparent objects and all wildlife and human photos) during the survey time period, the non-*Panthera* cat species (referred to as 'cat species', hereafter) photo records were identified with the assistance of J. W. Duckworth (Supporting Online Material SOM Table T1). To derive the number of photograph records for each species and reduce the risk of double counting, for each single species only notionally 'independent photos' were included, defined as consecutive photographs of individuals of the same species taken more than 30 minutes apart (there were no cases of a same individual photographed consecutively for over 30 minutes) and non-consecutive photos of individuals of the same species (following O'Brien et al. 2003). Records of cat species are shown in Fig. 2. Other cat species records (field sightings, remains, pre-2006 camera-traps) for NNT NPA and adjacent areas are presented in SOM T2. These were compiled from survey reports, other grey literature or opportunistic records.

Results

Photographs from 469 camera-trap-sites obtained between March 2006 and January 2011 were examined. These were in ten survey blocks, of which two were camera-trap surveyed twice (Table 1). Survey effort (camera trap days, CTD) over the survey period totalled 20,259 CTDs, during which 9,265 photos were taken (including tests, non-object and object photos; Table 1). Survey blocks ranged in size from ca. 5 hectares (NM-TKC Mar-May 09) to ca. 50 km^2 (NC-NV Jan-Mar 08).

Of the 9,265 photos, 21 were of 'independent' photo records of non-*Panthera* cat species (SOM T1). These involved four species: Asiatic golden cat (AGC, 1 photo), leopard cat (LC, 14 photos, 14 sites), clouded leopard (CL, 5 photos, 4 sites) and marbled cat (MC, 1 photo; Table 2, SOM T1, Fig. 2); there were no photos of *Panthera* cats nor of feral/domestic cats. Cats were recorded in eight survey blocks (Table 1, SOM T1). None of the trap sites (N=469) recorded more than one species of cat. Most photos of cats were taken between late afternoon (17 h) and early morning (06 h); two photos were taken during mid-day (10:46 h and 12:28 h, of a marbled cat and a leopard cat, respectively; Table 2).

Discussion

Surveys in NNT NPA during the 1990s confirmed the presence of at least six cat species, including four non-*Panthera* species: marbled cat, clouded leopard, Asiatic golden cat and

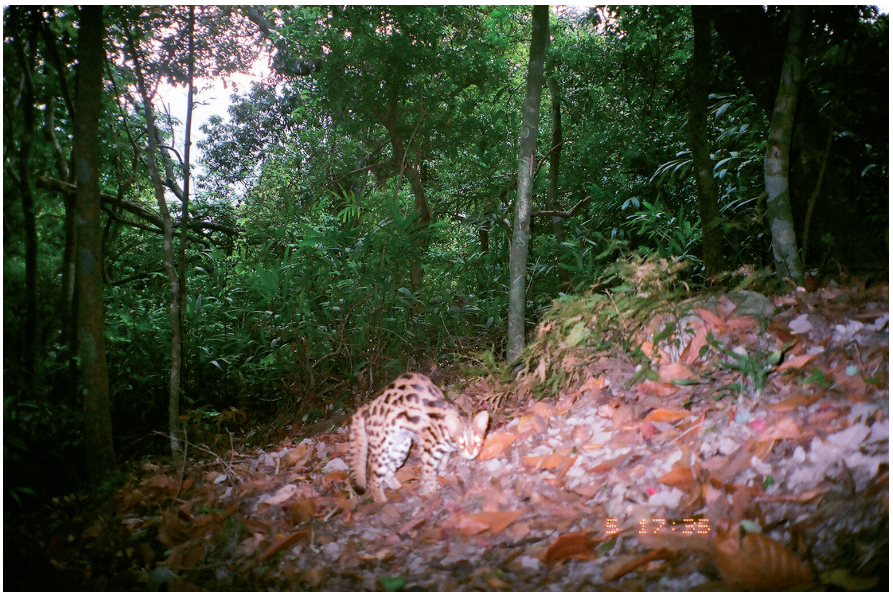

Fig.3. Leopard cat pictured in Nakai-Nam Theun NPA, 5 April 2007, 17:34 h.

leopard cat. From March 2006 to January 2011, systematic camera-trapping within the area photographed all of these four non-*Panthera* species (although neither of the *Panthera* species). Given the high total survey effort in 2006-2011, the frequency of records for the four species was very low: lower than any other camera-trap survey of evergreen forest in mainland Southeast Asia, for which the results were traced (SOM T3). These numbers are likely to indicate a low density of these species in NNT NPA, rather than any methodological factor causing them to be overlooked, as other camera-trapping studies that used similar methodology had more frequent records of cat species (Datta et al. 2008, Brodie & Giordano 2012, Johnson et al. 2009).

The leopard cat (Fig. 3) was the most photo-recorded species, with 14 independent photos, from 14 trap sites. This species has the widest global distribution range of all small Southeast Asian cats, and is generally found from sea level up to 3,000 m a.s.l. in various habitat types (Sunquist & Sunquist 2002, Sanderson et al. 2008). In Laos, it has been the cat species most widely and commonly recorded in the country (Duckworth et al. 2005). In the early and mid 1990s, over 25 records of the species (sightings, captive and remains) occurred, including 12 direct sightings during field surveys (Duckworth 1997). Photo records in NNT NPA during 2006-2011 occurred between altitudes of 500-1,500 m, in semi-evergreen and evergreen forest. Throughout Laos, leopard cat has been found from 200 to ca. 2,300 m (probably not actual altitudinal range limits) and from heavily degraded to almost undisturbed (semi-) evergreen forests (Duckworth 1997, Johnson et al. 2009). The species is evidently largely nocturnal in NNT NPA, which is corroborated by earlier records elsewhere in the country (Duckworth 1997, Johnson et al. 2009).

Clouded leopards (Fig. 4) were camera-trapped on five independent photos, from four trap sites (but the photos did not allow clear identification of the number of individuals). The species' status and distribution in Laos is little known; its national distribution has been hypothesised through nation-wide village interviews but there are too few firm records to confirm this (Duckworth et al. 1999). Numerous confusions during village discussions, however, indicate low reliability of interview information without parts for reference identification, so its occurrence in most of Laos has to be seen as unconfirmed, although plausible. Camera-trap surveys confirmed its presence in Nam Et-Phou Louey NPA (Johnson et al. 2006). Only two certain direct sightings in the wild by surveyors have ever occurred; one in NNT NPA (Duckworth 1998, Table 4) and one in Dong Ampham NPA (Davidson et al. 1997, Schaller 1997). Its status in Laos is considered 'At Risk' (Duckworth et al. 1999). It was first camera-trapped in NNT NPA in 1997, which was apparently the first wild photograph of clouded leopard anywhere (WCS 1997).

Asiatic golden cat (Fig. 5) was photographed only once, in the north. It was camera-trapped in NNT NPA also in 1997 (WCS 1997) and probably sighted in 1999 (Robichaud & Stuart 1999). In Laos, the species' distribution remains uncertain but it probably occurs across the country in suitable habitat. It appears to inhabit various habitat types, from lowlands to at least 2,300 m, and nationally was the second-most frequently recorded small cat (from sightings and remains) during the 1990s (Duckworth et al. 1999). The species was the most photographed cat species in Nam Et-Phou Louey NPA between 2003 and 2006 (Johnson et al. 2009). The species' national status is considered 'Little Known' in Laos (Duckworth et al. 1999).

Likewise, marbled cat (Fig. 6) was photographed only once. It has been previously sighted in Laos in the wild only twice: once each in NNT NPA and in Nam Xam NPA (Duckworth 1998, Showler et al. 1998). In Nam Et-Phou Louey NPA, the 2003-2006 camera-trap survey yielded 39 independent images from 24 trap sites (Johnson et al. 2009), the largest camera-trap-haul of the species for the country. The species seems in Lao to be primarily diurnal and to have an affinity with hilly (~700-2000 m) evergreen forest. Due to the paucity of information available on the species, its status is considered 'Little Known' in Laos (Duckworth et al. 1999).

Of the two other small to medium-sized cats perhaps inhabiting Laos, the jungle cat is unlikely to occur within NNT NPA given its association with open, deciduous, grassland areas. These habitats are rare in the NPA, and are more susceptible to overhunting than are forests. Although the species was reported from the adjacent Nakai Plateau in lowland pine/deciduous dipterocarp forest in several sources, none gave conclusive or convincing supporting evidence or detail. Reports from villagers cannot be used conclusively for the species, as the same Lao wording – *meo paa*, literally jungle/forest cat – is commonly used for unspecified non-domestic cats (Duckworth et al. 2005). It was reportedly sighted in open flat land in 1999 in degraded mixed deciduous forest in Boulapha District, outside the southern part of the NPA (Duckworth et al. 2005), but a description of the animal sighted was not given. The observer stated that he is still confident with his identification (R. J. Tizard in litt. 2012); the body structure was the exact same as his recent (2012) sighting of the same species in Gujarat, India, and the fur colouration of the individual sighted in Laos was similar to the photograph he saw of a dead jungle cat from Myanmar. The observer noted in particular the distinctiveness of the ears of the Boulapha animal.

Fishing cats are generally assumed to inhabit dense wetlands, primarily in lowland areas

(Sunquist & Sunquist 2002, Mukherjee et al. 2010), but the single plausible though unconfirmed sighting of the species occurred to the north of NNT NPA, in the then Nam Theun Extension proposed NPA in a habitat similar to NNT NPA hilly evergreen forest (Duckworth et al. 2010). Given the apparent rarity of the species throughout the country and absence of remains or live animals records, if it has ever occurred in NNT NPA, it might not be present anymore.

The presented records for NNT NPA and eastern adjacent areas probably represent all confirmed records of cats from biological surveys in the NPA for the 1990-2011 period; if any have been missed, the number is few. Despite regular field visits in NNT NPA (transect surveys, camera-trap setting and removal trips, patrolling, research) by management staff and other researchers since 2005, none of the above cat species has ever been directly sighted in its habitat since then, although the noisy and otherwise conspicuous behaviour of such teams renders sightings fairly unlikely. Captive leopard cats were occasionally seen in villages, mostly young animals, reportedly caught after killing the mother for food, during 2006-2007 (C. Nanthavong pers. obs.). The only confirmed direct sightings of wild cats of any size in NNT NPA date back to 1996: during a 3½-week direct-observation survey for large mammals, two leopard cats, one clouded leopard, one marbled cat and one tiger were seen. Surveyors of other groups had two leopard and two additional tiger sightings in that year. All these sightings occurred along an intended logging road (which had been abandoned, before construction had finished and before it was ever used for logging) above Ban Navang, in the Nam Chae-Navang zone (Duckworth 1998). The camera-trap photographs of golden cat and clouded leopard in 1997 were taken on the same abandoned road (WCS 1997).

Although the methods used in 1996-1997 and in 2006–2011 in the NNT NPA were different, relevant survey effort was far higher in the latter period than the former, and should have produced many records of cats judging by the rates at which they were recorded in 1996 by direct observation and in 1997 by exploratory camera-trapping. During many direct-observation-based surveys in Laos in the 1990s, no other survey area produced records of cats at anywhere near the rate found in NNT NPA in 1996, other than leopard cats. Duckworth et al. (1999) reported all Lao cat records between 1992 and early 1999 with clear locality

Fig. 4. Clouded leopard pictured in Nakai-Nam Theun NPA, 29 March 2010, 19:39 h.

and using credible methods, except for leopard cats, which were too commonly found for such detail. Individual records up to the end of 1996 were given in Duckworth (1997).

Most comparably Nam Et-Phou Louey NPA also had a direct-observation-based survey (but involving very little spotlighting) in the 1990s (Davidson 1998), and then intensive camera-trapping in the 2000s (Johnson et al. 2009). The 1990s survey recorded no direct sightings of cats, while many records were obtained by camera-trapping.

The large number of sightings along the Navang logging road in NNT NPA reflects in part the exceptional visibility along the road within little-degraded forest and the attraction of roads for some wild cat species (for resting or walking). Another important factor could be the then low hunting pressure. Observers could then stand under trees holding monkeys, gibbons or yellow-throated martens *Martes flavigula* without their showing evasive action, and muntjacs *Muntiacus* spp. walked along the road within 15 m of one surveyor (J. W. Duckworth in litt 2012). Clearly, the area then supported high numbers of cats, suggesting the suitability of NNT NPA's habitat for these species.

Variability in sampling design (e.g. camera set-up, use of bait, camera model, sample size) and species' behavioural ecology (e.g. home range, habitat use), which in turn vary across space and time, influence each species' detection probability in camera trap studies (Sollmann et al. 2013). Nonetheless, we believe the 2000s' extremely low camera-trap encounter rates of cats in NNT NPA reflects their actual status in the area. Although there might be some other unknown factors responsible for the recent low encounter rates of cats in NNT NPA, hunting is most likely the main driving factor behind these apparent low densities. Traditional hunting for local consumption may have already been responsible for population decrease by the mid-1990s in areas around villages. However, the trade-driven snaring that has intensified since its inception in the early and mid-1990s has evidently decreased today's populations in much of the interior of NNT NPA. Other small carnivore species (mongooses, civets, linsangs, mustelids) in NNT NPA were camera-trapped at relatively higher rates (Coudrat et al. 2014), suggesting cats are more sensitive to hunting than them, even perhaps to the less intensive traditional hunting.

The survey block with the largest encounter rates for cats (Thong Kacheng), was the only survey block where no snares were encountered at the time of the camera-trap set up (C. Nanthavong, pers. obs.). The latter site remains today one of the few sites within NNT NPA where intensive snaring does not occur, probably due to its remoteness from both the Vietnam border and Lao villages (Coudrat 2013).

Comparing the 2006-2011 NNT NPA camera-trap results with other areas in Southeast Asia where snare hunting seems to occur at a much lower intensity (or not at all), camera-trap encounter rates of cats are generally much higher in these others (Table 3): Deramakot forest reserve, Sabah, Malaysia (Mohamed et al. 2009); Taman Negara National Park, peninsular Malaysia (Kawanishi

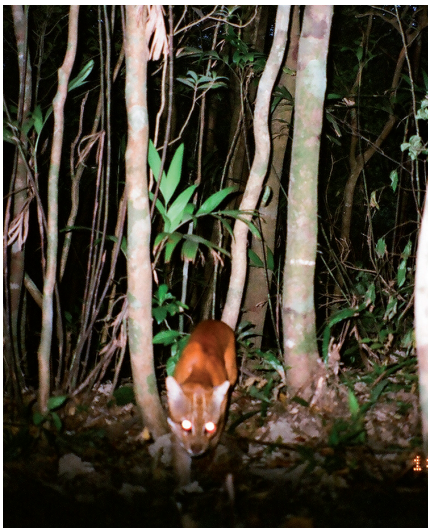

Fig. 5. Asiatic golden cat pictured in in Nakai-Nam Theun NPA, 18 March 2006, 18:09 h.

& Sunquist 2004), and Nam-Et Phou Louey NPA, Northeastern Laos (Johnson et al. 2009), where during a 5-month field survey in 2010 (19 sites visited across the NPA) not a single snare was encountered (Scotson 2010), which is inconceivable in NNT NPA. The difference may lie in part in NNT NPA's longer border shared with Vietnam.

As wildlife has dramatically decreased throughout Vietnamese forests due to deforestation and overharvesting (Bennett & Rao 2002, Milner-Gulland et al. 2002, Sodhi et al. 2004, Sodhi et al. 2009), targeted species have gained in trade value and therefore suffer increased hunting pressure. Illegal hunting in NNT NPA by Lao villagers has increasingly been for trade, not local consumption. Lao villagers sell wildlife to Vietnamese, who regularly visit their villages, within the NPA (Nooren & Claridge 2001, Robichaud et al. 2009, Johnston 2010, Coudrat 2013). There is no evidence that any of these non-*Panthera* cats are specifically targeted by trade-driven hunters in NNT NPA, or elsewhere in Laos (equally, it is not known that they are not), but the main method used, snaring, is non-selective and catches many individuals of untargeted species and is likely to have contributed to the decrease of cat populations within the area. All wild cat species in Laos are classified under the Prohibition category of the Lao hunting regulation, which includes species which are "rare, near extinct, high value and are of special importance in the development of social-economic, environmental, educational, scientific research" (National Assembly Lao PDR 2008: Article 11, p. 4), their hunting is not permitted at any time and anywhere. However, these rules were little enforced during the survey period.

Wild cats are regularly encountered in the trade in Southeast Asia (e.g. Duckworth et al. 1999, Nooren & Claridge 2001, Shepherd & Nijman 2008). For example, several Lao cat species are openly sold in Myanmar, in Tachilek city, at the Lao-Thai-Myanmar border (Shepherd & Nijman 2008); while the origin of vendors' stock is uncertain, some may come from Laos. The demand for wildlife hunted in Laos indeed comes principally from neighbouring countries, in particular Thailand, Vietnam and China (Srikosamatara et al. 1992, Compton et al. 1999, Nooren and Claridge 2001, Singh et al. 2006). Wild cats are generally used as trophies (e.g. stuffed, skins, pelts) or medicine (processed body parts; Martin 1992, Le Trong Trai 2007, Shepherd & Nijman 2008, Ashwell & Walston 2008).

The data collected in the Nakai-Nam Theun NPA suggests that even in the large primary forest blocks remaining in Southeast Asia, density reduction of these cat species may not be prevented where hunting for trade occurs. Compared with other forest blocks in Indochina where trade-driven, intensive-snaring hunting is common (e.g. Vietnam; Wilcox et al. 2012), NNT NPA, given its size and habitat condition, retains far more potential for the long-term conservation of these species. NNT NPA is among the key biodiversity areas of the Indo-Burma hotspot (Tordoff et al. 2012). Given the few Lao NPAs currently receiving funding and that have received technical assistance to develop conservation plans, the NPA is one of the country's best hope to preserve rare and threatened animals, including wild cats, if management strategies are well designed and implemented. All hunting with snares within conservation zone forests is unambiguously illegal in the NPA and this prohibition needs to be urgently enforced if small cats are to be saved from further decline. To be achieved, given the large area, priority zones need to be designated to focus all available resources and ensure that illegal hunting is strictly controlled. Only realistic, long-term conservation planning and committed actions in the area will ensure the survival of these species.

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Table 3. Number of independent photos of small-medium sized cats taken during camera-trap surveys in Southeast Asia. LC leopard cat, AGC Asiatic golden cat, CL clouded leopard, MC marbled cat, PA protected area. -: figures for the species are not provided in the cited work; n/a out of species's geographic range; CTD Camera trap days.

LC	AGC	CL	MC	Area (country)	survey period	CTD	reference
14	1	5	1	Nakai-Nam Theun National PA (Laos)	2006-2011	20,259	this study
24	48	40	39	Nam-Et Phou Louey National PA (Laos)	2003-2006	8,499	Johnson et al. 2009 A. Johnson, pers. comm.
-	n/a	44	-	Tangkulap-Pinangah and Segaliud Lokan Forest Reserves, Sabah (Malaysia)	Apr-Sept 2009; Jan-Apr 2010	5,328	Wilting et al. 2012
-	n/a	59	-	Maliau Basin Conservation Area (Malaysia)	Jan-Apr 2010	2,003	Brodie & Giordano 2012
62	37	16	16	Taman Negara National Park (Malaysia)	1999-2001	14,054	Kawanishi & Sundquist 2004
183	n/a	10	0	Deramakot Forest Reserve, Sabah (Malaysia)	Jul 08-Jan 09	1,916	Mohamed et al. 2009
-	-	2	-	Namdapha National Park (India)	Oct 2006- Jan 2007	1,537	Datta et al. 2008

the Department of Agriculture and Forestry. J. W. Duckworth and R. J. Timmins reviewed the manuscript and the former helped with species identification of camera-trap photos.

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Fig. 6. Marbled cat pictured in in Nakai-Nam Theun NPA, 26 February 2008, 10:47 h.

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