

Recent camera-trap records of Owston's Civet *Chrotogale owstoni* and other small carnivores from Xe Sap National Protected Area, southern Lao PDR

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Abstract

There are few published studies on small carnivores from southern Lao PDR. Camera-trapping (39 stations; 4,630 camera-trap-nights) in western Xe Sap National Protected Area, Salavan province, largely in Hill Evergreen Forest over 1,000 m asl, recorded nine species of small carnivore including Hog Badger *Arctonyx collaris*, Large Indian Civet *Viverra zibetha* and the IUCN Red List Vulnerable Owston's Civet *Chrotogale owstoni*. The latter was the most frequently encountered small carnivore with 42 notionally independent encounters from 11 camera-trap stations between 1,066 m asl and the upper limit of survey at 1,492 m asl. Owston's Civet has now been camera-trapped from four protected areas in Lao PDR, all at sites above 1,000 m asl.

Keywords: Activity patterns, *Arctonyx collaris*, Annamite mountains, Hog Badger, Large Indian Civet, Salavan province, Vietnam, *Viverra zibetha*

ຂໍ້ມູນລຳສຸດຂອງເຫງິນລາຍພາດກອນ(Owston's Civet *Chrotogale owstoni*) ແລະບັນດາສັດປະເພດລ່າເນື້ອຂະໜາດນ້ອຍ ບັນທຶກຈາກການຕັ້ງກ້ອງສຳຫຼວດໃນເຂດປ່າສະຫງວນແຫ່ງຊາດເຊຊັບ, ທາງພາກໃຕ້ຂອງລາວ

ບົດສະຫຼຸບຫຍໍ້

ການສຶກສາທາງດ້ານສັດປະເພດລ່າເນື້ອຂະໜາດນ້ອຍໃນລາວທີ່ໄດ້ຖືກເຜີຍແຜ່ຢ່າງເປັນທາງການແມ່ນມີຈຳນວນໜ້ອຍ. ການສຳຫຼວດຕັ້ງກ້ອງ(39 ຈຸດ; 4,630 ຄືນການສຳຫຼວດ) ໃນພາກຕາເວັນຕົກຂອງເຂດປ່າສະຫງວນແຫ່ງຊາດເຊຊັບ, ແຂວງສາລະວັນ, ເຊິ່ງປົກຄຸມໄປດ້ວຍປ່າດົງດິບເຂດສູງ(ລະດັບຄວາມສູງຂອງໜ້າດິນເໜືອກວ່າ 1,000 ແມັດ), ໄດ້ບັນທຶກຂໍ້ມູນຂອງ 9 ຊະນິດພັນສັດລ່າເນື້ອຂະໜາດນ້ອຍ, ເຊິ່ງໃນນັ້ນກໍລວມມີໝູ່ລື່ງ Hog Badger *Arctonyx collaris*, ເຫງິນທາງການ Large Indian Civet *Viverra zibetha* ແລະເຫງິນລາຍພາດກອນ Owston's Civet *Chrotogale owstoni* (ເຊິ່ງເປັນສັດບັນຊີແດງຂອງ IUCN ຈັດໃນປະເພດທີ່ມີຄວາມສ່ຽງສູງ). ເຫງິນລາຍພາດກອນໄດ້ຖືກພົບເຫັນຫຼາຍທີ່ສຸດໃນບັນດາຈຳພວກສັດລ່າເນື້ອຂະໜາດນ້ອຍ ເຊິ່ງລວມມີ 42 ເຫດການເອກະລາດທີ່ໄດ້ຖືກບັນທຶກໃນ 11 ຈຸດທີ່ມີການຕັ້ງກ້ອງສຳຫຼວດ ເຊິ່ງວ່າບັນດາຈຸດສຳຫຼວດຕັ້ງກ່ວານັ້ນແມ່ນມີລະດັບຄວາມສູງຂອງໜ້າດິນຢູ່ທີ່ລະຫວ່າງ 1,066 ຫາ 1,492 ແມັດ. ຈົນເຖິງປັດຈຸບັນນີ້, ເຫງິນລາຍພາດກອນໄດ້ຖືກພົບເຫັນຜ່ານການຕັ້ງກ້ອງສຳຫຼວດຈາກປ່າສະຫງວນສີ່ແຫ່ງຢູ່ໃນ ສປປ ລາວ ເຊິ່ງແຕ່ລະເຂດແມ່ນຕັ້ງຢູ່ທີ່ລະດັບຄວາມສູງເໜືອກວ່າ 1,000 ແມັດຂຶ້ນໄປ.

Introduction

Lao PDR has been identified as part of a priority region for small carnivore conservation (Schreiber *et al.* 1989) with 21 species of small carnivores recorded (Duckworth 1997, Coudrat *et al.* 2014). Intensive camera-trapping has improved the knowledge of the local status of selected small carnivores in Lao PDR including in two national protected areas (NPAs) in Central and North Lao PDR: respectively, Nakai–Nam Theun NPA (Coudrat *et al.* 2014) and Nam Et–Phou Louey NPA (Johnson *et al.* 2009). However, small carnivores in the Annamite mountains in southern Lao PDR remain little known. This paper summarises records of mustelids (Mustelidae), linsangs (Prionodontidae), civets (Viverridae) and mongooses (Herpestidae) from camera-trapping in Xe Sap NPA, Salavan province, southern Lao PDR, between December 2012 and December 2013.

Survey area

Xe Sap National Protected Area lies in southeast Lao PDR (Fig. 1) in the Central Annamites. This camera-trapping occurred in western Xe Sap NPA, in Muang (= District of) Ta-Oy, Salavan province. The surveyed area comprised Semi-Evergreen Forest (*sensu* Lamxay 2012), mostly below 1,000 m asl, and Hill Evergreen Forest at higher elevations. Hill Evergreen Forest in Xe Sap NPA is characterised by a 20–30 m canopy of *Pinus dalatensis*, *Dacrydium elatum*, *Podocarpus neriifolius* and species of Fagaceae, Lauraceae, Myrtaceae, Theaceae and Magnoliaceae (Lamxay 2012, R. J. Timmins *in litt.* 2014). The only previous small carnivore field records from Xe Sap NPA seem to be those from a short direct observation and sign survey of the western part in early 1999: direct sightings of Common Palm Civet *Paradoxurus hermaphroditus* and Crab-eating Mongoose *Herpestes urva*, and signs of otter

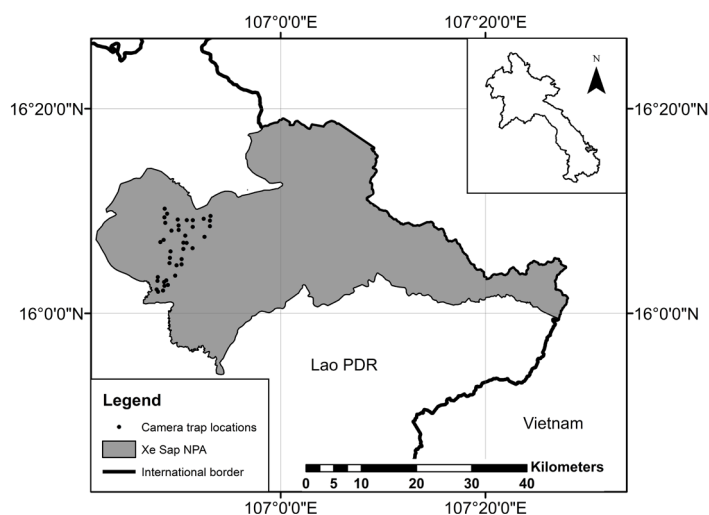


Fig. 1. Xe Sap National Protected Area, southern Lao PDR, showing locations of camera-trap stations during December 2012 – December 2013.

(Lutrinae) and potentially of various other genera (Steinmetz *et al.* 1999).

Methods

A semi-structured design placed one camera-trap (Bushnell Trophy Cam; infrared flash) within each of 39 1 × 1 km grid cells, selected using a random number generator from ~300 numbered grid cells across western Xe Sap NPA (Fig. 1). Survey teams visited each cell and searched for 25–60 minutes for suitable camera-trap stations. These sought to maximise encounters with ungulates and ground-dwelling carnivores (cats [Felidae], dogs [Canidae] and bears [Ursidae]). They were along small animal or human trails (22), positioned to photograph animals using streams (10), along larger human trails (four), and in open pine grassland (three, over 1,108–1,201 m asl). Camera-traps were set to take a three-picture burst when triggered and each photograph was stamped with the date and time. Successive triggers were separated by at

least 10 seconds. Triggers during camera setup and removal assessed whether the unit was operational. All camera-traps were placed on trees at 20–130 cm above the ground (mean = 45 cm, standard deviation = 25), none was baited and all were operational throughout the 24-hour cycle.

The 39 camera-traps operated for 86–173 camera-trap-nights (mean 119) between December 2012 and December 2013 at stations between 613 and 1,492 m asl (mean 1,096 m asl). Elevations were derived from hand-held GPS units in the field and are given as by the unit, despite the misleading implication of precision to within 1 m. Notionally independent encounters with small carnivores were defined as those when successive photographs of the same species at the same station were separated by at least 30 minutes. Species identifications from the photographs were initially made by KT and all were verified by TNEG and AT.

Results

Of the total of 4,630 camera-trap-nights, 3,418 (74%) were from above 1,000 m asl. No camera-trap stations below 1,000 m asl were beside streams. The total of 508 notionally independent mammal (87%) and bird (13%) encounters included 147 (29%) of small carnivores. Many (22 notionally independent encounters; 15% of the 147 small carnivore encounters) of these photographs could not be identified to species level because of blurring and ‘whitening’ from the infrared flash.

At least nine species of small carnivore were recorded (Table 1). One is categorised on *The IUCN Red List of Threatened Species* as Vulnerable (Owston’s Civet *Chrotogale owstoni*) and two as Near Threatened (Hog Badger *Arctonyx collaris* and Large Indian Civet *Viverra zibetha*) (IUCN 2014).

Owston’s Civet was the most frequently recorded small carnivore (42 encounters between 1,066 m and the upper limit of survey at 1,492 m asl). Two other taxa, Crab-eating Mongoose and ferret badger *Melogale*, were recorded only above 1,000 m asl (Table 1). There were few records of small carnivores from below 1,000 m: only 12 of the 124 identified

Table 1. Small carnivores camera-trapped in Xe Sap National Protected Area, Lao PDR, December 2012 – December 2013.

Elevation (m asl)	# (%) of CTN ¹	# of CTS	Y-t Martens	Hog Badger	Ferret badger	L. I. Civet	C. P. Civet	M. P. Civet	Owston’s Civet	S. Lins.	C-e Mong.
601–700	244 (5)	2									
701–800	333 (7)	3	1 (1)				2 (1)			1 (1)	
801–900	319 (7)	3		1 (1)		2 (1)		1 (1)			
901–1,000	316 (7)	3		1 (1)		3 (1)					
1,001–1,100	526 (11)	5			2 (1)			4 (2)	12 (2)	1 (1)	
1,101–1,200	1,225 (26)	10			3 (2)	6 (2)	2 (1)	3 (3)	5 (2)	2 (1)	5 (3)
1,201–1,300	666 (14)	5	2 (1)	4 (2)	4 (1)	2 (2)		3 (3)	14 (3)	2 (1)	7 (2)
1,301–1,400	612 (12)	5		1 (1)	7 (3)			4 (3)	9 (2)	1 (1)	
1,401–1,500	389 (8)	3					2 (1)	3 (2)	2 (2)		
Total	4,630	39	3 (2)	7 (5)	16 (7)	13 (6)	6 (3)	18 (14)	42 (11)	7 (5)	12 (5)

The figure for each species in each altitude-band gives the number of notionally independent camera-trap encounters (see text) and camera-trap stations with records (in parentheses). Full English names and scientific names in Table 3.

¹CTN = camera-trap-nights, CTS = camera-trap stations.

Table 2. Activity patterns for small carnivores camera-trapped in Xe Sap National Protected Area, Lao PDR, during December 2012 – December 2013.

Species	04h00–06h00	06h01–18h00	18h01–20h00	20h01–03h59
Yellow-throated Marten	-	100	-	-
Hog Badger	14	43	-	43
Ferret badger	13	-	20	67
Large Indian Civet	23	8	23	46
Common Palm Civet	17	-	-	83
Masked Palm Civet	-	-	17	83
Owston's Civet	-	2	9	88
Spotted Linsang	-	-	20	80
Crab-eating Mongoose	-	100	-	-

The figure for each species in each time period is the percentage of notionally independent camera-trap detections of that species. Scientific names in Table 3.

records, involving six taxa of which four were found at only one station each.

Activity patterns of each species (Table 2) matched published information: Crab-eating Mongoose and Yellow-throated Marten *Martes flavigula* were entirely diurnal with Masked Palm Civet *Paguma larvata*, Common Palm Civet, Owston's Civet and Spotted Linsang *Prionodon pardicolor* markedly nocturnal (over 80% of encounters between 20h00 and 03h59). The two Owston's Civet records by daylight were at 07h32 and 08h17.

Discussion

This camera-trapping from Xe Sap NPA, southern Lao PDR, complements that in Nakai–Nam Theun NPA (Coudrat *et al.* 2014) and Nam Et–Phou Louey NPA (Johnson *et al.* 2009) further north in the country. Despite more than four times the effort (20,452 camera-trap-nights), Coudrat *et al.* (2014) camera-trapped only one additional small carnivore species: Binturong *Arctictis binturong*, once. Johnson *et al.* (2009) in Nam Et–Phou Louey NPA camera-trapped three additional species (Small Indian Civet *Viverricula indica* and single encounters of Stripe-backed Weasel *Mustela strigidorsa* and Oriental Small-clawed Otter *Aonyx cinereus*) whilst not detecting ferret badger. Of these three areas, Nakai–Nam Theun NPA has received far heavier direct observation survey than the other two; it is the only one to have hosted intensive spotlight surveys (Duckworth 1998). Coudrat *et al.* (2014), collating all previous records from the NPA, presented direct sightings of three additional small carnivore species (Siberian *Mustela sibirica* and Stripe-backed Weasels and Small-toothed Palm Civet *Arctogalidia trivirgata*) and sign observations of otter, whilst skulls confirmed the presence of two species of ferret badger (Coudrat & Nanthavong 2013). Recent field surveys in Xe Sap NPA have also detected otter by sign (Timmins 2012). With a range of methods evidently required for complete area-lists of small carnivores in the Annamites, because other survey methods are not yet much applied in Xe Sap NPA, its true carnivore richness cannot be determined.

The breakdown of identified small carnivore encounters across the three survey areas is given in Table 3. Each survey's most frequently photographed small carnivore differed: ferret

badger (with Common Palm Civet a close second) in Nakai–Nam Theun NPA, Yellow-throated Marten in Nam Et–Phou Louey NPA and Owston's Civet in Xe Sap NPA. Much variation could result from differences between surveys in precise camera-trap placement. Some might reflect between-area habitat differences, but with each protected area so large and so patchily camera-trapped, vagaries of survey block selection might also be significant. In Nakai–Nam Theun NPA, very little camera-trapping was in areas with extensive habitat believed suitable for Owston's Civet, although the NPA holds several such areas (R. J. Timmins *in litt.* 2014). Some species showed similar encounter rates in the three areas, notably Large Indian Civet and Masked Palm Civet. Than Zaw *et al.* (2008) strongly suspected that the latter species's semi-arborescence might reduce its camera-trap encounter rate. In Xe Sap NPA the low number of repeat encounters at camera-trap stations are consistent with this idea of low detectability of the species by standard camera-trapping.

All three studies obtained a few photographs (fewer than 10) of Spotted Linsang supporting the assumption that the species, although likely to be under-recorded by camera-trapping (see discussion in Coudrat *et al.* 2014), remains relatively widespread across its Lao range.

The most significant small carnivore records from Xe Sap NPA are those of Owston's Civet, the first live records from South Lao PDR. Extensive spotlighting in South Lao PDR in the 1990s did not detect Owston's Civet (Duckworth 1997). None took place in the Annamites: all previous Lao Owston's Civet records are in the Annamites or eastern northern highlands (Sivilay *et al.* 2011). R. J. Timmins (2012, *in litt.* 2014) found at least two Owston's Civet skulls in Ban Bhale, a village south-east of Xe Sap NPA. The species's presence in Xe Sap NPA is unsurprising given its Annamite location and the records from much further south in Vietnam (Dang & Le 2010). To encounter Owston's Civet so many times in a generic camera-trap survey suggests high detectability of the species from such camera-trapping. Thus, non-recording of Owston's Civet by other camera-trapping surveys is more likely to reflect the species's local absence than for some other species of small carnivores that are readily overlooked by 'standard' camera-trapping, such as weasels (Supparatvikorn *et al.* 2012 and references therein).

Table 3. Comparison of small carnivore camera-trapping results across three protected areas in Lao PDR.

Species	Xe Sap NPA	Nakai–Nam Theun NPA	Nam Et–Phou Louey NPA
Stripe-backed Weasel <i>Mustela strigidorsa</i>	–	–	<1 (<1)
Yellow-throated Marten <i>Martes flavigula</i>	2 (5)	4 (3)	37 (16)
Hog Badger <i>Arctonyx collaris</i>	6 (13)	16 (9)	10 (5)
Ferret badger <i>Melogale</i>	13 (18)	20 (7)	–
Oriental Small-clawed Otter <i>Aonyx cinereus</i>	–	–	<1 (<1)
Large Indian Civet <i>Viverra zibetha</i>	10 (15)	10 (8)	14 (9)
Small Indian Civet <i>Viverricula indica</i>	–	–	1 (1)
Common Palm Civet <i>Paradoxurus hermaphroditus</i>	5 (8)	20 (12)	13 (7)
Masked Palm Civet <i>Paguma larvata</i>	15 (36)	11 (8)	16 (8)
Binturong <i>Arctictis binturong</i>	–	<1 (<1)	–
Owston's Civet <i>Chrotogale owstoni</i>	34 (28)	12 (3)	<1 (<1)
Spotted Linsang <i>Prionodon pardicolor</i>	6 (13)	1 (<1)	3 (2)
Crab-eating Mongoose <i>Herpestes urva</i>	10 (13)	8 (6)	5 (4)
Total identified small carnivore encounters	124	508	244
Elevation range (m asl)	613–1,492	532–1,942	543–2,288
Total camera-trap-nights	4,630	20,452	8,499

The figure for each species in each survey area is the percentage comprised by that species of all notionally independent small carnivore camera-trap detections identified to species in that survey area. The percentage of camera-trap stations in the survey area which detected the species is in parentheses. Sources: Xe Sap NPA, this study; Nakai–Nam Theun NPA, Coudrat *et al.* (2014); Nam Et–Phou Louey NPA, Johnson *et al.* (2009).

Whilst recorded as low as about 100 m asl in Vietnam (Robertson 2007), all Lao camera-trap records of Owston's Civet are from above 1,000 m asl. Coudrat *et al.* (2014) recorded Owston's Civet between 1,033 and 1,675 m asl, whilst the single photograph from Nam Et–Phou Louey NPA was at 1,600 m asl (Johnson *et al.* 2009) and that from Phou Chomvoy Provincial Protected Area, Bolikhamxai province, at 1,100 m asl (Sivilay *et al.* 2011). Coudrat *et al.* (2014) suggested occurrence at lower elevations in Vietnam could be linked to the species's preference for wet evergreen forest. This occurs widely at lower altitudes in Vietnam than in Lao PDR, where it is patchily distributed. There seems to have been no significant camera-trapping effort in Lao wet evergreen forest much below 1,000 m. Thus, the lower limit to which Owston's Civet occurs in Lao PDR remains uncertain. Captive animals in Ban Lak-20 in the 1990s reportedly came from the villages of Ban Nape-3 (local name, Ban Tongphe) (Duckworth 1997) or Ban Nape (King 2002), two villages amid wet evergreen forest at about 550 m.

Owston's Civet is categorised as Vulnerable on the *IUCN Red List*. This is based on ongoing population decline, inferred to exceed 30% per three generations (taken as 15 years) from over-exploitation and habitat loss. Its ground-dwelling habits (corroborated by high detection rates and multiple photographs per camera-trap station in Xe Sap NPA) suggest that the pervasive snaring widespread in its range (Vietnam, eastern Lao PDR and a small part of adjacent China; Schreiber *et al.* 1989, Dang & Le 2010, Sivilay *et al.* 2011) might affect it strongly. Extensive camera-trapping in the Hue and Quang Nam Saola Nature Reserves in wet evergreen forest at 280–

1,000 m asl has not detected the species in over 15,000 camera-trap-nights since August 2012 (WWF unpublished data). Conceivably this might reflect a natural scarcity of the species in this particular area, perhaps in part because of its lower elevation. An alternative, perhaps more likely, explanation, given the relatively large number of past lowland records in Vietnam, is that it declined through the sustained, intensive hunting there before protected area establishment. Indeed, none of the post-2005 camera-trap surveys in Vietnam collated by Willcox (2014: Table SOM T3) found Owston's Civet, whereas all those during 1998–2006 did so. In this light, on current knowledge Xe Sap NPA – and plausibly other large tracts of wet evergreen forest in easternmost Lao PDR – might now be the most important known areas for the species.

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