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IUCN SSC Small Carnivore Specialist Group

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Common Palm Civet *Paradoxurus hermaphroditus* (Photo: Amod Zambre)

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EDITORIAL

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Editorial:

Global Small Carnivore Conservation: geographical distribution of small carnivore research

Small Carnivore Conservation (SCC) is one of the main outlets for publication of small carnivore research on ecology, taxonomy and conservation globally (González-Maya & Schipper 2015, Ramírez-Chaves *et al.* 2016). Across its long history, first published in 1989, SCC has promoted the dissemination of quality and critically needed information for advancing small carnivore research and ultimately supporting their conservation (González-Maya & Schipper 2015). However, small carnivore research has not been homogeneously or simultaneously developed across the globe, and some geographic focus has dominated not only publication but in general research on this important, yet still neglected group across the world.

On the 29 years-history of SCC, contributions have been geographically-biased distributed to certain regions, probably as a result of editorial management, composition of the IUCN SSC Small Carnivore Specialist Group, and even due to underlying political and economic reasons. We reviewed the origin of the 591 contributions published so far in the journal, including this volume, and assessed origin according to continent, country and year, as an indicator of research efforts and publication of the group globally, and aiming to help promote contributions from those areas poorly represented in our journal. Considering small carnivores are present in almost all continents and countries, we believe the origin of manuscripts published in SCC along its history might reflect countries and regions with higher need of small carnivore research and likely conservation efforts.

Of the 591 papers published to date, Asia is the continent with the largest contribution (42%), followed by Europe and Africa (13%), North America (including Central America; 6%), South America (5%), and Global papers (4%; Figure 1). In total, 70 countries (and three former countries) have papers published, dominated by India with the largest number of contributions (16.9%), followed by Indonesia (6.8%), Colombia (4.7%), and Malaysia (4.6%), with a mean (±SD) number of papers on all countries of 5.7±10.1 (3.9±4.4 for the countries excluded from the previous list). A largest number of contributions from India might be reflecting the sympatry of several small carnivores in the country (Kalle *et al.* 2013).

In temporal terms, the largest number of papers was published in 2013, with most global papers published between 2012 and 2014; most papers for Africa were published in 2014 (Special issue), while the largest number of papers for Asia was published in 2014, for Europe in 1993, and North and South America in 2009 (Special issue; Figure 2).

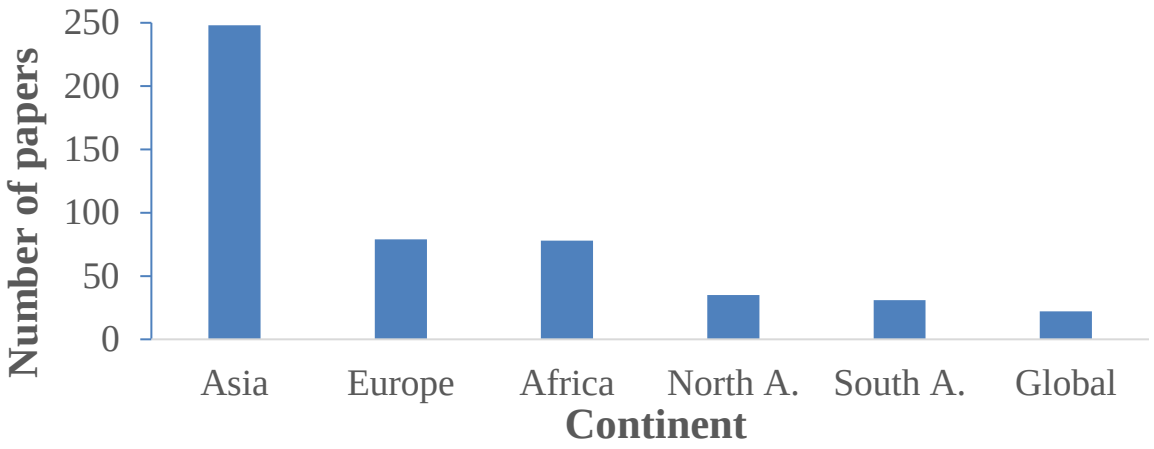

Figure 1. Number of papers published in Small Carnivore Conservation from different continental origin. North A. (includes North America and Central America), South A. (South America).

Spatially, most papers published are concentrated towards Southern Asia. In contrast, Central Asian countries have not been part of SCC contributions (Figure 3). Despite the Special issue published in 2014, African countries are not homogeneously represented on the contributions published in the journal. It is important to highlight that differences in number of countries per continent can bias the continental contribution of papers to SCC (for instance for India). Additionally, this evaluation only shows the role that SCC is playing in promoting knowledge of small carnivore species. Further comparisons on small carnivore richness and general number of publications per area could provide basis for global analyses and research priorities of this charismatic group.

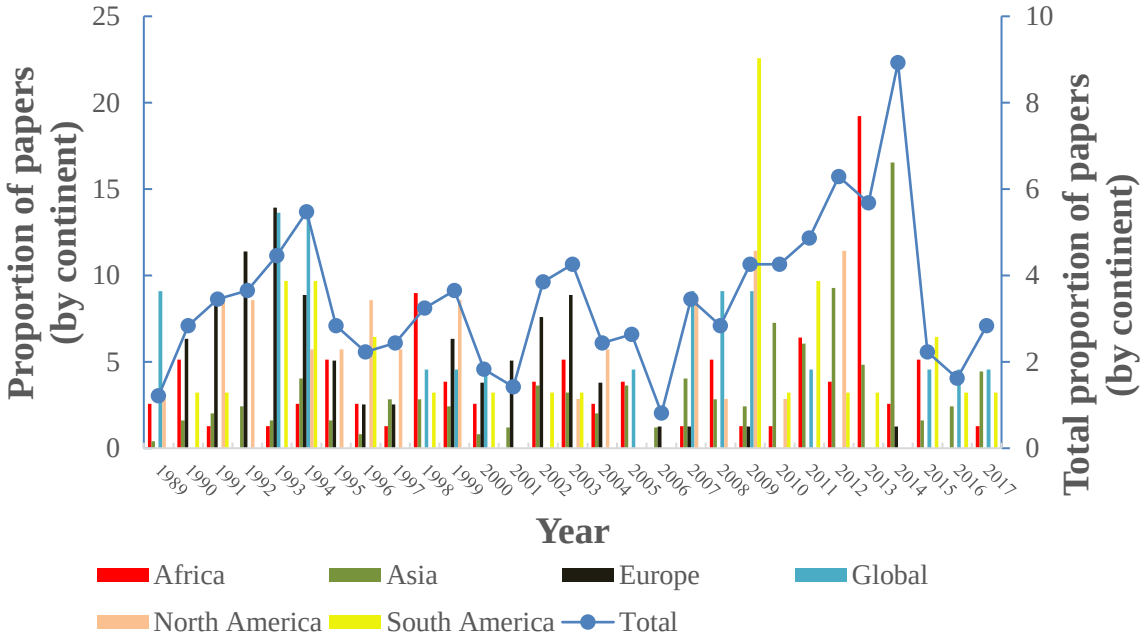

Figure 2. Number of papers published in Small Carnivore Conservation from different continental origin across year of publication. Secondary Y-axis for the Total number of papers published in the journal.

Even when distribution of research (in terms of contributions in SCC) have not been homogeneous both in space and time, previous efforts from multiple editors, and SCSG members, have yielded on a global representation in the journal. Efforts towards promoting contributions from

historically neglected countries, in terms of small carnivore research, seems warranted. Furthermore, exploring those species and geographic locations where priority should be allocated, has been previously proved to be an effective stimulus towards improving small carnivore knowledge and conservation in various countries (Andrade-Ponce *et al.* 2016, Di Minin *et al.* 2016, González-Maya *et al.* 2011). We expect SCC to multiply efforts towards ensuring high quality research on small carnivores globally, as a necessary tool for their appropriate conservation. We call to authors, members of the SCSG, and researchers in general to not only consider SCC for publishing their small carnivore research, but to promote research submission and publication, especially from those areas not represented in the long and prolific history of our journal.

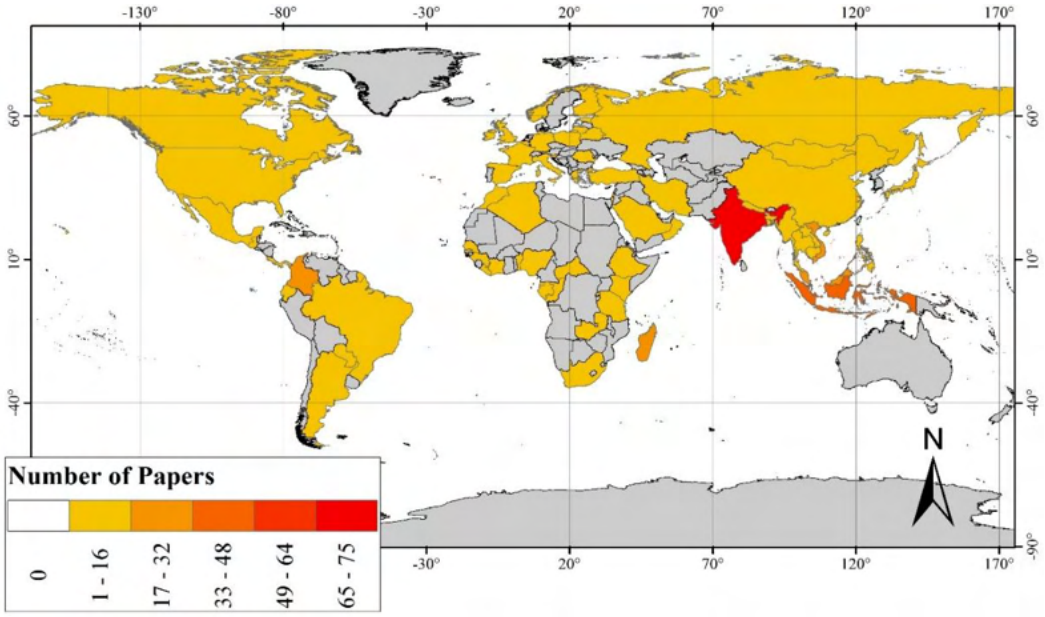

Figure 3. Number of papers published in Small Carnivore Conservation by country.

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ORIGINAL ARTICLE

Small carnivore records from the U Minh Wetlands, Vietnam

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Abstract.

The U Minh Wetlands in the Mekong Delta have been under-surveyed for small carnivores, despite the known historical presence of several species of national, regional and global priority. Surveys in two sites that form part of this wetland complex, U Minh Ha National Park and the U Minh Ha Fishery and Forestry Enterprises, were conducted in 2007–2008 and 2009–2010 respectively. Hairy-nosed Otter *Lutra sumatrana* and Asian Small-clawed Otter *Aonyx cinereus* were both confirmed in U Minh Ha National Park. However, Large Indian Civet *Viverra zibetha* and Large-spotted Civet *Viverra megaspila* are likely to be locally extinct, or at least at very low population sizes, at these two survey sites. The U Minh Wetlands are far from pristine and their biodiversity is under pressure from a variety of threats. The mammals recorded in these surveys offer some evidence of the robustness of these species and of the potential for their successful conservation; more effective management of the landscape and an immediate suppression of illegal hunting and fishing activities could rapidly improve the conservation status of a number of globally threatened species in the U Minh Wetlands.

Keywords: camera-trapping, peat-swamp, *Melaleuca*, otters, pangolins.

Introduction

The U Minh Wetlands in Vietnam are the last remnants of a *Melaleuca*-dominated peat-swamp forest ecosystem that would have once covered a significant portion of the Mekong Delta (Buckton *et al.* 1999, Triet Tran 2016). Decades of overexploitation for the illegal wildlife trade, rapid agricultural expansion, and the America–Vietnam War (particularly the use of defoliants) have had significant impacts on the area's biodiversity (Safford *et al.* 1998, Buckton *et al.* 1999). This peat-swamp forest ecosystem is now mostly confined to the protected areas of U Minh Ha National Park, U Minh Thuong National Park and the U Minh Ha Fishery and Forestry Enterprises (FFEs).

Rapid biodiversity surveys in the early 2000s confirmed the presence of several globally threatened small carnivore species including Hairy-nosed Otter *Lutra sumatrana*, Fishing Cat *Prionailurus viverrinus* and Large-spotted Civet *Viverra megaspila* (Nguyen Xuan Dang *et al.* 2004). The area's potential conservation significance was given further weight in Roberton (2007), whose exhaustive national review of small carnivore records suggested that the U Minh Wetlands were of definite national, and probable global,

significance to small carnivore conservation, principally because of the relatively large number of confirmed Hairy-nosed Otter records from the landscape. As well as these confirmed records, Hog Badger *Arctonyx collaris*, Yellow-throated Marten *Martes flavigula*, Spotted Linsang *Prionodon pardicolor* and Large Indian Civet *Viverra zibetha* were all predicted to be in this landscape based on confirmed records from similar habitats in mainland South-east Asia (Roberton 2007). Binturong *Arctictis binturong* has been confirmed in peat-swamp forest in Borneo (Semiadi *et al.* 2016); there is a possibility that the species is distributed in this habitat in mainland South-east Asia too (including Vietnam), but that it has so far been overlooked.

Here we report on the results of small carnivore surveys in U Minh Ha National Park and the U Minh Ha FFEs. Conservation recommendations for the landscape follow the discussion.

Materials and methods

Survey areas

U Minh Ha National Park (U Minh Ha NP) and the U Minh Ha Fishery and Forestry Enterprises (U Minh FFEs) are both in Ca Mau province. Between these two sites is U Minh, the main town in the district. Approximately 6 km north of the U Minh Ha FFEs is the buffer zone of Minh Thuong National Park (U Minh Thuong NP), Kien Giang province. This site was not included in the survey, because it had already been well surveyed for mammals (including small carnivore species) in 2000 (Nguyen Xuan Dang *et al.* 2004). These three sites form what is referred to here as the U Minh Wetlands.

The U Minh Wetlands are a mosaic of agricultural land (mainly rice paddy), fruit trees, grasslands dominated by *Phragmites* reeds, or grasslands dominated by *Eleocharis* sedges, open swamp (Figure 1), mixed peat-swamp forest, intensively managed *Melaleuca cajuputi* plantations, and inactive *M. cajuputi* plantations that have been left untended for several decades (defined as "mature semi-natural" forest in Buckton *et al.* 1999). There is no primary *Melaleuca* forest in the area and trees with a diameter-at-breast-height (dbh) of over 30 cm are rarely observed (e.g. U Minh Thuong NP: Tran Triet 2004).

A network of human-made canals has lowered the water levels in many areas, causing the peat soils to dry out during the November to April dry season. Forest fires are consequently a regular occurrence across the U Minh Wetlands, often burning several thousand hectares of forest (Sanders 2002, BirdLife 2004, Tran Triet 2004, Anon. 2016). The peat soil layer is likely to have now become very shallow or entirely absent in most of the U Minh landscape; it was already rare and decreasing in extent due to human-induced fires in the late 1990s (see Safford *et al.* 1998). Climate change is also a longer-term threat; the Mekong Delta is one of the lowest lying parts of Vietnam, and the entire U Minh area is

threatened by sea-level rises and salt water intrusion (Wassmann *et al.* 2004, Kuenzer *et al.* 2013, Erban *et al.* 2014).

The U Minh Wetlands experience a humid tropical monsoon climate with two seasons: a rainy season from May to October and a dry season from November to April.

Figure 1. Open swamp habitat in U Minh Ha National Park, 2007.

U Minh Ha National Park

U Minh Ha National Park (NP) includes the former Vo Doi Nature Reserve, U Minh III and Tran Van Thoi state-owned Fishery and Forest Enterprises (FFEs). The National Park is in Ca Mau Province, (9°12′ – 9°14′N, 104°55′ – 105°00′E) and is around 30 km south of U Minh Thuong NP. The total area of U Minh Ha NP is 144 km², which is split into a 'grid' of approximately 70 squares by a network of human-made canals. The maximum elevation is approximately 2.5 m above sea level (m asl).

Vo Doi gained some level of protection as a Nature Reserve on 9 August 1986 (BirdLife 2004). Prior to this date, the whole area was production forest. The predominant tree species is *Melaleuca cajuputi*, although *Ilex cymosa* and *Alstonia spathulata* are also present and the nature reserve supports areas of open swamp and grasslands (Buckton *et al.* 1999, Birdlife 2004). The national park has been drained by a network of canals but the

former Vo Doi range is kept artificially flooded by a series of artificial dams. The site has some relatively mature *Melaleuca* peat-swamp forest (estimated at the time of the survey to be approximately 30 years old). The now inactive and untended *Melaleuca* forest plantations (the former U Minh III and Tran Van Thoi forestry concessions) are seasonally flooded to a depth of approximately 1.5 m.

U Minh Ha Fishery and Forestry Enterprises

To the North of U Minh Ha NP are the U Minh Ha Fishery and Forestry Enterprises (FFEs). This complex is composed of U Minh I, U Minh II, Song Trem and 30/04 FFEs. These four FFES are collectively referred to and managed as the U Minh Ha FFEs. All of them are active forestry enterprises, mostly for *Melaleuca cajuputi*, though there are also *Acacia* and *Eucalyptus* plantations along the canal bunds. The total size of all four FFEs is approximately 30,000 ha.

U Minh I is adjacent to U Minh Ha National Park and at the time of the survey was only separated from the protected area by a narrow (under 10 m wide) tarmacked road. U Minh II and Song Trem are adjacent to each other but are separated from U Minh I by the main district town, U Minh. Song Trem is approximately 6 km from the buffer zone of U Minh Thuong National Park. 30/04 is the most isolated of the four forestry enterprises and it is separated from the others by rice fields. An extensive network of human-made canals exists in all of the FFEs.

During the surveys, the FFEs used traditional and intensive management of *Melaleuca cajuputi* plantations; it is unknown whether the harvesting practices have since changed. Some of the *Melaleuca* forest patches have been given to local villages, to be managed by village co-operatives (also known as Local People's Forest). Dispersed around these forest patches are rice paddy fields and other types of agriculture. The canal bunds in all of the FFEs have mixed vegetation, often dominated by *Acacia*, *Eucalyptus* or banana plantations, sometimes with dense thickets of reeds and grasses, as well as small fruit trees, which had been planted by local people.

Field survey effort

Three survey methods were used to obtain small carnivore records: diurnal walks, nocturnal spotlighting walks and camera-trapping. Semi-structured interviews of local hunters were conducted in the villages surrounding U Minh Ha NP and the U Minh Ha FFEs to assess threats to small carnivores and hunting methods. The two survey periods ran from September 2007 – April 2008 in U Minh Ha NP and from August 2009 – January 2010 in the U Minh Ha FFEs. Not all of the U Minh Ha FFEs were surveyed; the local management board would not approve any surveys in the 30/04 FFE.

Semi-structured interviews

Semi-structured interviews were conducted from 11–18 September 2007 in U Minh Ha NP and 9–20 November 2007 in the U Minh Ha FFEs. Local hunters living in proximity to the National Park or the FFEs were questioned on their knowledge of otter, civet and cat presence and hunting methods for these small carnivore taxa. Interviewees were identified from their stated reputation among their peers as people with a high understanding of how to hunt carnivore species. The issues discussed in the interviews were highly sensitive because it is illegal to hunt the focal species. Hunters' names are not common knowledge therefore completely random sampling within this demographic unit was not possible. The interviews were in Vietnamese. Questions were memorized but neither written down nor said in any pre-determined order. Twenty interviews were completed in five separate local communities near U Minh Ha NP. Twenty-eight interviews were completed in local communities living near or in the four FFEs.

Nocturnal spotlighting and diurnal walks

Human-made pathways were followed for both diurnal and night walks. In the U Minh Ha FFEs there are few human-made pathways, so the majority of the spotlighting had to be done from the canals in a small four-person boat with an outboard motor. LED head-torches were used to detect the eye shine of mammals by scanning trees and other vegetation along the main trails, in addition to along the trail itself (see Duckworth 1998). A number of globally threatened small carnivore species give a strong eye-shine and are detectable using this method (e.g. Mathai *et al.* 2013: Table 1). When eye-shine was detected, a stronger (approximately two million candle-power) spot-light was used to help confirm the identity of the species. If far from the edge of the pathway or obscured by vegetation, binoculars were used to assist identification. During diurnal walks, canal bunds and pathways were searched on foot for any potential small carnivore field signs that might help to direct survey effort. This included faeces ('scats'), tracks, den sites, and food remains.

A total of 16 nocturnal spotlighting surveys were conducted in U Minh Ha NP during 2007 – 2008. Eight were in the former Vo Doi Nature Reserve and U Minh III because these areas were, based on hunter interviews in nearby communities, thought to contain relatively large numbers of quarry species of mammal. Areas for the remaining eight were randomly selected from U Minh Ha NP. Total spotlighting survey effort was approximately 14 hours. The same 16 walks were also selected for diurnal surveys; approximately 16 hours were spent walking along these human-made pathways looking for possible small carnivore field signs.

A total of 21 nocturnal spotlighting surveys were conducted in the U Minh Ha FFEs in 2010; nine in Song Trem, six in U Minh I and six in U Minh II. Seventeen of these

surveys were conducted from canals using a boat, the remaining four by using human-made pathways that ran along the sides of canals. Habitats covered included 5 to 10-year-old *M. cajuputi* plantations, blocks of *Phragmites* reeds, and canal bunds dominated by Acacia or by banana plants. Survey routes avoided any areas where there were recent or ongoing disturbances e.g. clear-felling of *Acacia* trees. Survey effort was approximately 43 hours.

Ten diurnal walks were also conducted: three in Song Trem, four in U Minh I and four in U Minh II. All the *Melaleuca* stands were flooded during the survey so these diurnal walks were restricted to the canal bunds, which were slightly more elevated and therefore drier. Habitats covered were canal bunds dominated by *Acacia*, banana plants or fruit trees of various species, *Phragmites* reed beds and *M. cajuputi* plantations. Survey effort was approximately 36 hours.

Camera-trapping

All camera-traps were attached 20–30 cm from ground level on sturdy trees, taking into account the probable water level fluctuations at each site. This height was chosen because the identification of otter species, one of the main targets for the survey, through camera-trap photographs is particularly challenging. Among the main distinguishing characteristics for otter species are the chin, rhinarium and neck patterning; by placing the camera-traps low to the ground, there was a better chance to photograph these characteristics and therefore to enable confident species identification. Camera-traps were typically stationed on canal bunds as these were one of the few microhabitats that were not inundated with water. Within this microhabitat care was taken to set the camera-traps near to possible animal trails or facing areas where there was relatively easy access to the water's edge. Camera-traps were positioned north or south to prevent image overexposure by the sun. Any vegetation was removed from a 3 m zone in front of the camera-trap to increase the camera sensor's ability to detect any passing wildlife and to reduce the risk of vegetation preventing successful identification. This however would have reduced the possibility of recording skulking small carnivore species such as weasels *Mustela*. All camera-traps were set to be operational for 24 hours. Commercially available artificial lures and natural baits were poured into split rotten logs and left to soak. This prevented the lure from being washed away when it rained. These 'target logs' were then placed in the middle of the camera-trap's field of view, at a distance of approximately 2.5 to 3 m from the camera. Camera-traps were maintained every month to ensure that they were working correctly, changing films, batteries or memory cards (if digital) when necessary.

During September 2007 – April 2008, Cuddeback Deercam film camera-traps were deployed at ten locations in U Minh Ha NP. Distance between each camera-trap station was approximately 2 km. General locations were identified initially during hunter interviews in local villages. The camera-traps were then set in stations where there was evidence of animal trails, faeces and/or foot prints. Hawbaker's Wild Cat Lure No. 2 or Hawbaker's

Otter Lure were used for these ten camera-traps. A total of 896 effective camera-trap nights were achieved.

Thirteen digital camera-traps were used to survey the U Minh Ha FFEs from August –November 2010. This included five Bushnell Trophy Cams and eight Cuddeback Captures. All surveyed FFEs were active to varying levels; extra care had to be taken to ensure that camera-traps were not placed near or in blocks of *M. cajuputi* plantations that were scheduled to be harvested or were in the process of being harvested. This limited the area for camera-trapping and some units had to be placed within 200 m of each other, because undisturbed locations away from local people and workers' camps were scarce. All camera-traps were baited with tinned sardines in tomato sauce and one of the following artificial lures; Hawbaker's Wild Cat Lure No. 2, Hawbaker's Otter Lure or Kishel's Crossbreed Lure. A total of 532 effective camera-trap nights were achieved.

Results

In total, the camera-traps recorded, excluding people and Domestic Dog *Canis familiaris*, 12 species of mammal, including five small carnivores. Local people and Domestic Dogs were frequently recorded on camera-trap: there were a total of 31 notionally independent photographs of local people and seven of Domestic Dog. Notionally independent camera-trap photographs are here defined as photographs of the same species separated by 30 minutes or more. No efforts were made to identify individual animals.

Four species of small carnivore were recorded during spotlighting exercises. Only one species of small carnivore was recorded during diurnal walks: Small Asian Mongoose. There were no signs or print marks detected that could be reliably attributed to small carnivores, other than Domestic Dog tracks. All confirmed small carnivore records from these surveys are in Tables 1 and 2.

Semi-structured Interviews

Responses to questions were often highly variable and some interviewees declined to answer certain questions. Response frequencies are presented as percentages in the format of x% (y/z), where y is the number of interviewees who gave a particular answer and z is the total number of interviewees who responded to that question (see Newton *et al.* 2008).

Otters were reported during the hunter interviews to be commonly hunted in both U Minh Ha NP (68% 13/19) and the U Minh Ha FFEs (100% 27/27) in 2007. A variety of hunting methods was said to be used for otters with snares (48% 22/46), snap-traps (39% 18/46), and domestic hunting dogs (24% 11/46), the most commonly used. Several interviewees confused mongoose species with civets, consequently invalidating the results and any subsequent discussion on the civet-focused interview questions. The majority of

interviewees stated that they did not know whether wild cats occurred in U Minh Ha NP (70% 14/20) or in the U Minh Ha FFEs (79% 22/28).

Table 1. Confirmed small carnivore records in U Minh Ha National Park, September 2007 – April 2008.

Species	Record type	Lat/Long dd mm ss	Habitat type	Record dates
Small Asian Mongoose *Herpestes javanicus*	CT	9°13′24″N, 104°58′44″E	Banana	3 Oct, 25 Nov, 26 Nov 2007
	CT	9°15′04″N, 104°56′43″E	Eucalyptus	29 Nov, 12 Dec 2007, 16 Feb 2008
	CT	9°15′35″N, 104°57′51″E	Eucalyptus	4 Dec, 6 Dec 2007, 26 Jan 2008
	O	Not recorded	Banana	23 Mar 2008
	O	9°15′40″N, 104°56′34″E	Open scrub	31 Mar 2008
	O	9°15′43″N, 104°55′50″E	Reeds	31 Mar 2008
Common Palm Civet *Paradoxurus hermaphroditus*	CT	9°15′04″N, 104°56′43″E	Eucalyptus	18 Dec 2007, 3 Jan, 10 Jan 2008
	CT	9°13′26″N, 104°57′09″E	Banana	7 Feb, 11 Feb, 25 Mar 2008
	CT	9°13′24″N, 104°58′44″E	Banana	29 Nov, 30 Nov 2007
	CT	9°13′48″N, 104°57′30″E	Banana	24 Nov 2007, 1 Jan, 8 Jan, 23 Jan, 5 Feb, 12 Feb, 12 Mar 2008
	CT	9°12′39″N, 104°57′32″E	Banana	15 Oct, 19 Oct, 24 Nov, 24 Dec 2007, 7 Jan 2008
	CT	9°15′35″N, 104°57′51″E	Eucalyptus	1 Dec 2007, 3 Jan, 15 Jan, 18 Jan, 20 Mar, 25 Mar 2008
	O	Not recorded	Banana	27 Mar 2008
Small Indian Civet *Viverricula indica*	CT	9°15′04″N, 104°56′43″E	Eucalyptus	28 Feb 2008
	CT	9°13′24″N, 104°58′44″E	Banana	15 Nov 2007
	CT	9°12′39″N, 104°57′32″E	Banana	23 Dec, 21 Nov 2007
	CT	9°15′33″N, 104°56′43″E	Eucalyptus	Oct 2007
	CT	9°15′35″N, 104°57′51″E	Eucalyptus	23 Nov, 28 Nov 2007, 5 Jan, 20 Jan 2008
Leopard Cat *Prionailurus bengalensis*	CT	9°15′04″N, 104°56′43″E	Eucalyptus	25 Sep, 26 Sep, 29 Sep, 1 Oct, undated Oct, 14 Nov, 25 Nov, 30 Dec 2007, 29 Jan, 25 Mar, 26 Feb, 19 Mar 2008
	CT	9°13′26″N, 104°57′09″E	Banana	21 Mar 2008
	CT	9°13′25″N, 104°58′06″E	Reeds	7 Apr 2008
	CT	9°12′39″N, 104°57′32″E	Banana	11 Oct, 16 Nov, 30 Nov, 4 Dec 2007
	CT	9°15′33″N, 104°56′43″E	Eucalyptus	25 Sep, 28 Sep, 5 Oct, 8 Oct 2007
	CT	9°15′35″N, 104°57′51″E	Eucalyptus	Oct, 13 Oct, 19 Oct, 28 Oct 2007, 6 Feb 2008
	CT	9°17′13″N, 104°55′10″E	Eucalyptus	16 Oct, 17 Nov, 4 Dec, 17 Dec, 21 Dec 2007
	O	9°16′00″N, 104°57′19″E	Reeds	29 Mar 2008
Hairy-nosed Otter *Lutra sumatrana*	O	9°17′09″N, 104°57′20″E	Reeds	28 Mar 2008
Asian Small-clawed Otter *Aonyx cinereus*	CT	9°13′24″N, 104°58′44″E	Banana	16 Nov, 19 Nov 2007, 14 Mar, 29 Mar, 10 Apr, 16 Apr 2008

Record Type: O = Directly observed, CT = Camera-trapped

Habitat type: Acacia = Acacia-dominated canal bund, Banana = Banana-dominated canal bund, Eucalyptus = Eucalyptus-dominated canal bund, Reeds = Phragmites reed beds / All elevations are between 0 and 2.5 m asl.

Table 2. Confirmed small carnivore records in the U Minh Ha FFEs August – December 2010.

Species	Record type	Lat/Long dd mm ss	Habitat type	Record dates
Small Asian Mongoose *Herpestes javanicus*	CT	9°28′46″N, 104°56′15″E	Acacia	19 Sep, 21 Sep, 3 Nov 2010
	CT	9°20′11″N, 104°55′29″E	Banana	20 Sep, 7 Dec 2010
Common Palm Civet *Paradoxurus hermaphroditus*	CT	9°29″53″N, 104°57′35″E	*Melaleuca*	17 Oct, 6 Dec 2010
	CT	9°28′46″N, 104°56′15″E	Acacia	29 Sep, 6 Nov,18 Oct 2010
	O	9°27′46″N, 104°55′26″E	Banana	13 Sep 2010
Small-toothed Palm Civet *Arctogalidia trivirgata*	O	9°31′36″N, 104°57′52″E	*Melaleuca*	4 Sep 2010
Leopard Cat *Prionailurus bengalensis*	CT	9°20′11″N, 104°55′29″E	Banana	28 Aug, 31 Aug, 1 Sep, 5 Sep, 6 Sep, 10 Sep, 12 Sep, 17 Sep, 29 Sep, 4 Oct, 17 Oct, 26 Oct, 27 Oct 2010
	CT	9°28′46″N, 104°56′15″E	Acacia	4 Sep, 19 Oct 2010
	CT	9°19′14″N, 104°55′47″E	Banana	23 Nov 2010
	O	9°20′13″N, 104°55′49″E	Papaya garden	28 Aug 2010
	O	9°20′50″N, 104°57′08″E	Banana	13 Nov 2010
	O	9°31′45″N, 104°58′00″E	Banana	3 Sep 2010
	O	9°31′51″N, 104°57′30″E	Acacia	19 Nov 2010

Record Type: O = Directly observed, CT = Camera-trapped
Habitat type: Acacia = Acacia-dominated canal bund, Banana = Banana-dominated canal bund, Eucalyptus = Eucalyptus-dominated canal bund, Reeds = Phragmites reed beds / All elevations are between zero and 2.5 m asl.

Species accounts

Common Palm Civet Paradoxurus hermaphroditus

This was one of the most commonly recorded species in the survey and was recorded in U Minh Ha NP and the U Minh Ha FFEs. The species was camera-trapped 31 notionally independent occasions in a variety of habitats: young (five to seven years old) *Melaleuca* plantations and canal bunds with mature *Acacia*, *Eucalyptus* or banana plants. There were two direct sightings of Common Palm Civet. The location of one of these observations was approximately 1.5 km away from an active workers' camp, where the forest management were engaged in clear-felling *Melaleuca* and *Acacia* plantations.

Small-toothed Palm Civet Arctogalidia trivirgata

A Small-toothed Palm Civet was seen on the 4 September 2010 in a Custard-apple fruit tree *Annona reticulata*, on a canal bund next to a block of approximately 5-year-old *Melaleuca* plantation in Song Trem FFE. A full description of the record is in Willcox *et al.* (2012).

Small Indian Civet Viverricula indica

Small Indian Civet was camera-trapped nine times at five different stations, all in U Minh Ha NP. There were no direct sightings of Small Indian Civet and no records from the U Minh Ha FFEs.

Small Asian Mongoose Herpestes javanicus

Small Asian Mongoose was the third most commonly recorded small carnivore. Of the 14 notionally independent camera-trap records, nine were in U Minh Ha NP and five in the U Minh Ha FFEs. The camera-trap records were from five stations, positioned in a variety of habitats: canal bunds supporting mature *Acacia* plantations, *Eucalyptus* plantations or banana plants. All three direct observations were in U Minh Ha NP in March 2008, by day.

Leopard Cat Prionailurus bengalensis

This was the most commonly recorded small carnivore with a total of 52 notionally independent records from ten camera-trap stations: 33 records were from U Minh Ha NP and 19 from the U Minh Ha FFEs. The camera-traps that recorded this species were stationed in *Phragmites* reed stands, and along canal bunds dominated by banana plants, *Eucalyptus* or mature *Acacia* plantations.

In addition to these camera-trap records there were five direct observations of Leopard Cats: four in the U Minh Ha FFEs and one in U Minh Ha NP. One was seen half-way up a 2 m high Papaya tree in a local person's garden in U Minh 1 FFE. The Leopard Cat was observed by torchlight for about 30 seconds before running back down the tree and escaping along the ground. The sighting was approximately 50 m away from a local person's house, where as many as six domestic dogs had been seen during the morning.

Hairy-nosed Otter Lutra sumatrana

A pair of Hairy-nosed Otters was observed in U Minh III, U Minh Ha National Park at 20h30 on 28 March 2008. The location was along an open dirt track approximately 2 m wide and 2 m from a canal bank. On the other side of the track were dense *Phragmites* reeds. The first otter was scared into the reeds upon first sight of the researchers, whilst the second otter was more curious and came within 3 m of the research team; photographs were taken of this animal (Figure 2). On the 31 March 2008, a camera-trap was set within several metres of this sighting but did not record the species; there were no camera-trap records for this species during the surveys.

Figure 2. Hairy-nosed Otter *Lutra sumatrana* observed in U Minh Ha National Park, Vietnam, 28 March 2008.

Asian Small-clawed Otter Aonyx cinereus

Asian Small-clawed Otter was camera-trapped in the Vo Doi part of U Minh Ha National Park on six dates at one camera-trap station, approximately 1 m from the edge of a canal. The maximum group size documented was eight and all except one series of photographs was during daylight hours.

Smooth-coated Otter Lutrogale perspicillata

An otter skin confiscated and given to the research team during the interviews in Song Trem FFE, U Minh district, in November 2007 was identified as a Smooth-coated Otter by S. I. Roberton, RB and DW (Figure 3). This skin is highly unlikely to have had an origin outside of U Minh. During the interviews, there were no suggestions of a trade of otters or their skins into the survey area; all trade in otters were of animals hunted in U Minh, including the national parks, with the skins then sold on. The skin's poor condition is presumably why it had not been sold.

Figure 3. Smooth-coated Otter *Lutrogale perspicillata* skin collected during interviews in Song Trem FFE, U Minh, Vietnam in November 2007.

Other significant mammal records

Sunda Pangolin *Manis javanica* was recorded at three camera-trap stations and there were three records during spotlighting. Two Sunda Pangolins were observed in *Phragmites* reeds next to the road that leads to the central forest guard station in the Vo Doi part of U Minh Ha NP, and one pangolin was observed on the border of Vo Doi and U Minh III. The latter record was observed at 20h30 on 1 April 2008 in a block of *Melaleuca* forest that was regenerating from a forest fire in 2003. It was observed feeding on weaver ants *Oecophylla*. Sambar *Rusa unicolor* was recorded at four camera-trap stations in U Minh Ha NP.

Observed threats to small carnivores

U Minh Ha National Park

Various anthropogenic disturbances and threats were recorded on 14 of the 16 spotlighting transects during the 2007–2008 survey. In total 49 local people were observed within the boundaries of U Minh Ha National Park in the early morning or late at night; none of the people observed were thought to be NP staff or FPD rangers (RB pers. obs.). Spotlighting transects on the border of Vo Doi and U Minh III were regularly disturbed by large lorries carrying shingle along the new road.

Domestic dogs were another source of disturbance within U Minh Ha NP. Every FPD station that the field team visited had at least two resident dogs. These dogs left the stations to roam the forest for several days at a time, before returning to their FPD station. In U Minh III a dawn transect was abandoned after 0.5 km because two domestic dogs were 50m ahead of the research team and so no animals would have been seen on the transect. These dogs belonged to the local FPD rangers. On the 2 April 2008, one set of snare traps were observed in U Minh Ha NP (Figure 4); this was the only record of this hunting method during the survey.

Figure 4. Snare trap observed in U Minh Ha National Park, 2 April 2008.

U Minh Ha Fishery and Forestry Enterprises

Each FFE consists of local people's forest (which is effectively state-owned land, leased to local communities) and strictly protected forest that is controlled and managed as state-owned forestry enterprises. No one should be living, hunting or fishing within the strictly protected forest according to Vietnamese state law; however there were several violations recorded during the 2010 survey.

U Minh I FFE

In U Minh I, local people were living within the strictly protected area. On this land the local people were growing crops, mainly papaya, and had set up numerous fine-mesh (1-2 inches) nylon gillnets in the canals. Nearly all of the houses within this FFE had domestic dogs; in one instance as many as six were seen in one household. Walks along the canal bunds in U Minh 1 produced several observations of illegal hunting, including a single cable-snare trap and four gillnets that had been placed in shallow water and along the ground; these nets had been allegedly set to catch snakes. In the agricultural fields surrounding the strictly protected area there was a mist-net approximately 15 m in length.

SFE rangers in U Minh I were observed hunting, consuming and trading wildlife. The SFE rangers for this FFE had set up gillnets in the blocks of *Melaleuca* plantation near their Forest Guard Station and were harvesting snakes for consumption and for trade. At least 12 green pigeons *Treron* were delivered to the Forest Guard Station and later eaten by the rangers. On the 12 November 2010, whilst doing some spotlighting exercises, a Purple Swamphen *Porphyrio porphyrio* was disturbed, promptly shot with a slingshot by the accompanying SFE Ranger and then taken back to the Forest Guard Station to be eaten.

Song Trem FFE

Song Trem FFE contained the largest number of people living inside the FFE and had the largest number of recorded threats. Eight cable-snare traps were recorded in this area, all in the strictly protected part of the FFE. These were set along two animal runs, both of which contained four snare traps each. Several gillnets recorded during diurnal walks were large with a mesh approximately 2 inches in width and set perpendicular to the canal bund (Figure 5). These nets were allegedly set to catch Sunda Pangolin *Manis javanica*; hunters and their dogs scour the banks at night and drive animals into these nets, collecting what becomes entangled. This was supported by an observation on 3 September 2010 of two hunters using head-torches and at least six dogs along the same bank where one of these gillnets had been recorded. Statements from the local hunters interviewed in 2007 also supported this; this method was allegedly used by the interviewees as a method to hunt pangolins in the area.

Figure 5. Hunting nets in Song Trem FFE, September 2010.

On the 4 September 2010, a Small-toothed Palm Civet was recorded in the strictly protected part of Song Trem FFE. On 6 September 2010, the field team was told by the SFE ranger who had accompanied the team during the spotlighting exercises on 3 and 4 September that the Small-toothed Palm Civet had been killed. Local people had apparently cut down the tree and killed the civet with dogs; this was backed up by the field team's observation of the remaining tree stump. This same SFE Ranger had on 3 September beached the boat and tried to shake a Leopard Cat out of a tree, later claiming that the species can fetch as much as 500,000 VND/Kg (about 25 USD/Kg) in the local markets. Two small houses were also found within in the strictly protected area and were being used for short stays by hunters/fishermen during trips into this part of the FFE.

U Minh II FEE

No local people were seen living inside the strictly protected area of U Minh II. However, this FFE was the most active of the three surveyed and there was a large camp of workers who were engaged in harvesting from *Acacia* and *Melaleuca* plantations. No snare traps were observed but during the day local people were observed collecting lotus *Nelumbo* and/or water-lily *Nymphaea* from a canal inside the strictly protected area. Approximately five fish box-traps were seen inside flooded *Melaleuca* plantations, or in canals close to

these. The SFE rangers destroyed or confiscated all fish traps and nets that they came across inside the strictly protected zone.

Other threats

Small (under 15 m in length) segments of canals in the U Minh Ha FFEs were damned at both ends with deposits of canal bed. The water would then evaporate during the dry season and any fish left were collected and either traded or consumed. Fish is likely to be an important prey for a wide range of animal species in this landscape, and this fishing practice, which is likely to be unsustainable, could be contributing to prey depletion.

The majority of local communities in the U Minh wetlands live alongside the canals: plastics, animal waste, food remains and human excrement were regularly observed being dumped into the canals. Agricultural runoff from the surrounding paddy fields is also likely to be affecting water quality; chemical use is high in Vietnam. It is assumed that water quality in the U Minh wetlands, including the two survey sites, is low, and a probable threat to the landscape's biodiversity, including its small carnivores.

Discussion

This survey confirmed the presence of several globally threatened small carnivore species in U Minh Ha NP. No small carnivore species of conservation concern were recorded in the U Minh Ha FFEs.

The confirmation of Hairy-nosed Otter in U Minh Ha NP is arguably the most significant result from this survey; this is one of the most threatened otter species in the world (Aadrean *et al.* 2015). This species was not recorded for many years in Vietnam until its rediscovery in U Minh Thuong NP in 2000, where it was camera-trapped (Nguyen Xuan Dang *et al.* 2001, 2004). Subsequent otter-focused surveys in U Minh Ha NP in 2002 provided some indications based on local people's reports, observed otter tracks attributed to Hairy-nosed Otter, and found a Hairy-nosed Otter skin, allegedly from an animal hunted in Vo Doi NR (IOSF, undated). No photograph of the skin is in the unpublished report. The U Minh Wetlands are the only landscape in Vietnam where this globally threatened species has been recorded within the last 20 years. Historical records exist for Nha Trang (Roberton 2007).

Asian Small-clawed Otter has previously been recorded in U Minh Thuong NP (Nguyen Xuan Dang, 2004) and this is the first confirmed record for U Minh Ha NP. The species has recently been recorded in other protected areas in Vietnam including Cat Tien National Park, Dong Nai province (Willcox *et al.* 2014: SOM T3). It is though, like the other otter species in the country, threatened with national extinction. The records during this survey were all from the same camera-trap station, and likely to involve only one family group.

The Smooth-coated Otter skin suggests that at least three otter species inhabited the U Minh wetlands, and potentially other sites in the Mekong Delta. There are areas in South-east Asia that are known to support multiple otter species, in Thailand (Kruuk *et al.* 1994) and also in South Asia (Raha & Hussain 2016). Hairy-nosed Otter and Smooth-coated Otter are known to co-exist in the Tonle Sap Great Lake, Cambodia (Willcox *et al.* 2016). Smooth-coated Otter is one of the more readily recorded otter species in Asia, with a significant proportion of records being direct observations during the day (e.g. Chutipong *et al.* 2014 and citations therein). The species's behaviour and ecology lends itself well to camera-trapping as it tends to leave easily-detectable signs, including well-used latrines, by which camera-traps can be set (DW pers. obs.). The lack of any wild records of this species from U Minh Ha NP or the U Minh Ha FFEs suggests that it is very likely now to be locally extinct within these two sites. This fits with the conservation status of Smooth-coated Otter in Vietnam where it is thought to be very close to extinction in the country (Roberton 2007, Duckworth & Le Xuan Canh 1998).

The observation of Small-toothed Palm Civet in the U Minh Ha FFEs is apparently the first record for *Melaleuca*-dominated wetland forest from anywhere in its range. This record and its conservation implications for the species are given further discussion in Willcox *et al.* (2012).

Large Indian Civet *Viverra zibetha* and Large-spotted Civet *V. megaspila* have both been previously recorded in U Minh Thuong NP (Nguyen Xuan Dang *et al.* 2004) but were not recorded in this survey. This is unlikely to reflect differences in survey methods or efforts; similar methods were used, and survey effort was comparable to if not greater than that in Nguyen Xuan Dang *et al.* (2004). The relatively large size of these two civet species (adults of both species can reach around 10 kg), and their vulnerability to ground-level snares and other hunting methods, makes them obvious targets for the illegal wildlife trade. Neither species seems to be particularly sensitive to habitat degradation (e.g. Chutipong *et al.* 2014); therefore, it seems likely that the absence, or at best very low populations, of these two species from this survey is because of recent hunting-driven declines.

Leopard Cat was the most commonly recorded small carnivore species in these surveys, being found regularly by camera-traps and spotlighting. The records give further evidence that this cat species is very adaptable and highly unlikely to be threatened in Vietnam or, presumably, in other parts of its range. Fishing Cat *Prionailurus viverrinus* was recorded several times during surveys in U Minh Thuong NP, both by camera-trap and by direct observation (Nguyen Xuan Dang *et al.* 2004). The reasons for its absence/non-detection in this survey are unclear but they are unlikely to be habitat-based; the areas surveyed are ecologically very similar to U Minh Thuong NP and as a species it is very tolerant to habitat degradation (e.g. Adhya 2014). A fuller discussion of Leopard Cat and Fishing Cat conservation status in Vietnam is given in Willcox *et al.* (2014).

Hunter interviews indicated that illegal incursions into U Minh Ha NP to hunt wildlife are commonplace; this was supported by the relatively large number of observations of local people during fieldwork at both sites. Ground-level snares, snap-traps and domestic hunting dogs were some of the commonly reported methods for hunting small carnivores and this was partly supported by field observations; domestic dogs were frequently seen and camera-trapped. Snares were very rarely encountered relative to surveys in other protected areas in Vietnam, where several thousand can be recorded in a single survey (e.g. Willcox *et al.* 2015; WWF 2015; Harrison *et al.* 2016). It is likely that because a significant proportion of the available dry-land is flooded for at least half a year, snaring is either concentrated in these areas (and that these areas were missed during the survey), and/or that snaring is a seasonal activity that had not yet been started or reached its peak during either the surveys in 2008 or in 2010. Statements from some local hunters supported the latter; there was some suggestion that wildlife hunting was a wet-season activity as the animals had limited dry land during this time.

The hunter interviews provided a good example of the limitations of using this technique for wildlife surveys. The majority (75%) of local hunters interviewed, whilst open and relatively knowledgeable about hunting otter and pangolin species, stated that they did not know if cats occurred in the area. All interviews were in Vietnamese and there are no local or regional differences in the standard Vietnamese word that authors are aware of. The results from the camera-trapping and spotlighting surveys were in contrast to these interview statements; Leopard Cat was one of the more commonly encountered small carnivore species at both sites. This apparent inconsistency is likely to stem from the difficulties of locals and outsiders being sure they are speaking about the same animal species (or group of species), rather than a genuine failure of the interviews to have ever noticed these evidently almost synanthropic Leopard Cats.

Conclusion

The confirmation of Hairy-nosed Otter and Asian Small-clawed Otter in U Minh Ha NP, and the previous records of both species in U Minh Thuong NP, make the U Minh Wetlands one of the most important landscapes for small carnivore conservation in Vietnam. Large Indian Civet and Large-spotted Civet are likely to be extinct, or nearly so, in U Minh Ha NP and the FFEs; however there has been too little survey effort in U Minh Thuong NP to be confident of either species's status there. The U Minh Wetlands are far from pristine and their biodiversity is under pressure from a variety of threats. The mammals recorded offer some evidence of the robustness of these particular species and of the potential for their successful conservation; more effective management of the landscape, including an immediate suppression of illegal hunting and fishing activities, could rapidly improve the conservation status of a number of globally threatened species in the U Minh Wetlands.

Conservation recommendations

1. Strengthen wildlife protection

Illegal wildlife hunting is common across the U Minh Wetlands, sometimes with the direct participation of SFE Rangers. SFE or FPD rangers that contribute or facilitate the illegal wildlife trade must be held accountable so that Vietnam's wildlife protection laws are not undermined. Patrolling activities should focus on the removal illegal snares, gillnets and the larger nets set along the banks, apparently for Sunda Pangolin. Domestic Dogs that are seen within the strictly protected areas should be confiscated immediately. Dogs that belong to the SFE/FPD guard stations should be vaccinated against diseases (canine distemper, rabies) and prevented from wandering into the protected areas.

2. Surveys in U Minh Thuong NP

U Minh Thuong NP was the last place in Vietnam where Fishing Cat was recorded in the wild. The conservation status of this species in Vietnam is assumed to be poor and it is likely to be extinct from most of its former range in the country. Surveys for this species, as well as otters, need to be urgently implemented in U Minh Thuong NP; surveys since Nguyen Xuan Dang *et al.* (2000) have been too limited in duration to determine the current status of small carnivores (e.g. Tran Van Bang *et al.*, undated; Nguyen Xuan Dang, 2009). Surveys should use methods likely to generate verifiable records (i.e. camera-trapping) and be of a duration that will enable confident assessments of probable conservation status (i.e. minimum of 1000 camera-trap days). Some of the camera-traps should be placed at the same locations given in Nguyen Xuan Dang *et al.* (2004).

3. Develop and implement an effective long-term management plan

There are a variety of threats facing the U Minh's biodiversity. Some are direct threats (e.g. illegal hunting and fishing) for which interventions could be, if there is sufficient political will from the local authorities, quickly implemented. Other threats will need longer-term management plans to mitigate them. The landscape has been significantly altered by decades of human-induced modification, particularly through canalisation and the consequent drying out of the peat layer. It is now probably too late wholly to reverse this and completely to restore the habitat; education on the impacts of human-made fires, enforcement against activities likely to cause fires, and better fire suppression activities at a landscape level may help to mitigate the impact of forest fires. No new canals should be built within either National Park; this is the main reason why the peat layer dries and becomes combustible. Attempts to reach a more natural water regime would significantly aid biodiversity conservation in these wetlands.

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ORIGINAL ARTICLE

Small carnivores' records from Virachey National Park, north-east Cambodia

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Abstract.

A two-year camera-trapping project in Virachey National Park (NP), Ratanakiri province, north-east Cambodia, has produced clear evidence of the presence of 10 small carnivore species, including some which are not often recorded in the country. These photographs include the third published record of Spotted Linsang *Prionodon pardicolor* for the country and several photographs of Binturong *Arctictis binturong* with young. Species that have become rarer in the region such as Asian Small-clawed Otter *Aonyx cinereus* were also photographed. Hog Badger *Arctonyx collaris*, which has undergone one of the most dramatic declines of any small carnivore in Indochina (Lao PDR, Vietnam and Cambodia), is also well represented. This survey, which did not target any specific species and relied entirely on camera-trapping, is the first wildlife survey to come out of Virachey NP in over seven years. Virachey NP appears to have many small carnivores, despite years of conservation neglect, probably reflecting slightly lower recent and current levels of destructive human pressure such as logging and poaching than are typical in many other parts of southern Indochina. The park's relatively rugged and mountainous terrain makes it more difficult to access in comparison with many other protected areas in Cambodia; this may partly explain the relatively large number of small carnivores recorded there.

Keywords: Binturong, camera-trapping, Hog Badger, Virachey National Park, Cambodia.

Introduction

Virachey National Park (NP) is Cambodia's largest national park, encompassing 3325 km^2 of protected habitat. Virachey NP comprises the southern half of a westward-stretching arm of the Annamite Mountains; the northern half of the mountain range lies in Lao PDR and comprises the Nam Ghong Provincial Protected Area (PPA). Taken together, these can be referred to as the 'Virachey – Nam Ghong Mountains'. Portions of Virachey NP have been degraded, especially near the border with Vietnam, where economic land concessions have been granted to rubber interests. However, local media have reported that several economic land concessions in Virachey NP were recently cancelled (Phak 2014). Until fairly recently Vietnam's Chu Mom Ray National Park and its forest was contiguous with Virachey NP, but road building and other development in both Cambodia and Vietnam have severed much of the forest linkage. Virachey NP has been speculated to be an important transboundary site for wildlife (BPAMP 2003, CEPF 2012), and within Cambodia, Veun Sai – Siem Pang National Park, which was decreed in 2016 (Souter *et al*. 2016), effectively extends Virachey NP's protected status with forest to the south in Veun Sai district of Ratanakiri province and Siem Pang district, Stung Treng province by an

additional 550 km². The entire forest area, including the other contiguous protected areas, in all three countries, is over 5000 km², of which Virachey NP is the central core.

Virachey NP consists of dense evergreen, semi-evergreen, mixed deciduous and bamboo forest, as well as scrub forest over formerly logged forest, and extensive upland savannas. The highest peaks reach over 1400 m asl (metres above sea level) with the highest mountains located on the Lao PDR border. Many of these high peaks have been named by the Brao, Kavet, and other highlander tribes of Ratanakiri because, being animists, they believe these mountains are the homes of powerful deities (Baird 2009, 2013, McCann 2011). In fact, the highest mountain visited in the survey area, Phnom (= mountain/hill) Haling (1455 m asl) is considered to be the most powerful 'spirit mountain' in Virachey NP, and according to Brao and Kavet customs, no logging is permitted there. Resettlement from areas inside Virachey NP, to the lowlands along the Sesan River, first began in the 1960s under policies administered by the Khmers Rouges (Baird 2013). Virachey NP was declared a national park in November 1993 and all people living within the park were subsequently evicted from their forest homes, a situation many were unhappy with (Baird 2009, 2013). Virachey NP therefore has a somewhat controversial history and its protected status is viewed with some ambivalence by local highlanders who now reside in its periphery. Maps provided by Ironside and Baird (2006) show several villages in this area dating back as far as 1958, so Virachey NP, which has now largely returned to thick forest, was in fact disturbed habitat at least 60 years ago, and perhaps for longer. H. Weiler (*in litt*. 2016), on an expedition to the Yak Yeuk Grasslands in 1998, found that some villagers had defied relocation outside Virachey NP and had moved back to the mountains of Virachey NP and set up farms there as well.

From 2004 to 2008, the World Bank sponsored a conservation and ecotourism-building programme in the park, but the Bank was taken by surprise when the Cambodian Government announced that it would allow the Australian mining company Indochine Ltd to explore for minerals throughout 90% of the Park (Baird 2013). When the World Bank withdrew its support for Virachey NP the other NGOs active in the Park (WCS, WWF, and others) exited with them, leaving Virachey NP almost completely unprotected. The lack of conservation investment for the park's largest mammals, such as Asian Elephant *Elephas maximus*, Tiger *Panthera tigris*, Leopard *P. pardus* and Gaur *Bos gaurus*, since that time, and the regional increases in hunting pressures on these for the illegal wildlife trade, is assumed to have probably resulted in their local extinctions or declines to very low population levels.

Gray *et al*. (2014) traced confirmed records for Hog Badger *Arctonyx collaris*, Large Indian Civet *Viverra zibetha*, Large-spotted Civet *Viverra megaspila*, Small Indian Civet *Viverricula indica* and Common Palm Civet *Paradoxurus hermaphroditus* for Virachey from camera-trapping that ran from June 1999 – August 2001. Since then there have been no further survey work and very limited conservation management of the area;

the status of small carnivores in this large protected area is unknown. In 2014, a new conservation group called Habitat ID carried out the first camera-trapping survey in Virachey NP in over seven years. The purpose of these surveys was to assess the current status of camera-trappable wildlife species in the park. This paper presents the small carnivore camera-trap records from these surveys.

Materials and methods

A combination of Bushnell HD Trophy Cams, Reconyx HC600 Hyperfire, and Covert camera traps were used. Camera-traps were set approximately 20–100 cm from the ground, dependent upon slope, vegetation and anchoring trees. No baits or lures were used. All camera-traps were set to be active for 24 hours each day, recording time, date, and temperature when triggered. Single camera-traps were set at 20 stations (13 in Survey Area 1 and 7 in Survey Area 2), for a total of 7,806 camera-trap nights (Figure 1). Out of 20 camera-traps, 19 were set to photograph stills, recording three pictures every time they were activated by movement, in various time intervals, ranging from 30 seconds to 5 minutes. Camera-traps at wallows or areas that showed intense foraging signs were set at lengthier time intervals to minimise the number of redundant photographs. Camera-traps on animal trails were set at shorter intervals to maximise the number of records. The camera-trap set to video recorded for 1 minute and restarted after a 1-minute interval if motion was detected; the video would record until the animal had left the area.

One camera-trap in Survey Area 1, in the middle of the Veal Thom Grasslands, was stolen, but had not recorded any small carnivores as of its last check four months previously. Another camera-trap, in the same grasslands, malfunctioned due to moisture damage but had not photographed any small carnivores as of its last check. Species were identified by the authors and others with knowledge of small carnivores. Trigger events were defined as a single or series of photographs separated by more than 30 minutes at the same camera-trap location (not number of images). Coordinates and altitudes were recorded directly from a Garmin GPSMAP.

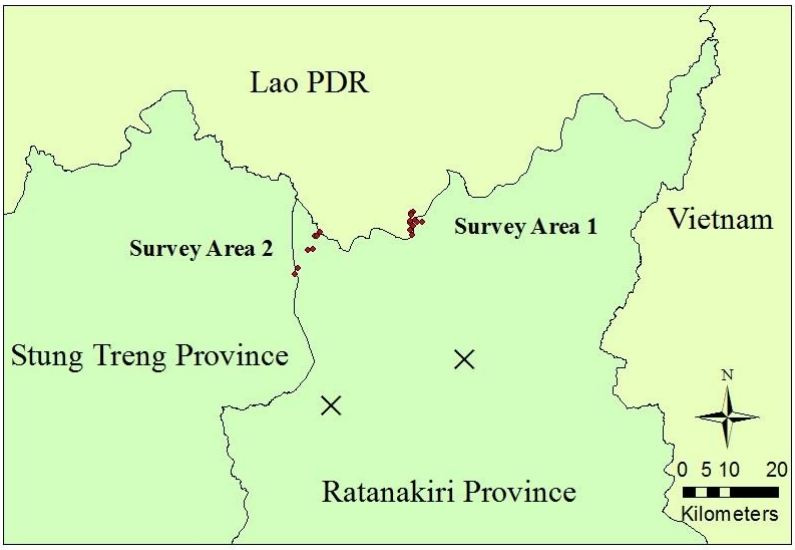

Figure 1. Map showing location of the two survey areas in Virachey National Park. X: Village location, Red dots: Camera-trap stations' locations.

Survey areas

Camera-traps were deployed in two separate areas of Virachey NP. Field work began in January 2014 in the Phnom Veal Thom grasslands and north through the O (= river) Gan Yu valley to the Lao border, terminating at a 1455 m peak known has Phnom Haling (Survey Area 1). All coordinates in Area 1 are in Tavang district of Ratanakiri province. The Phnom Veal Thom grasslands consist of open savannas with riparian forest corridors, and most of the grassland area is over 700 m asl. The survey area north of Phnom Veal Thom along the O Gan Yu all the way up to the Lao border at Phnom Haling consists of a mixture of semi-evergreen, evergreen and bamboo forest. Two camera-traps were placed about 4 m from the river's edge. In Area 1, there was an abundance of larger bamboo species (approximately 10–20 cm diameter) at lower elevations (500–800 m) but forest then became predominantly semi-evergreen with the exception of the highest elevations, Phnom Haling ridgeline, which was dominated by the smaller 'rice wine' bamboo species (approximately 3–6 cm diameter).

In January 2015, a second group of camera-traps was deployed in the Yak Yeuk Grasslands area of Veun Sai district (Survey Area 2) with several camera-traps near the Lao border. According to Park staff, this is first time the border mountains have been surveyed for wildlife; Weiler (1998) visited the Yak Yeuk Grasslands but his guides did not want to trek beyond into the border mountains for fear of the Lao police. Although perhaps only one third of the size of Phnom Veal Thom, the Yak Yeuk grasslands encompass an extensive area of open and hilly savannah, with much of this area being over 700 m asl and also containing gallery forests that line permanent streams. Survey Area 2 was predominantly semi-evergreen, but had many hills and valleys near the Yak Yeuk

grasslands, which seemed to create a heterogeneity of microclimates that supported fragmented grasslands, shrubland and mixed coniferous forests.

The nearest villages to both sites are situated along the Tonle Sesan, approximately 30 kilometres apart. Expeditions to Survey Area 1 (Tavang district) began in the village of Tom Phoun Roueng Toech (14°04′46″N, 107°04′33″E; elevation 105 m asl) and treks to Survey Area 2 commenced from the village of Koun Nouk in Veun Sai (13°59′34″N, 106°49′23″E; elevation 97 m asl). From our observations, the border mountains seem to have the least encroached forest cover in the park, and possibly within the whole country. While selective illegal logging occurs in these areas, there has been no recent discernible large-scale clearing and no building of permanent roads, although logging tracks were discovered south of both the Yak Yeuk and Veal Thom Grasslands. Survey Area 2 is a considerable distance from the logging and development occurring in the Siem Pang area in the Stung Treng province section of Virachey NP, and Survey Area 1 is also far away from the Vietnamese border where loggers, poachers and miners penetrate Virachey NP on a regular basis and where economic land concessions (rubber plantations, cassava) threaten the park.

Almost the entire length of the international Cambodia–Lao border is wild, mountainous forest; Virachey NP and Nam Ghong PPA in Laos are merely two sides of a mountain range. The high peaks such as Phnom Haling serve as border markers, and indeed a cement border post on top of this peak had been helicoptered up in 2003 in a joint Cambodia–Lao effort to demarcate key border points (Virachey NP Deputy Director Thon Soukhon verbally February 2015). Every camera-trap station near the border lay south of the ridge line, thus inside Cambodia, even though mapping software such as Google Earth can suggest some were slightly to the Lao side.

Results

Species accounts

Ten species of small carnivore were camera-trapped, comprising: a weasel *Mustela* (either Yellow-bellied Weasel *M. kathiah* or Stripe-backed Weasel *M. strigidorsa*), Yellow-throated Marten *Martes flavigula*, Hog Badger *Arctonyx collaris*, Asian Small-clawed Otter *Aonyx cinereus*, Spotted Linsang *Prionodon pardicolor*, Large Indian Civet *Viverra zibetha*, Small Indian Civet *Viverricula indica*, Common Palm Civet *Paradoxurus hermaphroditus*, Masked Palm Civet *Paguma larvata*, Binturong *Arctictis binturong* (Table 1). Camera-trap stations within the Yak Yeuk grasslands did not record any small carnivores, but those in the surrounding forests, which consist of semi-evergreen, evergreen, and bamboo forest, did. No small carnivores were camera-trapped in Phnom Veal Thom.

Yellow-bellied Weasel Mustela kathiah *or Stripe-backed Weasel* M. strigidorsa

One record (three camera-trap photographs) showed one of these two weasel species at the top of Phnom Haling (1420 m asl) on 15 January 2016 at 18h54. The most likely candidate in this area is Yellow-bellied Weasel. In 2013–2014 Phan *et al*. (2014) obtained Cambodia's first, and thus far only, record of Yellow-bellied Weasel in the Cardamom Mountains of southwestern Cambodia, far outside the then known range of this species. Stripe-backed weasel has never been recorded in Cambodia, although it occurs south to similar latitudes in Thailand (Chutipong *et al*. 2014) and Vietnam (Roberton 2007).

Yellow-throated Marten Martes flavigula

This marten was camera-trapped above 500 m asl in both Survey Area 1 and 2, including on the top of the highest mountains. It was recorded mostly by day, with one trigger event at 18h33 on 27 July 2015; it appeared in duos twice out of 28 trigger events. It appeared at seven stations and was camera-trapped throughout the year.

Hog Badger Arctonyx collaris

Hog Badger was among the most frequently photographed animals, with 60 trigger events in Survey Area 2 and 10 in Survey Area 1, from eight camera-trap stations. It appeared in locations as varied as atop Phnom Haling at 1420 m, and as low as 493 m on an animal trail through semi-evergreen forest and bamboo forest near the Gan Yu river. All adult-only photographs were of singletons. Adults with cubs were photographed twice in Survey Area 2; in mid-August 2015 with three cubs (Figure 2) and in early September (12 kilometers away) with two. This species perhaps takes on a lighter pelage during summer (Figure 3), with some individuals appearing almost totally white in July and August; much of their fur appears black and grey during winter months, although one individual on Phnom Haling appears with normal dark colouring on 1 July 2015, so further information would be useful. Hog Badger appears to have suffered notable population declines in neighbouring Lao PDR and Vietnam, and also in Myanmar (Than Zaw *et al*. 2008, Willcox *et al*. 2014: Table SOM3, Duckworth *et al*. 2016), so this being among most frequently camera-trapped small carnivores in Virachey NP, could mean that the park is an important conservation area for the species.

Asian Small-clawed Otter Aonyx cinereus

Four individuals were camera-trapped crossing the headwaters of the O Gan Yu near the base of Phnom Halang on 24 February 2015 at 06h35 and again on the same day at 10h25. Image quality is sufficient for one otter to be positively identified as Asian Small-clawed Otter (Figure 4). Three otters, presumably the same group, were camera trapped at the same station (at 910 m asl) on 28 April 2015 at 15h01 and on 14 July 2015 at 18h00.

Size, body shape, and where visible, pelage colour, are all consistent with all 11 photographs showing only Asian Small-clawed Otter.

Figure 2. Hog Badger *Arctonyx collaris* with three cubs, camera-trapped on 15 August 2015, Virachey National Park, Cambodia.

Spotted Linsang Prionodon pardicolor

Spotted Linsang was camera-trapped in eight trigger events between 19 February 2015 and 22 January 2016 at one station in Survey Area 1. This station lay along a ridgeline trail which holds many dense bamboo stands near the summit of Phnom Haling near the Cambodia–Lao cement border post at an elevation of 1420 m asl (Figure 5). All records showed solitary individuals at night. This is the third Cambodian record of Spotted Linsang; the other two were in the Cardamom Mountains (Holden & Neang 2009).

Large Indian Civet Viverra zibetha

This civet was camera-trapped at six stations in Survey Area 1 (but not within the Phnom Veal Thom grasslands themselves or their forest stream corridors) and at six stations Survey Area 2, at elevations above 600 m. It was often photographed climbing boulders, or apparently hunting along streams and trails, or in open basaltic clearings. It was one of the most frequently recorded mammals, 82 trigger events, always solitarily and generally by night or around dawn and dusk, with just one record in daylight at 08h58.

Figure 3. A Hog Badger *Arctonyx collaris* camera-trapped on 7 July 2015, showing the lighter pelage colour seen on some animals during the summer months (May. Virachey National Park, Cambodia.

Small Indian Civet Viverricula indica

This species is typically found in disturbed forests and village areas (Than Zaw *et al*. 2008), so its appearance in a camera-trap in semi-evergreen far away from any settlement, disturbance, or clearing initially appeared unusual. However, park rangers reported that the site was formerly a Kavet village known as Thorm. This species was encountered by night at two camera-trap stations in Survey Area 2: in May, 2015, at 806 m asl, and over three days in later December, at 775 m asl.

Figure 4. Asian Small-clawed Otter *Aonyx cinereus* seen in focus, part of a group of four camera-trapped individuals in four trigger events at this station. 24 February 2015, Virachey National Park, Cambodia.

Common Palm Civet Paradoxurus hermaphroditus

This civet appeared at 14 stations but never at those in open grasslands or within the grasslands' riparian forests. It was encountered by night in over 100 trigger events, almost equally in Survey Areas 1 and 2, over an elevation range of 493–1420 m asl. Several individuals had single white-looking rings near or on the tips of their tails (Figure 6). At one station along the O Gan Yu amidst dense forest, one individual paced back and forth for long periods, providing nearly 100 photographs; the camera trap was perhaps near its den. This species was often camera-trapped scent marking, with multiple individuals often marking the same spot. In Survey Area 1, two Common Palm Civets were observed, on one camera, repeatedly scent-marking and smelling the same earthen mound through a period of 8 months. They were observed 12 days, 22 days, 6 days, 8 days, 22 days, and 91 days apart, respectively. One individual had a white ring near the tip of its tail and appeared smaller (approximately 20%) than the other, which had a uniformly dark tail. In the dry season, the larger, civet visited the mound first, followed by the smaller one. When this Survey Area was flooded in the wet season, both individuals were observed throughout the

camera view in various locations with no discernible behavioural pattern. The larger dark tailed civet was then not recorded for 91 days, when it reappeared at the mound.

Figure 5. Spotted Linsang *Prionodon pardicolor* camera-trapped on Phnom Haling, Virachey National Park, Cambodia on 18 January 2016.

Masked Palm Civet Paguma larvata

Masked Palm Civet was camera trapped by night at the Phnom Haling ridge station at 1420 m asl in April and July. This station is located on one of the highest mountains in the park and forest there is a mixture of evergreen, semi-evergreen, and bamboo forest. Selective logging in the past may have contributed to its current forest cover. It is a relatively sharp, thin ridgeline, no more than 2 m in width.

Binturong Arctictis binturong

This civet was photographed and video recorded once each at six stations. Records came from Survey Area 1 near the base of Phnom Haling, and in the high mountains of Survey Area 2. These locations consist of evergreen and semi-evergreen forest and are probably the least disturbed areas in Virachey NP. Individuals were photographed either alone or with cubs, both by day and by night, at altitudes ranging from 730 to 955 m. One record shows a mother with two cubs (Figure 7), while two encounters at separate stations

show an adult with one cub in tow, confirming breeding populations. This species could be rare in Cambodia, and there are only "several records" from the country (Willcox *et al*. 2016). Holden & Neang (2009) did not camera-trap Binturong in the Cardamom Mountains but did find one dead in a village nearby. A review of camera-trap records from eastern Cambodia from 1999 to 2013, produced no records of Binturong in Virachey NP and only three from eastern Cambodia (Gray *et al*. 2014). Binturong has not been camera-trapped in the Veun Sai – Siem Pang National Park (B. Rawson *in litt*. 2016).

Figure 6. Common Palm Civet *Paradoxurus hermaphroditus* with a distinctive white band near the tip of its tail, camera-trapped on the 28 February 2014, Virachey National Park, Cambodia.

Table 1. Small carnivore species camera-trapped in Virachey National Park, Cambodia, Jan 2014–16.

English name	Scientific name	Habitat	Number of trigger events	Encounter rate	Altitude (m asl)
Weasel	*Mustela*	SB	1	0.013	1420
Yellow-throated Marten	*Martes flavigula*	SB	28	0.359	490–1420
Hog Badger	*Arctonyx collaris*	EF, SEF	70	0.897	490–1420
Asian Small-clawed Otter	*Aonyx cinereus*	EF	4	0.038	910
Spotted Linsang	*Prionodon pardicolor*	SB	11	0.141	1420
Large Indian Civet	*Viverra zibetha*	SEF, G	82	1.051	490–1420
Small Indian Civet	*Viverricula indica*	SEF	7	0.090	775–806
Common Palm Civet	*Paradoxurus hermaphroditus*	EF, SEF	102	1.307	730–1420
Masked Palm Civet	*Paguma larvata*	SB	3	0.038	1,420
Binturong	*Arctictis binturong*	EF, SEF	6	0.077	730–955

Habitat: EF = evergreen forest, SEF = semi-evergreen forest, SB = small bamboo forest, G = grassland/clearing.
Trigger events: number of notionally independent camera-trap events (see text).
Encounter rate: number of notionally independent encounters per 100 camera-trap-nights.

Figure 7. An adult Binturong *Arctictis binturong* with two cubs. Virachey National Park, Cambodia, 30 May 2015.

Discussion

Given that there was no directed effort for small carnivores, the total of 10 species is good by regional standards. Of the larger mammals, Asian Elephant, Tiger and Leopard were not camera-trapped, although Asian Elephant dung and footprints were found, and Gaur and Sambar *Rusa unicolor* were camera-trapped.

Given the area's varied range of habitats, and abundant signs of wildlife, it is logical that small carnivores would be well represented in the area. All species encountered were previously known from, or could have been predicted occur in Virachey NP (see Gray *et al*. 2014).

Species such as Common Palm Civet, Large Indian Civet and Hog Badger are likely to be overrepresented in number of records (compared to actual animal abundance) versus species like Binturong and Spotted Linsang. Coincidental camera trap placement, near an animal's den or prime browsing areas may influence encounter rates. Also, both individual and different civets, particularly Common Palm Civet, were often found scent marking the

same location throughout our survey. In areas where perineal gland marking was camera-trapped, we often found higher abundances of civets.

Seven species of civet occur in Cambodia (Iseborn *et al*. 2012) and of these five were camera-trapped, including Binturong, a species that has undergone significant declines in Indochina (Willcox *et al*. 2016) and for which there are few recent camera-trap records from Cambodia (T. Gray *in litt*. 2016). Small-toothed Palm Civet *Arctogalidia trivirgata* was not camera-trapped, mostly likely because of its arboreal nature. Iseborn *et al*. (2012) found this species in Veun Sai – Siem Pang National Park directly south of Virachey NP in 2011 by foot-based spotlighting. Had we used a similar method we may very well have encountered the species. In addition, there were no ferret badger *Melogale* records. Ferret badgers are commonly camera-trapped in Vietnam (Willcox *et al*. 2014: Table SOM3), but are not often found in Cambodia (Schank *et al*. 2009, Gray *et al*. 2014). Gray *et al*. (2014) also did not record ferret badger in Virachey NP.

There are Large-spotted Civet *Viverra megaspila* records almost throughout Cambodia, and the country is among the global strongholds for this species (Gray *et al*. 2010). Large-spotted Civet was camera-trapped in 2011 in nearby Veun Sai – Siem Pang National Park, an area of lower elevation than surveyed here in Virachey NP (Iseborn *et al*. 2012), and has been previously recorded in Virachey NP (Gray *et al*. 2014). The single previous record in Virachey NP was from lowland Deciduous Dipterocarp Forest (approx. 100 m asl) in the far west of the park (Gray *et al*. 2014). The lack of records in this survey may reflect the survey's limited effort below 300 m asl (see Chutipong *et al*. 2014).

The Hog Badger records show that this species, which is suffering declines regionally has relatively good conservation status in Virachey NP despite regional trends. This is likely to be because a large proportion of the camera-traps were stationed in remote areas of Virachey NP. Healthy Hog Badger populations persist in Thailand as well, in well-protected areas (Chutipong *et al*. 2014).

The otter records, while limited, are important. Local guides and Virachey NP staff report that otters were once common in the region, being found in many of the park's main streams and in the Tonle Sesan itself. However, otters were photographed at only one of the two river camera-trap stations, and it was the one deepest inside the park and at a relatively high elevation (910 m asl) where the stream was much smaller in width, and in an area of evergreen forest. This is consistent with otters having been reduced severely and persisting only in the most remote parts of the park. However, targeted survey effort was too small to be confident of otter status in this area; camera-traps should be deployed by headwater streams in the mountains along the Lao–Cambodia border and set to specifically target otters in order to obtain a better assessment of otter conservation status in Virachey NP.

It is surprising that we did not get any confirmed Crab-eating Mongoose *Herpestes urva* records; this species is commonly recorded in hill evergreen forest in nearby countries (e.g. Than Zaw *et al*. 2008, Chutipong *et al*. 2014). Although one photograph of two animals travelling together could be of this species, low image quality forestalls positive identification. Reasons for the absence/non-detection of this species are unclear; suitable habitats were surveyed, the camera-traps were set at heights likely to record the species, and given the species's high encounter rates in similar general camera-trap surveys in the region it seems implausible that exact camera-trap placement might have led to it being overlooked, although present, in these parts of Virachey. The lack of records for Small Asian Mongoose *Herpestes javanicus* is expected; this species prefers open deciduous forest and degraded edge habitats (Duckworth *et al*. 2010), and in Virachey NP camera-traps were not stationed in these habitats. Grey *et al*. (2014) did not record any Crab-eating mongoose or Small Asian Mongoose from Virachey NP, either.

Hog Badger and Binturong are well-represented in our survey, and Virachey seems very likely to be a regional (Cambodia, Lao PDR and Vietnam) stronghold for these species. Neither Tiger nor Leopard were recorded; camera-trap survey effort was too limited to be confident of status, but given regional declines in both species, these are likely to be in very low number, and possibly extirpated in Virachey NP. However, Leopard was camera trapped in one trigger event in Veun Sai – Siem Pang National Park in 2010 (B. Rawson *in litt*. 2016), suggesting that it may still be present in Virachey NP too. Mainland Clouded Leopard *Neofelis nebulosa* and Dhole *Cuon alpinus*, which were camera-trapped frequently, now represent the largest common predators in Virachey NP. It is unclear what effects—if any—the declines of the largest wild predators have had on small carnivore populations.

Holden and Neang (2009) noted that small carnivores are probably not specifically targeted by Cambodian hunters but are caught in snares indiscriminately as bycatch; however, this could be changing because civets have been specifically targeted in other areas of Cambodia for the civet coffee trade (Phak 2016). This is now a major issue in southern provinces, particularly in relatively accessible areas of forest, with a single live common palm civet selling for more than 100 USD$ (T. Gray *in litt*. 2016). Iseborn *et al*. (2012) were told by villagers near Veun Sai – Siem Pang National Park that they do not target civets at all during their hunts, but if they are seen they take them opportunistically. We have observed and heard about porcupines (Hystricidae), pangolins *Manis* and lorises *Nycticebus* being targeted for traditional medicine by Ratanakiri and Mondulkiri hunters, but never small carnivores. Hunting lorises for traditional medicine is also documented in Starr *et al*. (2010). Virachey NP's boundaries form large sections of the international borders with Vietnam and Lao PDR, and the vast majority of these border lines are unmarked forested mountain areas, making it very easy for both Lao and Vietnamese poachers to penetrate Virachey NP. Our camera-traps recorded many poachers, and locals

who have viewed the pictures have identified many of them as Vietnamese based on their dress, their weapons, and other professional gear that most local Cambodians cannot afford or do not have. Vietnam is one of the global centres of demand for illegally traded wildlife, including small carnivores (Roberton 2007). The evidently secure current situation for small carnivores in Virachey NP will not last long without specific intervention.

Recommendations

Further camera trap surveys should be conducted in other areas of the Virachey NP, including the 'Dragon's Tail' area in the extreme northeast, as well as in riverine zones with more low-lying forests such as floodplain between the Phnom Veal Thom and Phnom Yak Yeuk grasslands—different habitats where other small carnivore species may be found.

Lao PDR's Nam Ghong PPA, a natural, uninterrupted extension of Virachey NP, warrants a camera-trap survey. Apparently only one systematic wildlife survey has been carried out there, for which no report was ever finalised (J. W. Duckworth *in litt*. 2016); the records of more significance to conservation or faunistics were included in Duckworth *et al*. (1999). Conservation efforts targeted at Nam Ghong PPA in Laos will be equally important to the future of Virachey NP's wildlife; road building and other development projects threaten the remotest regions of both areas.

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ORIGINAL ARTICLE

Lowe's Otter Civet *Cynogale lowei* does not exist

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Abstract.

Lowe's Otter Civet *Cynogale lowei* is known from only one specimen, which was collected in the winter of 1926-27 in northern Vietnam. It has been considered to be a global priority for small carnivore conservation. Its taxonomic status – a species or a highly disjunct subspecies of Otter Civet *C. bennettii* – has been debated. This study assessed the taxonomic validity of Lowe's Otter Civet through three principal methods: (i) a gross morphological comparison of tropical Asian otters, Otter Civet and 'Specimen 1927.12.1.93' (the Lowe's Otter Civet holotype), (ii) microscopic hair analysis from museum specimens of tropical Asian otters, Otter Civet and Specimen 1927.12.1.93 and (iii) DNA analysis of genetic material extracted from Specimen 1927.12.1.93, which was then compared with sequences from tropical Asian otters and Otter Civet. All methods indicated that the specimen is a juvenile Eurasian Otter *Lutra lutra*. The IUCN SSC Small Carnivore Specialist Group, conservation donors and practitioners should all immediately disregard 'Lowe's Otter Civet' as a priority, to ensure that the limited resources for conservation are not wasted.

Keywords: ancient DNA, microscopic hair morphology, Pocock, small carnivore, Vietnam, Viverridae

Introduction

During the winter of 1926-27, Jean Delacour and Willoughby Lowe collected a skin from a 'native' in Bac Kan province, northern Vietnam, at 500 feet above sea-level. At the time, Lowe entered the specimen in his workbook as an otter skin (Lowe 1947). It was brought to the British Museum (Natural History) (now, the Natural History Museum), South Kensington, where it was assigned accession number 1927.12.1.93, and identified as an Otter Civet *Cynogale bennettii* (Thomas 1928). There is no field tag on the specimen, and Thomas provided no justification for this identification in the accessions book. During review of Thomas's manuscript of his 1928 paper, although there was correspondence with Delacour and Lowe on other matters, neither indicated their disagreement with this identification (originals seen at the Natural History Museum). This northern Vietnam

locality is a remarkably disjunct record, Otter Civet only otherwise being known from the Thai–Malay peninsula, Borneo and Sumatra (Schreiber *et al*. 1989).

In a review of the rarer members of the oriental Viverridae, Pocock (1933) named this specimen as a new species, Lowe's Otter Civet *C. lowei*, on the basis of the following points (pp. 1034–1035): "…the extension of the white from the sides of the muzzle posteriorly over the cheek nearly as high as the eye and ear and along the sides of the neck at about the same level to the breast and all over the throat from the chin backwards, this white sharply marked off from the darkish brown tint of the top of the muzzle, of the head and nape without any blending of the two hues. General colour of the upper-side otter-brown without trace of silvery speckling, lower side paler brown; mystacial vibrissae dull buffy grey, not white as in *bennettii*…badly dressed and brittle, but the coat is fresh and glossy, not dull and fluffy as in the two young probably Sumatran examples of *bennettii*…'. Pocock (1933: 1035) considered his animal remarkably distinctive, and continued that "It is indeed quite possible that when the skull of *C. lowei* is known, the species will be found to differ generically from the southern form. At all events the difference between them in colour is as great as between [Banded Civet] *Hemigalus derbyanus* and [Owston's Civet] *Chrotogale owstoni*…".

Since Pocock (1933), no other specimen seems to have been referred to Lowe's Otter Civet and the taxon has been treated inconsistently as either a full species (Schreiber *et al*. 1989; Corbet & Hill 1992) or – despite Pocock's clarity in just how remarkably different the specimen was – as *C. bennettii* (Ellerman & Morrison-Scott 1966, Lekagul & McNeely 1977; Nowak 1991; Wozencraft 2005). Ellerman & Morrison-Scott (1966) stated that that too few specimens had been collected to regard it as a different species. Veron *et al*. (2006) re-examined the specimen and – in complete contrast to Pocock – considered that (p. 46) "Our morphological study of *C. lowei* does not support a specific distinction from *C. bennettii*". They left it an open question whether the species occurred in Vietnam and neighbouring countries, or not.

A 2005 compilation of 89 field survey reports for Vietnam covering 58 protected areas representing 67% of the total of 87 established at the time of the analysis made only one record of anything similar to a species of *Cynogale* (Roberton 2007). In total, globally there are only four reports that might be taken to refer to *C. lowei*:

- Phu Kradung National Park, Thailand: J. Nabhitabhata (pers. comm. 1987 to Schreiber *et al*. 1989) gave a detailed description of an animal that suggested he had seen a *Cynogale* species in 1986, and on range it was felt more likely to be Lowe's Otter Civet than Otter Civet.
- Yunnan, China: Wang Ying-Xiang reported various potential Lowe's Otter Civet skins in a fisherman's house in the 1970s–1980s (Schreiber *et al*. 1989, Veron *et al*. 2006).

- W.W. Thomas's unpublished notes report a mounted "Lowe's Otter Civet" seen in a collection in Vientiane, Lao PDR in the early 1980s. No basis is given for this identification and it is unclear if any photograph was taken (J. W. Duckworth *in litt*. 2009).
- Lowe's Otter Civet was listed in the "investment plan" for Phong Quang Nature Reserve, Ha Giang province, Vietnam (Anon. 1997). No basis for this record was given (Roberton 2007).

Examination of the specimen in the Natural History Museum (South Kensington, U.K.) in 2008 compelled us to question the decision to include this specimen in the genus *Cynogale* and opened up the possibility that it is in fact a skin of a juvenile otter. Subsequent evidence showed this to be so. The significance of this finding cannot be overstated: the most recent IUCN SSC action plan for weasels, civets, mongooses and related species listed Lowe's Otter Civet as one of nine species of the greatest global level of conservation concern (Schreiber *et al*. 1989), and as of 2008, the species at that time was listed as a priority species for funding by some donors. Communication with the relevant parts of the conservation community (e.g. donors, surveyors, and Small Carnivore Red List Authority Coordinator) in the interim has largely removed the risk of attention to a myth. This paper lays out the evidence behind the decision.

Materials and methods

Methods

The appropriate taxonomic treatment of Lowe's Otter Civet was considered through a comparative review of museum pelts (the specimen lacks a skull), microscopic hair analysis, and DNA analysis.

Morphological comparison

Skins of four otter species distributed in tropical Asia (57 Eurasian Otters *Lutra lutra*, 15 Hairy-nosed Otters *L. sumatrana*, 48 Smooth-coated Otters *Lutrogale perspicillata* and 71 Asian Small-clawed Otters *Aonyx cinereus*), of 16 Otter Civets *Cynogale bennettii* known or assumed to be from the main Sundaic range, and the type specimen of Lowe's Otter Civet ('Specimen 1927.12.1.93') (Figure 1) were examined in December 2009 at the Natural History Museum, South Kensington (BMNH) and the Raffles Museum of Biodiversity Research (now, the Lee Kong Chian Natural History Museum) (ZRC).

Microscopic hair analysis

Mid-dorsum guard- and underhairs were examined from all four otter species distributed in tropical Asia (four Eurasian Otters, two Hairy-nosed Otters, three Smooth-

coated Otters and four Asian Small-clawed Otters), and of six Otter Civets known or assumed to be from the main Sundaic range. Because of the poor condition of Specimen 1927.12.1.93, hairs were taken from various areas of its pelt (Figure 1). The specimens sampled are detailed in Table 1.

Figure 1. Pelt of Specimen 1927.12.1.93, the holotype and only specimen of Lowe's Otter Civet *Cynogale lowei* (Courtesy of the Natural History Museum, London, U.K.).

Table 1. Specimens sampled for microscopic hair analysis in the investigation of the validity of Lowe's Otter Civet *Cynogale lowei*.

Species	Age and sex	Number
Eurasian Otter *Lutra lutra* ssp.	Adult male	2
Eurasian Otter *Lutra lutra barang*	Adult male	1
Eurasian Otter *Lutra lutra nair*	Adult female	1
Hairy-nosed Otter *Lutra sumatrana*	Unsexed adult	1
Hairy-nosed Otter *Lutra sumatrana*	Juvenile male	1
Smooth-coated Otter *Lutrogale perspicillata*	1 adult female, 2 unsexed adults	3
Asian Small-clawed Otter *Aonyx cinereus*	2 adult male, 1 juvenile male, 1 female adult	4
Otter Civet *Cynogale bennettii*	3 unknown sex and age, 1 male adult, 2 unsexed adults	6
Specimen 1927.12.1.93	Unknown	1

The areas of animal hairs that may be used for identification are the cuticle cortex and the medulla. A representative number of guard hairs and underhairs for each of the samples was mounted on glass microscope slides in permanent mounting medium (Entellan) for a more detailed examination using transmitted light microscopy (Leica DME, up to 400 ×). Analysis was by initial assessment of the hairs with the unaided eye and with a stereo-microscope (Wild 3Z, 6.5-40 ×) in which the colour and hair profiles were determined. Hairs were examined on the basis of their morphological appearance, characteristics of the scale pattern, configuration of the medulla, and cross-sectional appearance. Cross-sections and scale cast patterns were obtained in accordance with the

procedures outlined in Brunner & Coman (1974). The nomenclature used to describe morphological characteristics exhibited by the hairs is in accordance with Brunner & Coman (1974) and Wildman (1954).

Genetic analyses

Genetic analyses compared Specimen 1927.12.1.93 with a blood sample of Asian Small-clawed Otter (provided by Copenhagen Zoo), and skin samples from Otter Civet (BMNH ZD 1850.10.24.17, the Natural History Museum), Hairy-nosed Otter (CN4494, Zoological Museum, University of Copenhagen) and Smooth-coated Otter (CN2531, Zoological Museum, University of Copenhagen). Mitochondrial genome sequence data for Eurasian Otter was taken from Ki *et al*. (2010). Genbank has no real quality control (Harris 2003) and the validity of the identification of some of the reference materials used not fully investigated by the authors. Otter species are often misidentified, including in museum collections (e.g. Barbanera *et al*. 2016); there is the potential that some of the material deposited in Genbank has been attributed to the wrong species. All specimens and samples used, including their Genbank numbers, are in Table 3.

DNA extractions were undertaken using the Qiagen DNEasy extraction kit. Initially all specimens were targeted with general mammalian primers that amplify a fragment of 116bp of the 16S ribosomal RNA. Following the initial results two additional fragments were PCR amplified, consisting of 135 and 167bp (respectively) of the mitochondrial DNA (mtDNA) control region, using the primers listed in Table 2. PCR amplification was performed in 25 μL volumes, using 1× PCR buffer, 2 mM of $MgSO_4$, 1.6 mg/ml Bovine Serum Albumin (BSA), 0.4 μM of each primer, 1 μM of dNTPs and 0.5U of High Fidelity Platinum Taq (Invitrogen, Carlsbad, CA, U.S.A.). Cycling conditions were: 94 °C for 2 min; 50 cycles of 94 °C for 30 s, 50/54°C for 30 s and 68 °C for 45 s followed by 72 °C for 7 min. PCR products were diluted 1:10 and subsequently cloned using TOPO TA cloning kit for sequencing (Invitrogen). A minimum of seven clones was Sanger sequenced for each sample using the commercial facility offered by Macrogen (Seoul, South Korea). DNA sequences were edited and aligned using Sequencher 4.7 (Gene Codes Corporation, Ann Arbor, MI). Sequences have been deposited in GenBank. A neighbour-joining tree was reconstructed on the data as well as using the relevant matching sequence excised from the publically available Eurasian Otter mitochondrial genome sequence (Genbank ID EF672696) for the control region fragment (167bp), using the program MEGA v.5.1 (Tamura *et al*. 2011), Kimura-2-parameters distance (Kimura 1980), gamma distribution and 1000 bootstrap replicates.

Table 2. Primer sequences used during DNA analysis.

Primer name	Primer sequence 5'-3'	Reference
16S3	TGGGGTGACCTCGGAGAAY	Haile *et al*. 2009
16S4	TAGGGTAACTTGKTCCGTTGA	Haile *et al*. 2009
Otter dloop 135F	GGAGCGAGAAGAGGTACACG	This study
Otter dloop 135R	GGTTTGCCCCATGCATATAA	This study
Otter dloop 167F	CGCAAGGATTGATGGTTTCT	This study
Otter dloop 167R	CTGTGCCTGCCCAGTATGTA	This study

Lastly, following the initial results and in the light of the subsequent public release to NCBI Genbank of complete mitochondrial genomes generated from vouchered and phylogenetically validated specimens derived from all the reference species mentioned above (Salleh *et al*. unpublished data), the complete mitochondrial genome of Specimen 1927.12.1.93 was generated through mining of mitochondrial DNA reads generated using Illumina HiSeq shotgun sequence data, following initial conversion of the DNA extract into an Illumina-compatible sequencing library using the NEB Next E6070 kit. Subsequently the library was PCR amplified and indexed, then sequenced on a partial lane using SR100bp chemistry. In total 16811802 sequence reads were generated, which were subsequently trimmed for sequencing adapters, low quality stretches and leading/tailing N's using AdapterRemoval 1.2 (Lindgreen 2012). The mitochondrial genome was reconstructed with MITObim 1.8 (Hahn *et al*. 2013) using the Eurasian Otter mitochondrial genome sequence (Genbank ID EF672696) as the seed reference. In order to obtain the mapping statistics of the samples, PALEOMIX (Schubert *et al*. 2014) was run with default parameters where reads shorter than 25 bp after trimming were discarded. The trimmed reads were aligned against the newly assembled mitogenome generated by MITObim using Burrows–Wheeler Aligner (BWA) (Li & Durbin 2009). Alignments showing low-quality scores and PCR duplicates are further removed using the MarkDuplicates program from Picard tools, and reads are locally realigned around small insertions and deletions (indels) to improve overall genome quality using the IndelRealigner tool from the Genome Analysis Toolkit (GATK) (McKenna *et al*. 2010).

Table 3. Details on specimens and samples used for the genetic analyses.

Genbank ID	Species	Assembly size	Locality	Tissue type	Specimen number	Institution /reference
KY117536	*Aonyx cinereus*	16153	captive	blood	n/a	CZ
KY117544	*Cynogale bennettii*	15784	Borneo	skin	BMNH ZD 1850.10.24.17	NHM
None	Specimen 1927.12.1.93	15625	northern Vietnam	skin	BMNH ZD 1927.12.1.93	NHM
EF672696.1	*Lutra lutra*	16536	n/a	n/a	n/a	Ki *et al*. 2010
KY117556	*Lutra sumatrana*	16580	Bang Nara, Thailand	dry skin	CN4494	ZM
KY117558	*Lutrogale perspicillata*	16042	Bang Nara, Thailand	dry skin	CN2531	

CZ: Copenhaguen Zoo, Denmark, NHM: Natural History Museum, U.K., ZM: Zoologisk Musuem, University of Copenhagen.

Following computational reconstruction, the final mitogenome sequence was curated by eye to detect any errors, resulting in a final mitogenome sequenced to an average depth of 54.93X. Both this new mitogenome and those of the aforementioned Hairy-nosed

Otter, Smooth-coated Otter, Asian Small-clawed Otter and Otter Civet were aligned to nucleotide positions 1 to 15447 of the Eurasian Otter reference mitogenome (EF672696.1) using Geneious v4.8.5 (Kearse *et al*. 2012). Subsequently a neighbour-joining tree was reconstructed on the data using the Geneious Treebuilder Jukes-Cantor Model and 100 bootstrap replicates.

Results

Morphological comparison

A number of key features differentiate Specimen 1927.12.1.93 from its suggested genus, *Cynogale*.

a) Carpal vibrissae

Thirteen adult and three juvenile skins of Otter Civet were examined. Supporting the conclusion of Pocock (1915) that *Cynogale* lacks carpal vibrissae, none was found. Carpal vibrissae were found in 170 of 177 (96%) of otter specimens examined including both adults and juveniles: in 50 of 53 Eurasian Otter skins (specimen condition forestalled determination in an additional four); 15 of 15 Hairy-nosed Otter skins; 43 of 44 Smooth-coated Otter skins (an additional four were in too poor condition for determination); and 62 of 65 Asian Small-clawed Otter skins (four were in too poor condition for determination, and two of the specimens without carpal vibrissae were new-born individuals with no vibrissae on the face). Specimen 1927.12.1.93 has five long carpal vibrissae on the left foreleg (there is no right leg on the specimen).

b) Foot webbing

In the Otter Civet skins examined no webbing reaches the proximal tips of the digit pads of either fore or hind foot. Pocock (1915) commented that in Otter Civet webbing extends no further up the digits than in many palm civet (Paradoxurinae) specimens and that in the Otter Civet in alcohol in BMNH the digits actually extend farther beyond the webbing than seems typical in Paradoxurinae. The extent of the webbing varies in the otter specimens examined, but it reaches the proximal tips of the digit pads in most specimens, and extends further than in any Otter Civet specimens viewed. Similarly, the foot webbing in Specimen 1927.12.1.93 extends to the toe tip on the three feet it has.

c) General coat colour and texture

Adult Otter Civets have a very dark brown dorsum (although one specimen in ZRC had a lighter brown coat, this was likely to reflect the antiquity of the specimen, from 1889) with whitish speckling. The underside is paler brown with no whitish speckling. The three infant Otter Civets examined have a much softer fur and no whitish speckling. The brown colour varied across the otter species and individuals but no adult or juvenile was found

with the whitish speckling typical of Otter Civet. Specimen 1927.12.1.93 had no whitish speckling. In addition, Otter Civet has a thick woolly underfur that is not found in otter specimens or in Specimen 1927.12.1.93.

d) Head colour pattern

In Otter Civet, the upper and lower lip, cheeks, chin and upper throat are white; there are two white spots on each cheek and above the eyes marking the origins of the vibrissae. The sides of the neck are as the upper body. In Eurasian Otter, Smooth-coated Otter and Small-clawed Otter the upper lip, cheeks, throat and sides of neck are a whitish grey, graduating to a light brown on the underside of the body and tail. In Hairy-nosed Otter the upper lip and chin are white, and the cheeks, sides of neck and underside are a marginally to moderately lighter brown than is the dorsum. The throat is patchy white and abruptly changes to a lighter brown on the lower throat. Similar to Eurasian Otter, Smooth-coated Otter and Small-clawed Otter, in Specimen 1927.12.1.93 the upper lip, cheeks, side of neck and throat are a whitish grey, graduating to a lighter brown on the underside.

e) Relative tail length.

Many Otter Civet specimens in BMNH have damaged tails so it was hard to determine relative tail length. In ZRC, where tails were better preserved, Otter Civet tail length was 19–33% of the head-body (HB) length and the tails were barely tapered. Otters were found to have more strongly tapered tails, with tail length range being 56–125% of HB. In Specimen 1927.12.1.93, the tail appears tapered and short and as prepared, looks to be around half HB. It is this short tail that gives this specimen a superficial resemblance to an otter civet. The specimen is in poor condition and appears to be comprised of at least two separate pieces matched back together rather oddly. Therefore, it is difficult to measure the relative tail length accurately as it is possible that some pieces of the specimen are missing.

Microscopic hair analysis

The comparison of the morphological characteristics and features of the hairs taken from the four tropical Asian otter species, Otter Civet and Specimen 1927.12.1.93 resulted in a number of significant features, and characteristics, that differentiate Specimen 1927.12.1.93 from *Cynogale*. Table 4 summarises the findings, with a more detailed description presented below.

a) Unaided eye and low-power microscopy of hairs

Specimen 1927.12.1.93 guard hairs were medium brown in the shield area with the remainder of the shaft a whitish/beige colour. Although the colour intensity of the guard hairs of the otter species varied, they all exhibited a uniform coloration of the shield and a whitish/beige colour in the remainder of the shafts. In contrast, some of the guard hairs

from the six Otter Civet specimens exhibited banding that results in the characteristic 'speckled' coat of the species.

The underhairs of Specimen 1927.12.1.93 and all the otter samples were 'sticky' in that they could not be separated and in addition to their waviness, the underhairs were twisted along the shafts like a corkscrew. These underhairs were fine, measuring approximately 5–10 μm in diameter. Although the underhairs of the six Otter Civet specimens were also wavy, they did not show the 'corkscrew' effect along their lengths and could be separated into individual hairs. The hairs were thicker than the under hairs of Specimen 1927.12.1.93, measuring approximately 10 μm in diameter.

b) Underhair scale pattern

Specimen 1927.12.1.93 shows a lanceolate scale arrangement on the entire length of the underhairs. Similarly, all 13 samples of otter underhair analysed exhibited the same lanceolate scale pattern. The 'tongue and groove' structure of the lanceolate otter underhairs, coupled with the twisting, is undoubtedly responsible for the 'stickiness' seen in the otter and Specimen 1927.12.1.93 underhairs. In contrast, the lanceolate scale pattern was not observed in the six Otter Civet underhair samples; these hairs exhibited a broad petal cuticle scale pattern. This 'softer' arrangement of scales is likely to be the cause of the relative ease with which the underhairs could be separated (Figure 2).

c) Guard hair scale pattern

The scale pattern on the guard hairs from the 13 otter samples and Specimen 1927.12.1.93 from base to tip is a narrow diamond petal and irregular pattern in the shield. The scale pattern on the guard hairs from the six Otter Civet samples, from base to tip, is a regular wave pattern (Figure 3–4).

d) Guard hair medulla

The medulla in the shield region in the hairs from the 13 otter samples and Specimen 1927.12.1.93 is a wide medulla lattice; the medulla in the shafts is fragmented or absent. The medulla in the shield portion of the six Otter Civet hairs is a narrow medulla lattice; the medulla in the shafts is fragmented or absent (Figure 5).

e) Underhair medulla

The underhairs from the 13 otter samples and Specimen 1927.12.1.93 exhibit an occasional fragmented medulla; no medulla was observed in the six Otter Civet underhair samples.

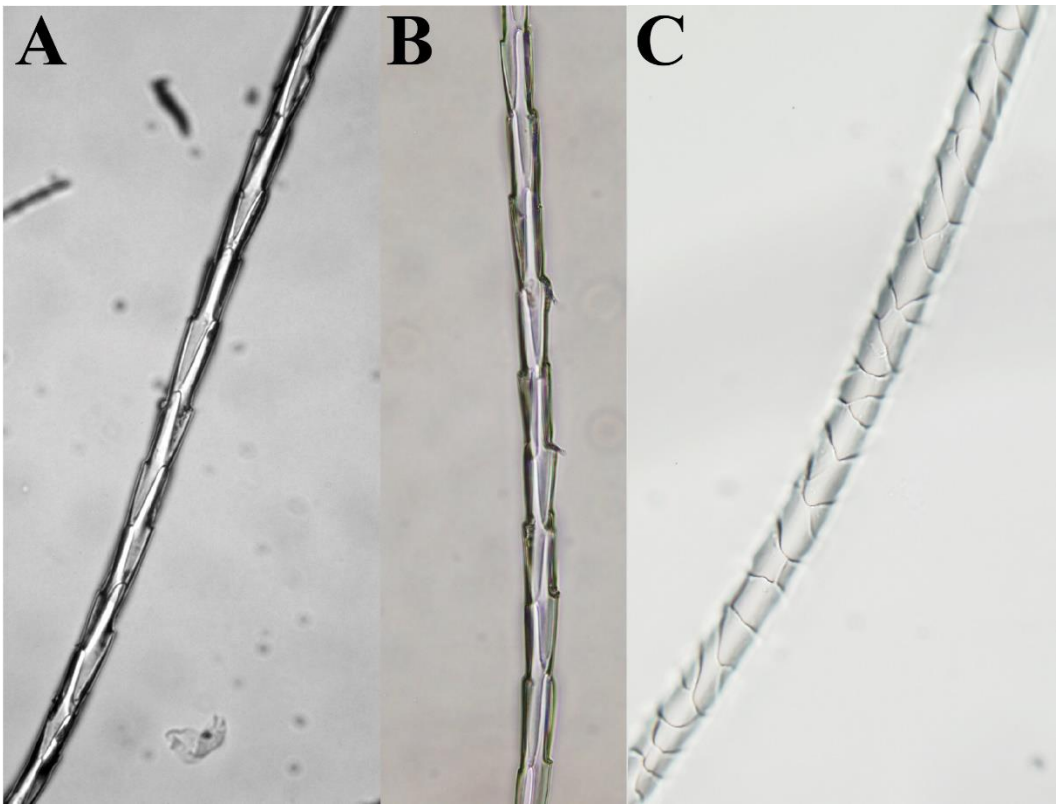

Figure 2. Scale cast patterns exhibited on under hairs from (A) Specimen 1927.12.1.93, (B) Eurasian Otter *Lutra lutra*, Hairy-nosed Otter *Lutra sumatrana*, Smooth-coated Otter *Lutrogale perspicillata*, Asian Small-clawed Otter *Aonyx cinereus* (all lanceolate) and (C) Otter Civet *Cynogale bennettii* (broad petal).

Table 4. Summary table for gross morphological and microscopic hair analysis of tropical Asian otter species and Specimen 1927.12.1.93

Identifying feature	Otter Civet *Cynogale bennettii*	Eurasian Otter *Lutra lutra*	Smooth-coated Otter *Lutrogale perspicillata*	Hairy-nosed Otter *Lutra sumatrana*	Asian Small-clawed Otter *Aonyx cinereus*	Specimen 1927.12.1.93
Carpal vibrissae	None	Present	Present	Present	Present	Present
Webbing on feet extends to toe tip	No	Yes	Yes	Yes	Yes	Yes
Tail length as % of head-and-body length	19–33%	All tropical Asian otter spp: 56–125%	As set looks to be around 50%, though specimen in poor condition			
Tail form	Not tapered	Tapered	Tapered	Tapered	Tapered	Appears tapered
Thick, woolly underfur	Yes	No	No	No	No	No
Head colour pattern	Upper and lower lip, cheek, chin and upper throat are white. Two white spots on each cheek and above the eyes marking spot of the vibrissae. Underside, slightly lighter than upper. Side of neck as upper body	Upper lip, cheeks, side of neck and throat are white/grey, graduating to a light brown on the underside	Upper lip, cheeks, side of neck and throat are white/grey, graduating to a light brown on the underside	White upper lip, chin, and patchy white throat. White does not extend to the cheeks. Marginally lighter brown on cheeks and sides of neck and underside. Patchy white throat abruptly changes to lighter brown on throat	Upper lip, cheeks, side of neck and throat are white/grey, graduating to a lighter brown on the underside	Upper lip, cheeks, side of neck and throat are whitish, graduates to a lighter brown on the underside
Whitish speckling in coat	Adults have whitish speckling. Infants no whitish speckling	No whitish speckling	No whitish speckling	No whitish speckling	No whitish speckling	No whitish speckling
Banding on guard hair	Yes	None	None	None	None	None
Under hair scale pattern	Broad petal	Lanceolate	Lanceolate	Lanceolate	Lanceolate	Lanceolate
Guard hair scale pattern	Regular wave	Narrow diamond	Narrow diamond	Narrow diamond	Narrow diamond	Narrow diamond
Primary guard hair scale pattern (mid-shield)	Regular wave	Close irregular wave, rippled margins	Close irregular wave, rippled margins	Close irregular wave, rippled margins	Close irregular wave, rippled margins	Close irregular wave, rippled margins
Guard hair medulla lattice	Narrow	Wide	Wide	Wide	Wide	Wide
Under hair shaft diameter	15–20 µm	5–10 µm	5–10 µm	5–10 µm	5–10 µm	5–10 µm
***Guard hair c/s shape**	Circular and oval	Elongated oblong and oval	Elongated oblong and oval	Elongated oblong and oval	Elongated oblong and oval	Elongated oblong and oval
***Under hair c/s shape**	Smooth, circular	Angular	Angular	Angular	Angular	Angular

*c/s = cross-section

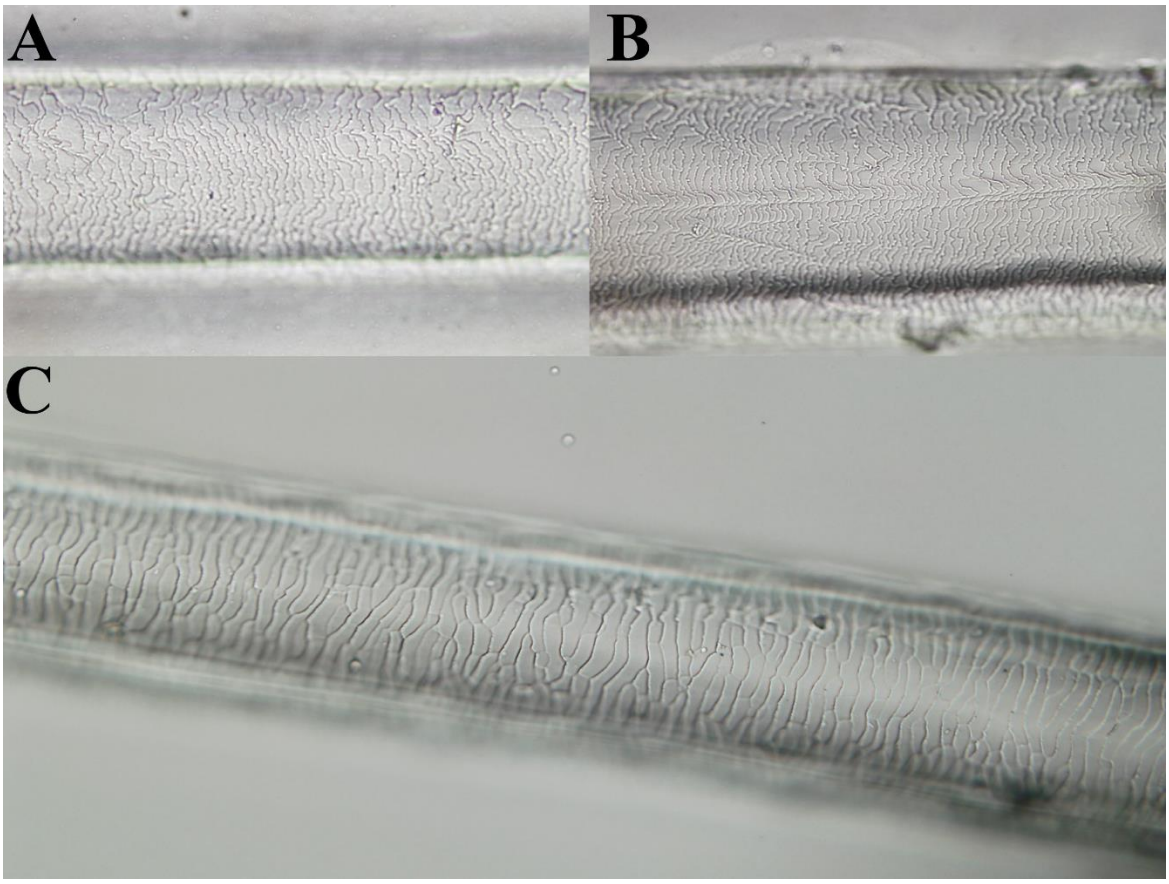

Figure 3. Scale cast patterns of primary guard hairs, mid-shield area of (A) Specimen 1927.12.1.93, (B) Eurasian Otter *Lutra lutra*, Hairy-nosed Otter *Lutra sumatrana*, Smooth-coated Otter *Lutrogale perspicillata*, Asian Small-clawed Otter *Aonyx cinereus* (all close irregular wave, rippled margins), and (C) Otter Civet *Cynogale bennettii* (near regular wave, smooth margins).

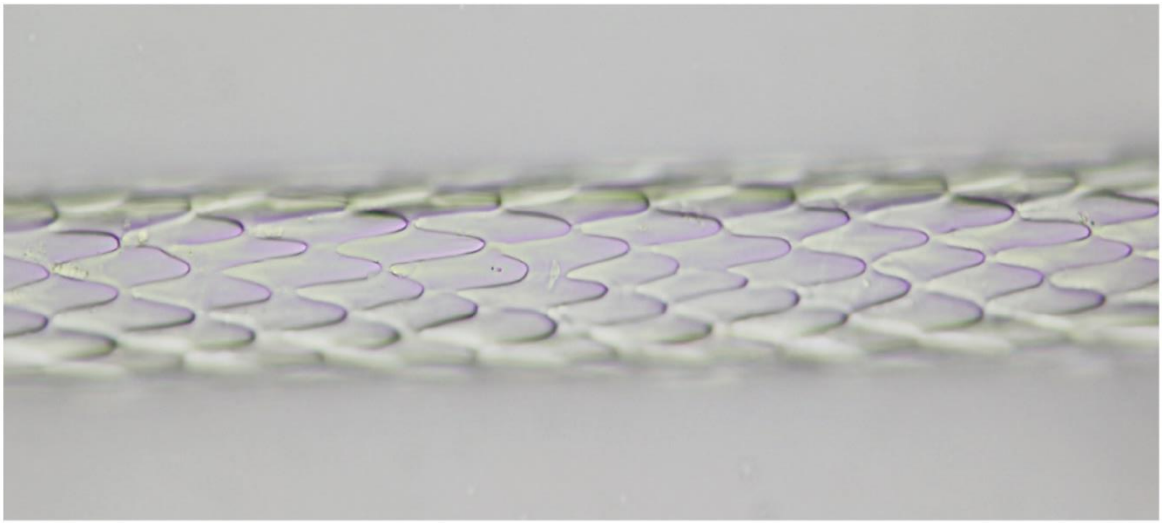

Figure 4. The narrow diamond petal scale pattern seen on the guard hairs of the 13 otter samples and Specimen 1927.12.1.9.

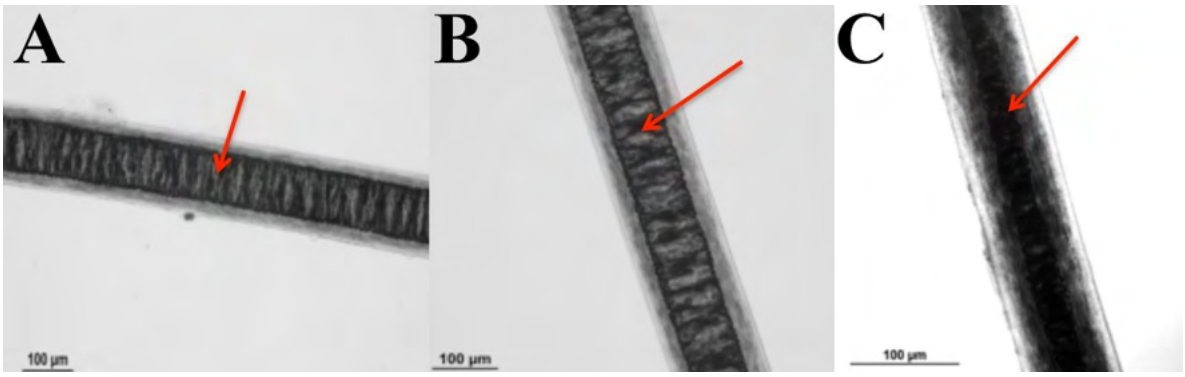

Figure 5. Medullae configurations exhibited in primary guard hairs of (A) Specimen 1927.12.1.93, (B) Eurasian Otter *Lutra lutra*, Hairy-nosed Otter *Lutra sumatrana*, Smooth-coated Otter *Lutrogale perspicillata*, Asian Small-clawed Otter *Aonyx cinereus* (all wide lattice medulla), and (C) *Cynogale bennettii* (narrow lattice medulla). Red arrows indicate medullae.

f) Underhair shaft diameters

The shafts of the underhairs from the 13 otter samples and Specimen 1927.12.1.93 were very fine, measuring 5–10 µm in diameter. This contrasted with the underhairs from the six Otter Civet samples which were significantly wider, with shaft diameters of 15–20 µm.

g) Cross-section of guard hairs

The hairs from the 13 otter samples and Specimen 1927.12.1.93 exhibited elongated oblong and oval cross-sections. The hairs from the six Otter Civets exhibited circular and oval cross-sections (Figure 6).

h) Cross-sections of underhairs

The hairs from the 13 otter samples and Specimen 1927.12.1.93 exhibited angular cross-sections whereas the cross-sections from the six Otter Civets were smooth and circular.

Genetic analysis

a) 16S ribosomal RNA

The sequence for Specimen 1927.12.1.93 (the Lowe's Otter Civet holotype), is a 100% match to that of the Eurasian Otter, and clearly distinct from all the other species analysed.

b) mtDNA control region

The biggest fragment was amplified successfully for all the species bar Otter Civet; this exclusion was perhaps due to significant genetic divergence of the sequences from

Eurasian Otter. The control region sequences are reliably of mitochondrial origin, not nuclear-encoded copies of mitochondrial sequences (numts), because they were consistent between fragments generated with different primer pairs and replicable between amplifications when the same primer pair was used. Furthermore, no alternative sequence was observed among the clones. All the sequences were aligned against the Eurasian Otter complete mtDNA genome. The neighbour-joining tree that was reconstructed (Figure 7) clearly shows that the Specimen 1927.12.1.93 falls within the Eurasian Otter mitochondrial DNA diversity (93% bootstrap).

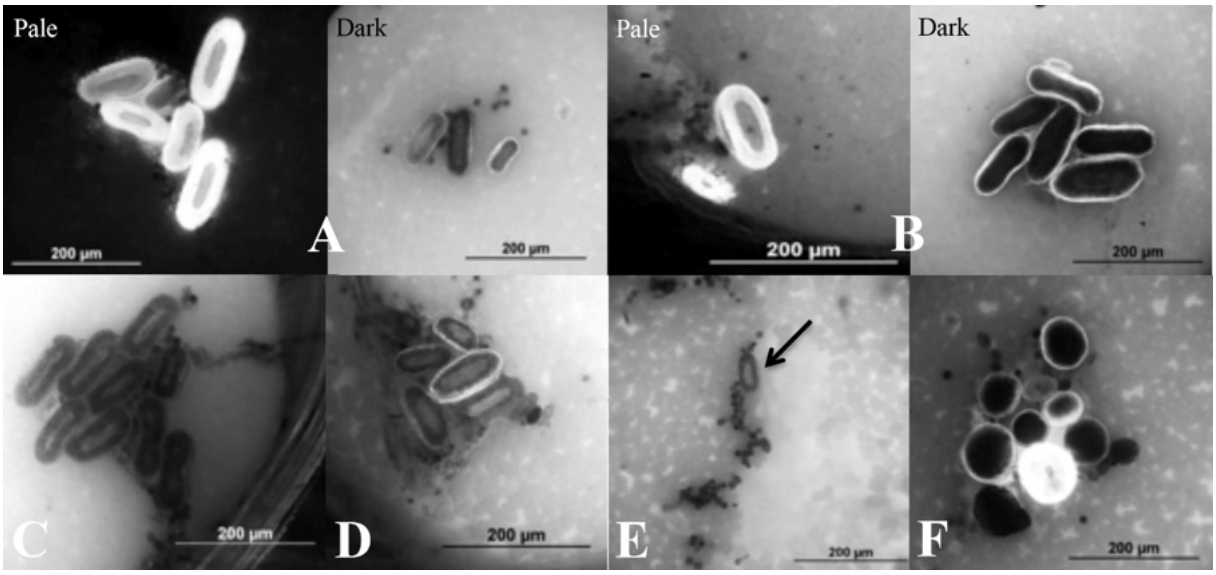

Figure 6. Cross-sectional configurations in primary guard hairs, mid-shield area of (A) Specimen 1927.12.1.93 (Paler and darker hairs), (B) Eurasian Otter *Lutra lutra* (Paler and darker hairs), (C) Hairy-nosed Otter *Lutra sumatrana*, (D) Smooth-coated Otter *Lutrogale perspicillata*, (E) Asian Small-clawed Otter *Aonyx cinereus* (black arrow indicates relevant cross-section), and (F) Otter Civet *Cynogale bennettii*. Specimen 1927.12.1.93 and otter hairs have oblong cross-sections, whereas *Cynogale bennettii* hairs have circular cross-sections.

c) The neighbour-joining tree reconstructed on the complete mitochondrial genome sequences confirms the findings based on the shorter DNA fragments, with 100% bootstrap support for the clade containing Specimen 1927.12.1.93 and the Eurasian Otter (Figure 8).

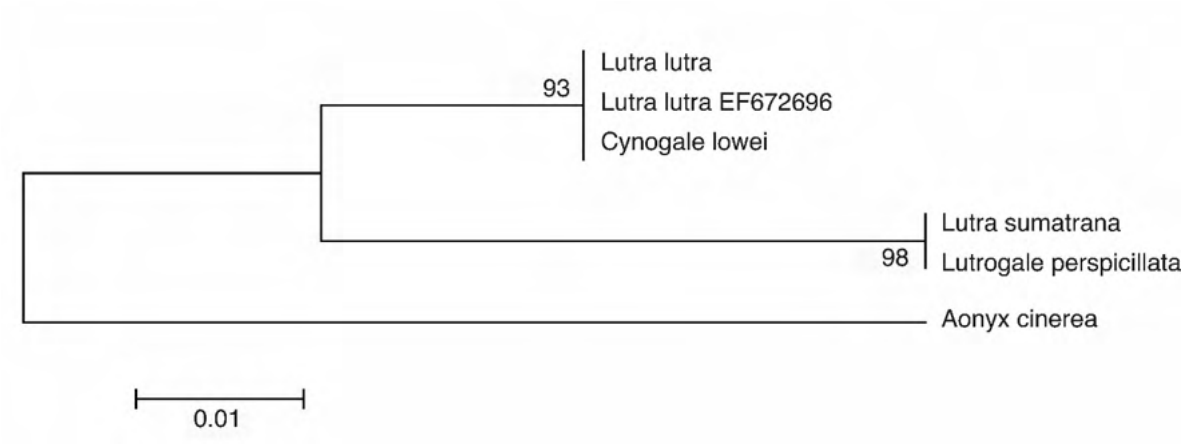

Figure 7. Neighbour-joining tree based on 132bp of mtDNA control region. The grouping of Specimen 1927.12.1.93 with the two specimens of Eurasian Otter *Lutra lutra* is supported by a bootstrap of 93%.

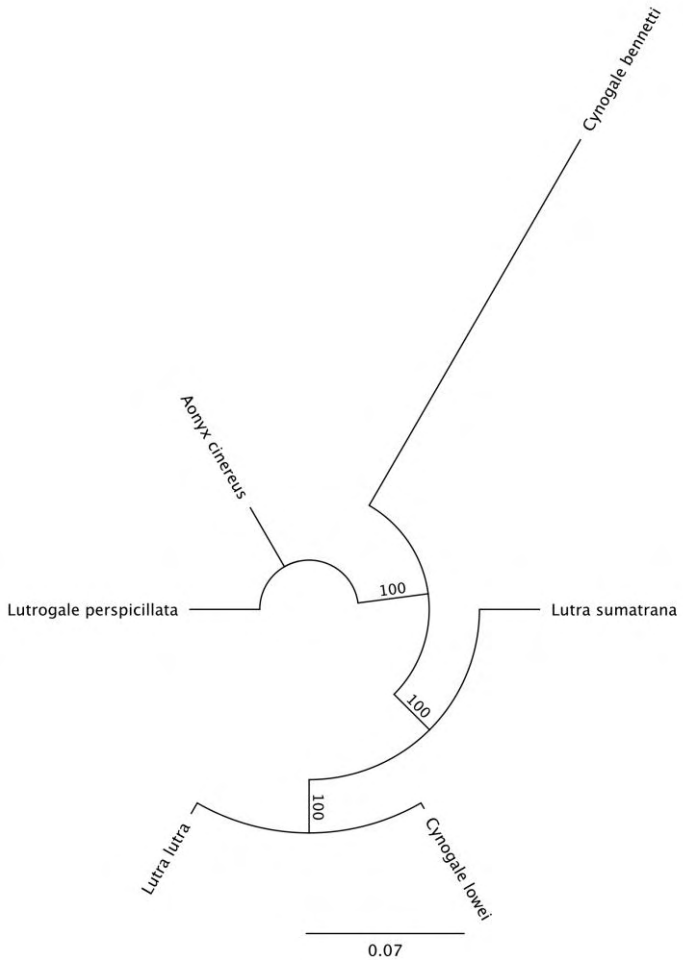

Figure 8. Neighbour-joining tree based on near-complete mitochondrial genome sequences confirming clustering of Specimen 1927.12.1.93 with the Eurasian Otter *Lutra lutra* with 100% bootstrap support.

Discussion

Gross morphological examinations, DNA extractions and microscopic hair analyses all suggest strongly that Lowe's Otter Civet is not a valid taxon. BMNH Specimen 1927.12.1.93 collected by Delacour and Lowe in 1927 is in fact a young Eurasian Otter, neatly consistent with the collector's original field identification as an otter. Pocock's (1933) prediction that further information would show that his 'Lowe's Otter Civet' was not congeneric with Otter Civet can now be shown to be correct, although in a way entirely different from that which he envisaged. *Cynogale lowei* Pocock, 1933 should be placed in the synonymy of *Lutra lutra*. The IUCN SSC Small Carnivore Specialist Group, and conservation donors and practitioners, should all immediately disregard the species as a priority, to ensure that the limited resources for conservation are not wasted. With the re-identification of this specimen, there is no evidence that the genus *Cynogale* is polytypic. Similarly, the credence that Specimen 1927.12.1.93 had been lent to sight-records from countries neighbouring Vietnam as potentially referring to a form of otter civet has now been removed. There is no basis to consider that the genus *Cynogale* is likely to extend outside the Sundaic sub-region. Two English names are used for *C. bennettii*: Otter Civet and Sunda Otter Civet. The 'Sunda' in the latter name is needed only if Lowe's Otter Civet is recognised; *C. bennettii* should forthwith be known as merely 'Otter Civet'.

Acknowledgements

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IUCN/SSC Small Carnivore Specialist Group

SHORT COMMUNICATION

Confirmation of the continued occurrence of Binturong *Arctictis binturong* in China

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Abstract.

A Binturong *Arctictis binturong* and two Common Palm Civets *Paradoxurus hermaphroditus* were photographed in the possession of local hunters in south-western Yunnan province, China, along the China-Myanmar border, in August 2014. This is the first confirmed record of Binturong for many years within its Chinese range.

Keywords: *Arctictis binturong*, distribution, conservation status, southwest China.

Binturong *Arctictis binturong* is the largest member of the civet family (Viverridae) and is classified as Vulnerable on the IUCN Red List of Threatened Species (IUCN 2014). It occurs from North-east India and Bangladesh, east through mainland South-east Asia to Borneo, Java and Sumatra (Corbet & Hill 1992), with a small range in southern China (Wang 2003) (Fig. 1; this includes several parts of China where the species' occurrence is predicted based on suitable habitat and/or climate (Widmann *et al.* 2008)). Lau et al. (2010), in an analysis of extensive multi-method surveys, speculated that the species might now be extinct in south China (Guangxi, Guangdong, Hainan, Hong Kong and Macau), whence only one confirmed record, from Dayaoshan in central Guangxi in 1926 (Wang 1998), and two uncertain interview records in Hainan province far from its known range (Lau *et al.* 2010), are available; there have been no published records from anywhere across its range in China for 22 years. This suggests that the 2008 map presented in Fig. 1 might be highly optimistic. This note presents a record from Yunnan province, along the Myanmar border, in August 2014, confirming the persistence of Binturong in the wild in China.

On 15 August 2014, a dead adult male Binturong (15-20 kg) was photographed in the flesh at Rui Li (23°56′N, 97°33′E), Yunnan province, China (Figure 1) along with two Common Palm Civets *Paradoxurus hermaphroditus* (Figure 2). The animal was

photographed 2.5 km from the Myanmar border, the habitat on both sides of the border being similar. The animals were being carried out of the forest by local hunters for bushmeat. It is highly unlikely that the animals were taken from the Myanmar side as this would involve crossing a boundary river with firearms; conversations with one of the hunters confirmed that the animals were indeed taken from the Chinese side of the border.

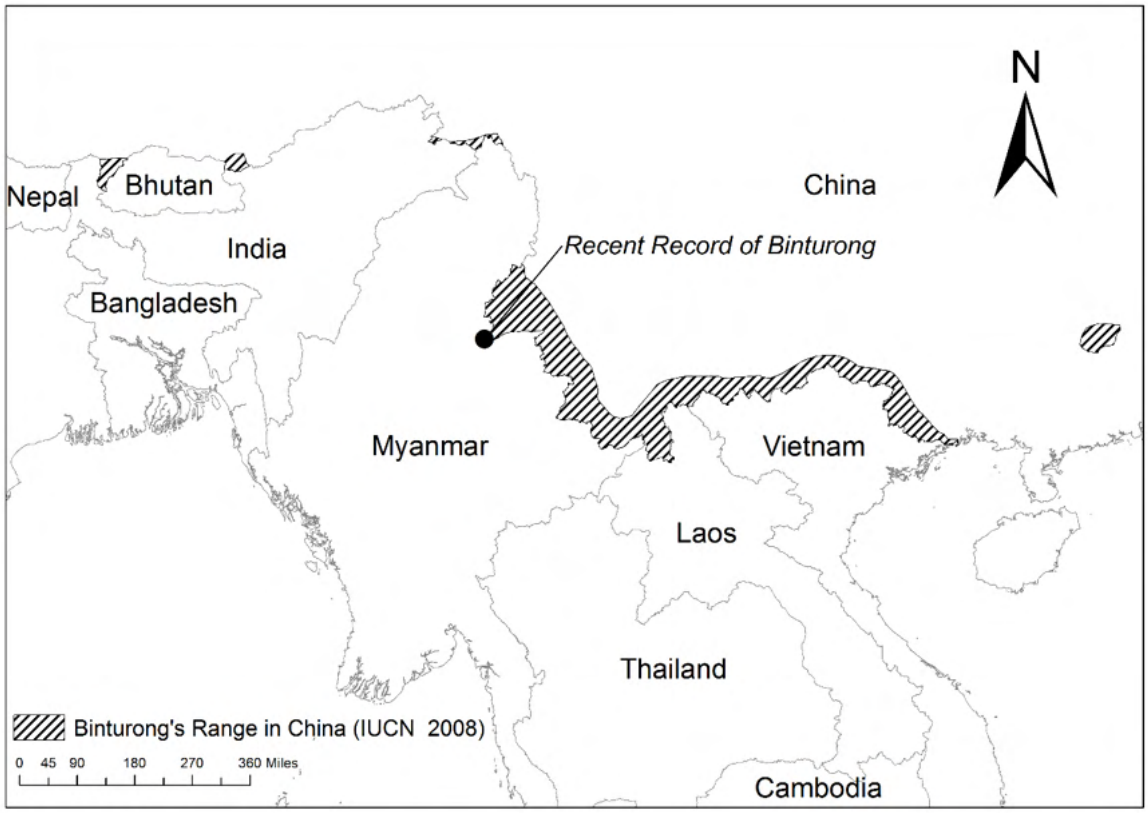

Figure 1. The confirmed record (black dot) and a partly predictive representation of the distribution range (shaded area) of Binturong *Arctictis binturong* in China (Widmann *et al.* 2008)

This is the first record of Binturong within the Chinese range for more than two decades, the last skin specimen being collected in 1992 in Yunnan province. Lau *et al.* (2010) traced no record from Guangxi province, where it certainly used to occur (Wang 1998), or from Hainan, where it has been recorded only provisionally. Occurrence in various parts of Yunnan (e.g. Yingjiang. Mengla. Menghai) is evinced from eight coat specimens collected in this area before 1992 and kept in the Kunming Institute of Zoology (Wang 2003). The lack of camera-trap records from the province's far south (Zhang *et al.* 2014) suggests the species might indeed be rare in China. However, interviews with one of the hunters reveal the lack of awareness regarding the higher conservation threat status of Binturong both in China and internationally, compared with other species of Viverridae still widespread in China.

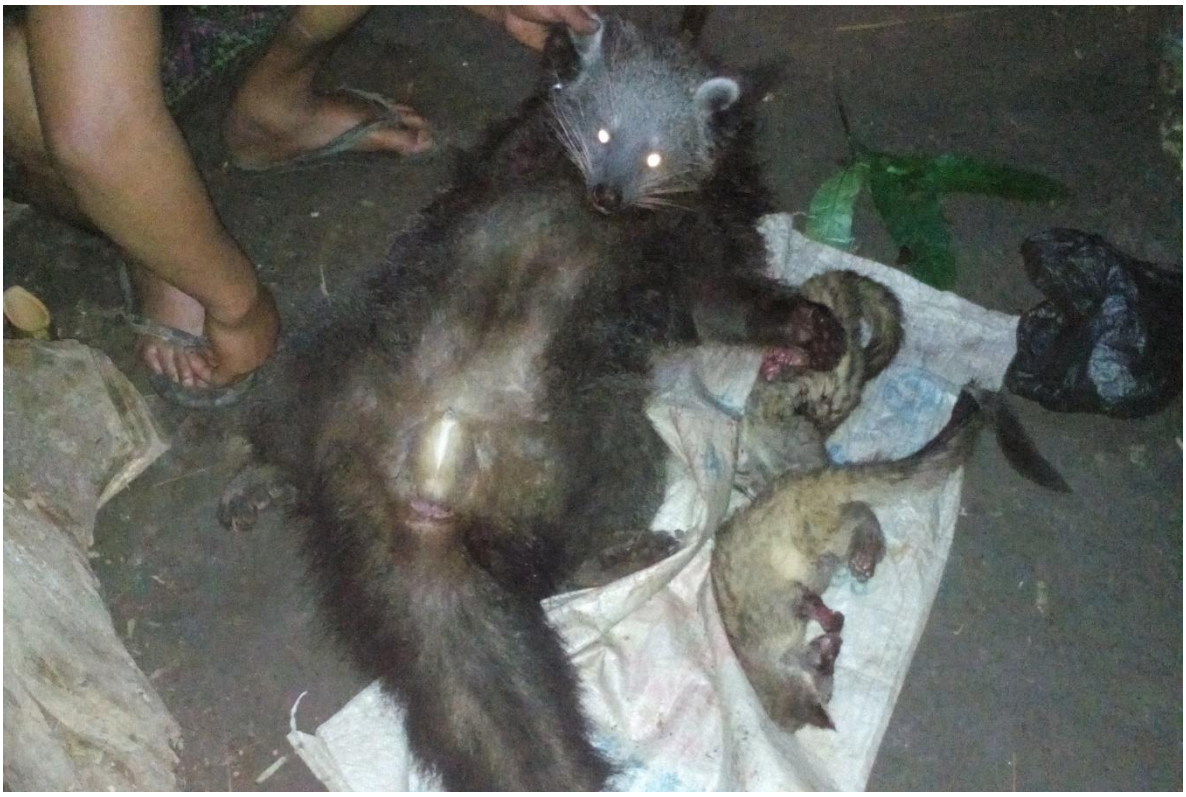

Figure 2. A Binturong *Arctictis binturong* and two Common Palm Civets *Paradoxurus hermaphroditus* photographed in the possession of local hunters in Aug. 2014, at Rui Li, Yunnan province, China

Binturong may now be rare in much of the north-eastern part of its global range. Willcox *et al.* (2014: Table SOM3), in a review of camera-trapping studies across Vietnam, traced records from only two of 11 surveys. Gray et al. (2014), collated results from three of the largest camera-trap surveys in Lao PDR, which, over 33,000 camera-trap-nights, produced only one record of Binturong. Eleven of twenty-one survey areas confirmed to hold the species across Thailand: six areas via camera-traps and another five by other methods such as direct sighting, live-trapping and confiscation of hunted remains (Chutipong *et al.* 2014). Than Zaw *et al.* (2008) camera-trapped the species in six of 18 survey areas across Myanmar. Although comparable collations are not available from Cambodia and countries to the south, in at least Borneo, the species seems to be encountered far more frequently (Semiadi. *et al.* 2016). There are no collations of recent locality records from India or Bangladesh, although the species certainly persists in this region (e.g. Murali *et al.* 2013).

As a largely arboreal animal, Binturong might be less detected by camera-traps than are ground-dwelling species of comparable local abundance; this is evidently the case for the highly arboreal Small-toothed Palm Civet *Arctogalidia trivirgata* (Willcox *et al.* 2012). However, Small-toothed Palm Civet is an agile user of small, canopy branches and is adept at jumping between gaps (Duckworth & Nettelbeck, 2008); the heavy Binturong lacks this

agility and so, for moving through the forest, may often need to descend to the ground (see Chutipong *et al.* 2014). Thus, it may be reasonable to assume that the rarity of recent records from China and northern South-east Asia reflects a genuine rarity of the species. The most probable cause of this is hunting: recent records from Vietnam and Lao PDR, where hunting is almost ubiquitously high, are extremely rare, whereas the species can still be detected, albeit not frequently, in Thailand and Myanmar, where hunting levels are not as high (Chutipong *et al.* 2014).

Binturong persists in China, though it may not be common. Conservation actions, chiefly protection from hunting, should be prioritized in the management plans of the areas in which it is likely to occur. Any recent records from within the Chinese range also warrant publication to clarify the species' current status in the country.

Acknowledgements

We are grateful to J. W. Duckworth who provided information about the species' status in adjacent countries.

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IUCN/SSC Small Carnivore Specialist Group

SHORT COMMUNICATION

Recent records of the elusive Ratel *Mellivora capensis* (Schreber, 1776) in Morocco and case of human persecution

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Abstract.

Ratel *Mellivora capensis* is a rare and localized Mustelidae in a large part of its range in Morocco which is home to the largest Mediterranean population, if not almost the only one in this ecoregion. We discovered an important area for the species with probably a high density of its population given the number of records reported by the local human population interviewed during a recent survey in Guelmim region. We also report a new case of human persecution by local beekeepers.

Observations récentes du mystérieux Ratel Mellivora capensis (Schreber, 1776) au Maroc et cas de persécution humaine

Résumé.

Le Ratel *Mellivora capensis* est un Mustélidé rare et localisé sur une grande partie de son aire de distribution au Maroc, pays qui abrite la population méditerranéenne la plus large de cette espèce, si ce n'est pratiquement la seule dans cette écorégion. Nous avons découvert une zone importante pour l'espèce avec probablement une grande densité de sa population étant donné le nombre d'observations reportées par la population humaine locale interviewée lors d'une enquête récente dans la région de Guelmim. Nous reportons aussi un nouveau cas de persécution humaine par des apiculteurs locaux.

Keywords: Aferkat Sanctuary, Guelmim region, beekeepers, illegal killing, persecution.

Ratel (or Honey Badger) *Mellivora capensis* is a medium-sized mustelid (6–14 kg) that has a wide distribution range, which extends from southern Morocco and south-western Algeria through most of sub-Saharan Africa to South Africa's Western Cape, and outside of Africa through Arabia and central Asia to the Indian peninsula (Proulx *et al.* 2016), typically exhibiting low population densities (Vanderhaar & Hwang 2003, Do Linh San *et al.* 2016).

In Morocco, the Ratel is a rare and threatened mammal (Cuzin, 2003) that exists mainly in Central and Eastern High Atlas, along Dra'a river and in Tafilat as well as in Moroccan Atlantic Sahara (Aulagnier & Thévenot 1986, Cuzin 2003) where we know very little about its ecology and social behavior (Cuzin 1996, Cuzin 2003). The species occurs in different habitat types from high mountains, where it reaches 3,000 m asl, to sea level plains in the Atlantic Sahara in arid and semi-arid areas. Habitats with scattered vegetation and encompassing rocky hills are preferably used by this carnivore species.

Regarding the interaction with human populations, it is commonly reported that Ratels are regularly persecuted by beekeepers and farmers throughout their distribution range (Do Linh San *et al.* 2016) due to their diet that includes honey and some farm animals (Do Linh San *et al.* 2016). To a smaller extent, they are also hunted by bushmeat traders in some sub-Saharan African countries (Do Linh San *et al.* 2016). This mustelid is also killed inadvertently by the non-selective use of poisons and gin traps set for other similar-sized carnivores (Begg & Begg 2002).

In Morocco, like elsewhere in their distribution range (Begg & Begg 2002), Ratels are occasionally persecuted for attacks on beehives; for instance, in the region of Aouinet Iloughmane in southern Morocco (Cuzin 2003).

In 2015, a seasonal survey that included transects (n = 10) with a total length of 122 km and interviews of local human population (farmers, beekeepers, hunters, shepherds and others) was carried out in the region of Aferkat in Guelmim Province (Figure 1) to (i) draw up a preliminary list of local biodiversity (fauna and flora), and (ii) investigate the distribution of local fauna and its interaction with humans via interviews with farmers, shepherds and hunters.

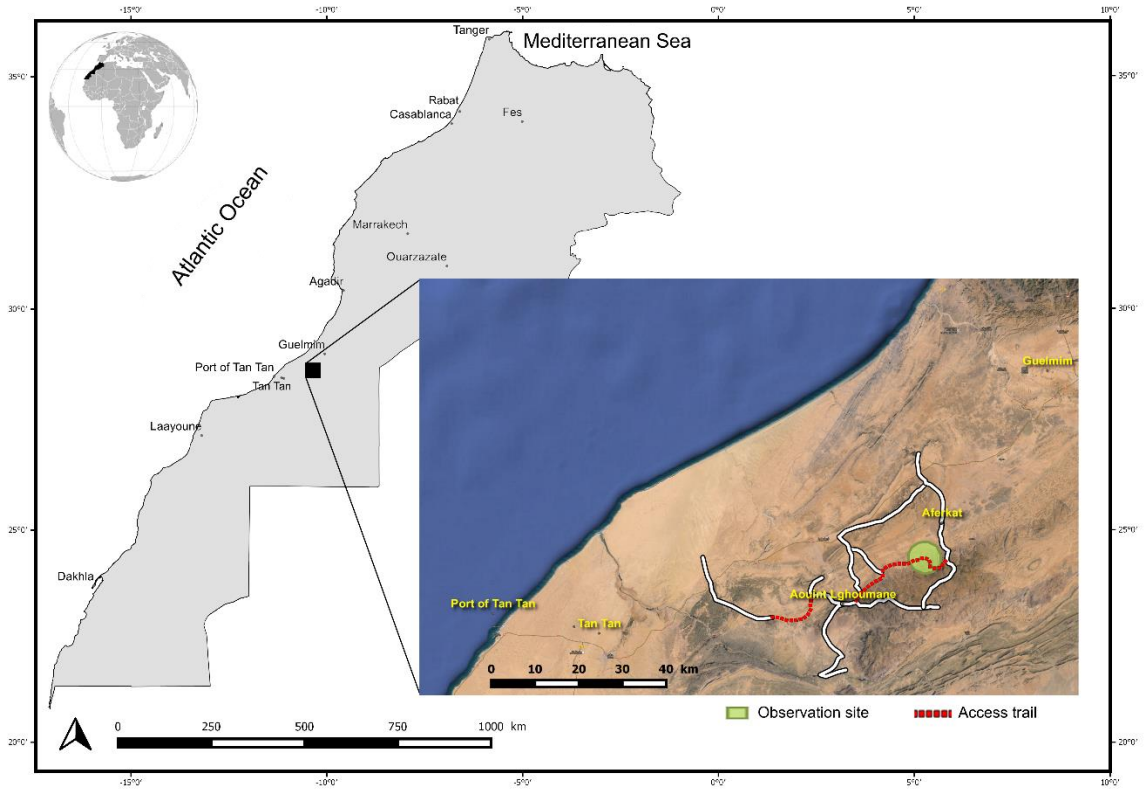

Figure 1. Location of the study area with Ratel records in Morocco.

The site provides habitats that attract a rich diversity of mammals observed during our survey like Ratel, Golden Jackal *Canis aureus*, Barbary Wild Boar *Sus scrofa*

barbarus, Red Fox *Vulpes vulpes*, African Wild Cat *Felis silvestris lybica* or Cuvier's Gazelle *Gazella cuvieri*. We found that Barbary Fig *Opuntia ficus-indica* cultivations, that are extensive in the study area, provide an ideal shelter locally for terrestrial fauna (Figure 2).

Figure 2. Habitat of Ratel *Mellivora capensis* in the study area (Photo: S. I. Cherkaoui).

According to the interviewed beekeepers (n = 8), Ratel is a fairly common animal in Aferkat. Indeed, two to five attacks per year were reported during the last decade which made this predator the main enemy for beekeepers in that area. Traditional beehives are located on the ground (Figure 3A) which makes them very vulnerable to a number of predators. Ratel's presence in the area probably would have gone unnoticed (because of its nocturnal habits) if the local human populations had not practiced beekeeping.

In October 2015, a male adult Ratel was killed by local beekeepers after being trapped (Figure 4), confirming the existing conflict with this carnivore. Two to three traps are systematically placed around the fence in order to catch the Ratels attracted by honey. However, given the high density of Wild Boars in this region, they are more regularly caught. Beekeepers do try to protect hives from Ratels' assaults by putting them within a fenced-off area (Figure 3B). This technique may reduce conflict but does not provide total protection. According to beekeepers up to five Ratels were killed in the last decade. The

number of sightings of Ratels in the past decade (≥2 observations per year between 2005 and 2015) in this area compared to only 28 observations in the whole country between 1986 and 2000 (Cuzin 2003) suggest that the Guelmim Sanctuary may be one of the most important stronghold for the species in Morocco.

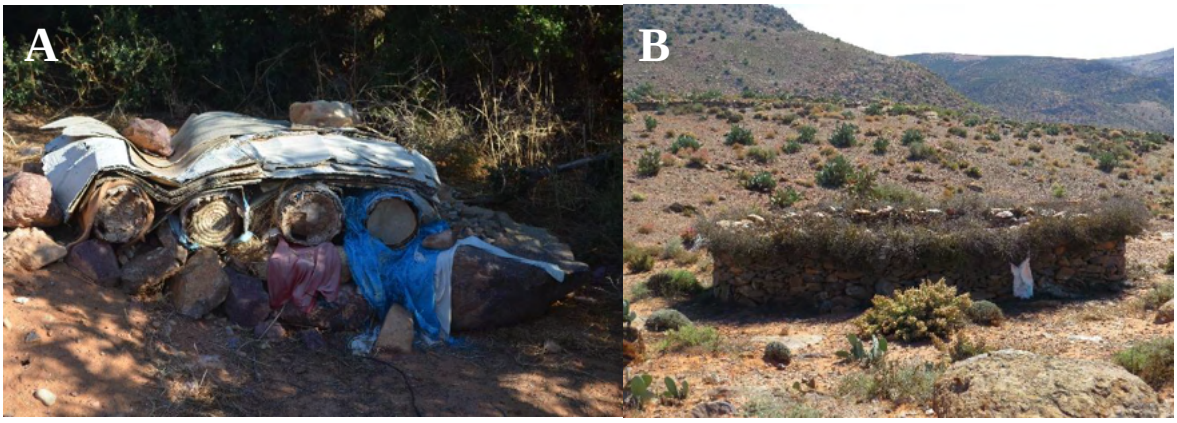

Figure 3. (A) Traditional beehives; (B) Fence used to protect beehives against Ratel (Photos: S. I. Cherkaoui).

Figure 4. Male Ratel killed by local beekeepers in October 2015 in the area of Aferkat (Photo: S. I. Cherkaoui).

Although Ratel is listed by IUCN in the Least Concern category (Do Linh San *et al.* 2016), it could be undergoing localized declines in common with many predators over the world. Insufficient data on this species make it very difficult to assess Ratel's population trends and consequently its conservation status. The very restricted distribution of Ratel sightings in both the Mediterranean and North Africa regions combined with evidence of species persecution by local populations in this area suggests that an extensive study to determine Ratel's population extent and status in this area is severely needed.

A specific awareness-raising program is, therefore, important to advocate for human population willingness and participation in Ratel's conservation as well as that of other threatened mammals living in Aferkat region. Local wildlife authorities in association with civil societies could support measures such as reinforcing fences around traditional beehives in order to reduce human–Ratel conflicts

Acknowledgements

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IUCN/SSC Small Carnivore Specialist Group

SHORT COMMUNICATION

A confirmed sighting of Pousargues's Mongoose *Dologale dybowskii* in Garamba National Park, Democratic Republic of the Congo

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Abstract.

With less than a handful of observations, Pousargues's Mongoose *Dologale dybowskii* is one of the world's least known carnivores. This report describes a confirmed observation of Pousargues's Mongoose in Garamba National Park (Democratic Republic of the Congo) on the 2nd of October 2016, being only Garamba's first reported sighting in more than 50 years.

Résumé.

La mangouste de Dybowski *Dologale dybowskii* est considérée comme l'un des carnivores les moins connus du monde. Cette note décrit l'observation d'une mangouste de Dybowski au Parc National de la Garamba (République Démocratique du Congo) faite le 2 octobre 2016, étant seulement la première observation en plus de 50 années.

Keywords: Savannah mongoose, Nagero, Herpestidae, Sudano Guinean savannah, African Parks.

After a period of more than three decades without any reported observation in their currently known range in Africa, Pousargues's mongooses have been confirmedly seen in July 2013 at Semliki safari lodge, Uganda (Woolgar 2014), and between 2009 and 2015 in the Chinko reserve, Central African Republic (Aebischer *et al.* 2013, Thierry Aebischer, pers. comm. 2016). Except for these observations, the species is only known from 31 museum specimens and a handful of historical observations (Aebischer *et al.* 2015).

Carrying out a research on the local Kordofan giraffe *Giraffa camelopardalis antiquorum* population, I am currently based in Garamba National Park (Figure 1A). During a late morning walk, on October 2 2016, in the park management camp, I observed a single mongoose on a road towards the river, which I could not immediately identify (exact location: 3° 45' 18.5" N, 29° 31' 28.6" E; altitude: 737 m asl; Figure 1B). The animal had a generally brown body with a tint of ochre, a distinct grey head and a pink nose that was visible from the rather long distance I was standing (±40 m). The grey head with pink nose and brown edges around the eyes gave a mask-like impression. Overall the mongoose had quite a compact body with short legs.

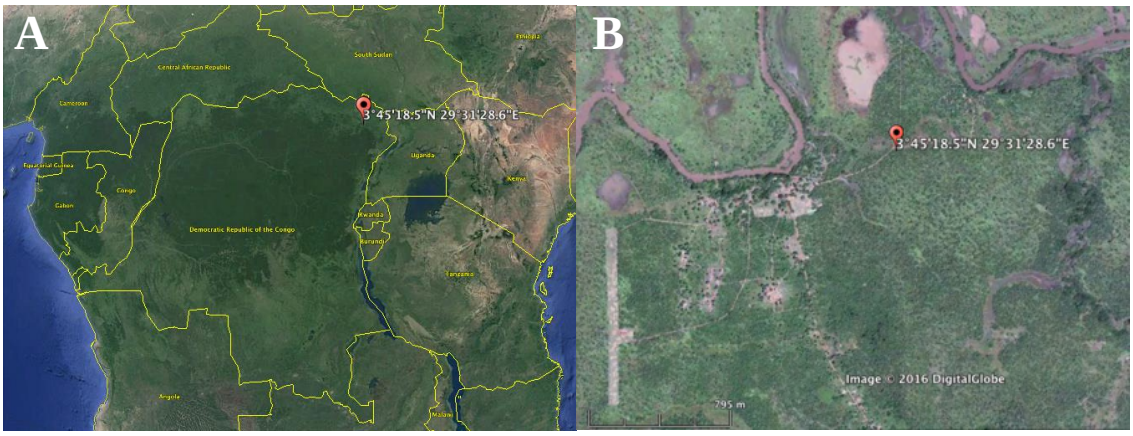

Figure 1. (A) Garamba National Park is located in the far north-eastern corner of the Democratic Republic of Congo and (B) exact location of the observation in close proximity of Garamba National Parks' headquarters (Source: Google Earth™).

After observing it with my binoculars, I could take a few pictures (Figures 2A–C) before the mongoose ran off in the vegetation. Having little experience with the family Herpestidae I had no idea of the identity of the species I had just observed, let alone its rarity. Later, when determining the observed mongoose based on the pictures, I assumed that it must have been a Pousargues's mongoose. Therefore, I got in contact with Chris and Mathilde Stuart who confirmed species' identity.

When looking at the pictures, the strongly developed claws (Figure 2A) and bushy tail (Figure 2B), as described in "The Kingdon Field Guide to African Mammals" by Jonathan Kingdon (1997) are present as well.

Figure 2. (A–C) Pousargues's Mongoose *Dologale dybowskii* at Garamba National Park, DR Congo, 2 October 2016 (Photos: M. D'haen).

The determination of the animal is based on the combination of characteristics mentioned above. Similar-looking species could be excluded. Dwarf mongoose *Helogale parvula* has similar looking characteristics and is probably the species with which Pousargues's mongoose is mostly confused with, but it has a more compact body and does not occur in Garamba National Park (Kingdon 1997).

Even though Garamba National park is historically known as a site of occurrence of Pousargues's Mongoose (Verschuren 1958, Stuart & Stuart 2013), this species had not been seen and/or reported in the last 50 years. However, this might well not be a representative reflection of its actual presence. Since Garamba National Park and surrounding areas were plagued by political instability, the park was focusing more on defending its wildlife against poachers and rather limited in energy to spend at inventories.

The park management camp lies roughly on a border zone of two vegetation types, being tropical wet savannah and wooded savannah, although the habitat type in the vicinity of the observation fits more onto wooded savannah (Figure 3). *Urelytrum giganteum*, *Piliostigma thoningii*, *Kigelia africana* and *Vitex doniana* are abundant species at the location where the animal was seen (Figure 1B). Several swamps with a high abundance of Papyrus *Cyperus papyrus* are in the direct proximity (<50 m) of the location the mongoose was seen. This habitat description is similar to the habitat type described by Aebischer *et al.* (2013), who reported savannah woodland as the most abundant habitat type. Other authors reported different habitat types as well. Aebischer *et al.* (2013) make notice of observations in thick riparian vegetation on the border of Lake Albert, while Stuart *et al.* (2008) reported observations in mountain forest grassland.

Figure 3. Habitat in which Pousargues's Mongoose *Dologale dybowskii* was detected at Garamba National Park, DR Congo (Photo: M. D'haen).

To conclude, this article describes the observation of a confirmed Pousargues's mongoose *Dologale dybowskii*, being one of only a handful of observations in the world and the first since more than 50 years for Garamba National Park. This does not necessarily mean that the species did not occur in the region during this period. The lack of reported observations in the region might fit with earlier assertions that the species' geographical distribution correlates with politically unstable regions (Aebischer *et al*. 2013) and that "not everyone takes a great deal of interest in most smaller animals" as Woolgar (2014) mentioned.

Acknowledgements

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IUCN/SSC Small Carnivore Specialist Group

SHORT COMMUNICATION

A sighting of Yellow-bellied Weasel *Mustela kathiah* in southern Vietnam

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Abstract.

With only one record, with no precise location, elevation or habitat, the Yellow-bellied Weasel *Mustela kathiah*, is scarcely known in Southern Vietnam. Here I present a direct record of the species on Lam Dong province, Vietnam, and provide details on behaviour and habitat type for this rare species in the region.

Keywords: Lang Bian, Lam Dong, Yellow-bellied Weasel.

Yellow-bellied Weasel *Mustela kathiah* occurs along the Himalayas and into northern South-east Asia. It was formerly considered to be restricted in South-east Asia to the far-northern highlands (e.g., Corbet & Hill 1992). Its known distribution has been expanded greatly in South-east Asia in recent years, with the first records for Thailand (from multiple localities) and Cambodia and publication of a 1930s specimen from southern Lao PDR (Tizard 2002, Supparatvikorn *et al*. 2012, Chutipong *et al*. 2014, Phan *et al*. 2014). Abramov *et al*. (2013) analysed the chromosomes and DNA of a specimen from the Da Lat plateau, the first record from southern Vietnam, but gave no details of the location, altitude or habitat. This note reports a sighting from the plateau.

On 27 April 2016 I was walking down the main hiking trail from the Peak of Lang Bian, Lam Dong province, Vietnam (approximately 12°02′N, 108°26′E), alone at about 08h30, when I stopped to look for a Grey-bellied Tesia *Tesia cyaniventer* that was singing in the undergrowth of the closed-canopy broadleaved evergreen forest (altitude 1900–2000 m asl). I saw movement in the vegetation about 2–3 m from the track where I was standing, but was surprised to see the face of a weasel *Mustela* rather than of a bird. It looked like a very large Least Weasel *M. nivalis* (or a slender Stoat *M. erminea*), species with which I am familiar from observations in the U.K., but with a bushy tail nearly as long as the body. The clear view of the head and face at close range ruled out any kind of squirrel (Sciuridae). It bounded away a short distance (when I saw the tail clearly) and was joined by a second weasel almost side-by side. The colour above was uniform light brown (head, body and tail) without any stripe or markings, assessed after the event as perhaps a little paler than the animal in Fig. 1 of Supparatvikorn *et al*. (2012). I did not see the underside of either (they were behaving like a

pair or family without aggression). I stood completely still for about 20 seconds, when one head popped up again, the body hidden by some kind of tree-stump that it seemed to be investigating. I watched it for about 10 seconds in this position, with binoculars, about 2 m away. I had the impression that the animals were unaware of my presence and behaving quite naturally. I did not investigate the possibility that they had a nest-hole behind the tree-stump, but their second disappearance, without obvious disturbance of surrounding vegetation, make this a possibility on reflection.

Given the observed morphology, of the three weasel' species in Vietnam, these animals could only be Yellow-bellied Weasel. Stripe-backed Weasel *M. strigidorsa* has an obvious pale dorsal stripe, and Bjorkegren's Weasel *M. (nivalis) tonkinensis* is the size of a Least Weasel, and is known only from one specimen in the far north (Groves 2007). Siberian Weasel *M. sibirica* occurs elsewhere in South-east Asia but has never yet been found in Vietnam (Roberton 2007); it invariably shows an obvious dark face mask. Although I did not specifically check for this marking, I am confident it was absent from the well-seen animal. Montane evergreen forest, the habitat in which this record occurred, is typical habitat of Yellow-bellied Weasel in its range in the Himalayas and northern South-east Asia (e.g. Chutipong *et al*. 2014).

Acknowledgements

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IUCN/SSC Small Carnivore Specialist Group

SHORT COMMUNICATION

A revised global conservation assessment of the Javan Ferret Badger *Melogale orientalis*

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Abstract.

In 2008, Javan Ferret Badger *Melogale orientalis* was categorised as Data Deficient by The IUCN Red List of Threatened Species, indicating that there was too little relevant information to assess its conservation status. According to the 2008 assessment, its known distribution was restricted to parts of the islands of Java and Bali with no records from Central Java and few, if any, explicitly from the lowlands or far from natural forest. During 2004–2014, 17 opportunistic Javan Ferret Badger records were obtained from various habitats, from 100 to nearly 2000 m altitude. These included four records in Central Java and the adjacent Yogyakarta Special Region, filling in a gap in the species' known range. West Java records included three locations below 500 m altitude. Several records were from around villages, up to 5–8 km from the closest natural forest, indicating that this species uses heavily human-altered areas. This evidence of a wider altitudinal and spatial distribution, and use of highly human-modified habitats, allowed re-categorisation in 2016 on the IUCN Red List as Least Concern.

Ringkasan.

Pada tahun 2008, biul selentek *Melogale orientalis* dikategorikan kedalam kelompok Data Defecient (Kekurangan Data) dalam The IUCN Red List of Threatened Species yang mengindikasikan bahwa saat itu sangat sedikit informasi yang digunakan untuk menilai status konservasi jenis ini. Berdasarkan kajian pada 2008, diketahui distribusi spesies ini terbatas di beberapa lokasi di Pulau Jawa dan Bali, namun tidak ada temuan di Jawa Tengah dan sedikit informasi yang secara eksplisit menyebutkan temuan di dataran rendah atau lokasi yang jauh dari hutan alam. Selama 2004-2017, temuan biul selentek secara oportunistik didapatkan dari berbagai tipe habitat dari ketingguan 100 hinngga 2000 m. Termasuk empat temuan di Jawa Tengah dan Yogyakarta yang mengisi kekosongan informasi sebaran sebelumnya. Tiga lokasi temuan di Jawa Barat berada di bawah ketinggian 500 m. Beberapa temuan ditemukan di sekitar pemukiman yang berjarak 5-8 km dari hutan alami, yang menunjukkan bahwa jenis ini juga mengunakan habitat yang sudah termodifikasi. Bukti luasnya sebaran spasial dan elevasi serta penggunaan habitat yang termodifikasi, mendukung pengkategorisasian ulang Daftar Merah IUCN di tahun 2016 sebagai Least Concern (Beresiko Rendah).

Keywords: biul selentek, distribution, Indonesia, IUCN, Java, Javan Ferret Badger

Javan Ferret Badger *Melogale orientalis* is endemic to the islands of Java and Bali (Riffel 1991). Until 1991, records came from across most of Java but none was traced from Central Java, while in Bali it was recorded only near Lake Buyan (Figure 1). There were records from three protected areas in Java: Gunung Gede – Pangrango National Park (GGPNP) and Halimun Salak National Park in West Java and Meru Betiri National Park in East Java. Occurrence in GGPNP was confirmed by Brickle (2007), Duckworth *et al*. (2008) and Ario (2010). As of the 2008 assessment on *The IUCN Red List of Threatened Species*, the species was categorized as Data Deficient, out of concern that the few recent records then traced might reflect either a poor conservation status or that the species was greatly under-recorded.

Surveys of nocturnal small- and medium-sized carnivores in 14 locations across Java during 2012–2014 provided 37 Javan Ferret Badger records (three direct sightings and

34 camera-trap photographs), but all from one location: Cipaganti village, Garut regency, West Java (Rode-Margono *et al*. 2014). The other 13 survey areas received much lower efforts (no camera trapping, only nocturnal transect surveys; see Rode-Margono *et al*. 2014), and the absence of Javan Ferret Badger at them should not treated as confirmed; but, equally, the lack of records could indicate a genuine rarity. At least five Javan Ferret Badgers were observed for sale in Javan animal markets (Kim 2012, Shepherd *et al*. 2012) further highlighting the uncertainty of the species' true conservation status.

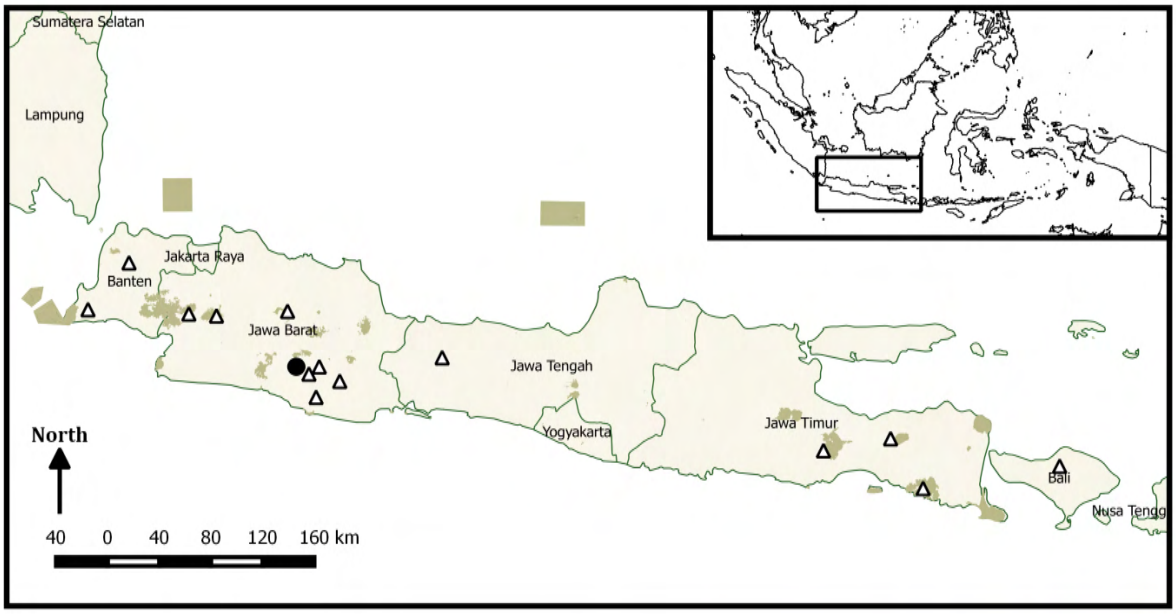

Figure 1. Previous records of Javan Ferret Badger on Java and Bali. Open triangles show records in Riffel (1991) and closed circle the new locality of Rode-Margono *et al.* (2014) near Cipaganti village, Garut regency, West Java. Shaded blocks represent protected areas.

In the last decade, while there has still been no targeted survey of Javan Ferret Badger distribution and status, the rise in leisure natural history observation on Java coupled with the explosion of internet-based means for sharing observations, offers the opportunity for distinctive species readily identified without museum examination, of far more precise status assessments. To provide baseline data for Javan Ferret Badger conservation, including review of its *IUCN Red List* category, a trawl was made for recent (2004–2014) Javan Ferret Badger records and reports. This collation of information drove the 2016 *IUCN Red List* reassessment as Least Concern (IUCN 2016). It is presented here in more primary detail than was practicable in the *IUCN Red List* species account.

All information presented here does not include published records (such as Duckworth *et al*. 2008, Rode-Margono *et al*. 2014), but only previously unpublished records from 2004–2014. Scientific journals, reports, news articles, images, and social media postings were searched for on the internet using available search engines such as Yahoo, Google and social media platforms such as Facebook with specific keywords

related to the species. Keywords and phrases used are *Melogale orientalis*, Javan Ferret Badger, and the local names for the species which comprises *teledu* (Javanese/Sundanese), *biul selentek* and *sigung* (Indonesian). To verify reports collected from the internet and social media, the source person's knowledge about this species was checked using a questionnaire (Table 1), coupled with an enquiry as to whether they had verifiable evidence such as a photograph. Information with unclear or no contact information were not included. Javan Ferret Badger is relatively distinct among the native mammals of Java. The only serious potential confusion species is Sunda Stink-badger *Mydaus javanensis*, which has a very different pattern of black and white markings, a much shorter tail, and which is infamous for its foul stench.

Of the 19 reports traced for 2004–2014, two could not be verified. The 17 acceptable records comprised seven camera-trap photographs, four direct sightings of which one was photo-validated, one individual rescued from a village, and five carcases of which three were road-kills, one was trapped in a bird trap and one was killed by a predator (Table 2). These records came from across Java, including four in Central Java, where the species had not previously been recorded. The records include some from lowlands and near human populated areas (Figure 2). None of these records came from Bali.

Table 1. Questionnaire used to collect information on Javan Ferret Badger.

Name :					
Address :					
Phone/mobile:				E-mail:	
Occupation :					
Organisation/Institution :					
No.	**Question**			**Answer**	
1.	Date & Time				
2.	Where you found this species? (please add GPS Coordinate if available)			Address:	
3.	Habitat description				
	a. Forest	b. near plantation	c. near villages	d. on the road	
4.	Finding Type:				
	a. Direct Observation (visual)			b. Indirect encounter (Sound, faeces, tracks, etc.)	
	c. Carcase			d. Other finding. _____	
5.	Number of Animal	_____ indv	Male: ____	Female: ____	Unknown: ___
6.	Description: (Size, coloration, etc.)				
	Size:			Colour:	
	Tail:			White Stripe pattern:	
	Other:				
7.	Local Name				
8.	How many times you found this species				
	All years:_____time(s)			This year:_____time(s)	
9.	Have you ever heard or known about people killing this badger?				
10.	Do you know what badger eat?				
11.	Do you that this species protected by low?				
12.	Do you know that you can arrested if killing protected animal?				
13	Do you know someone who kept this animal as pet?				
	Signature:				
	Date:				

West Java

Seven of the nine records in West Java came from protected areas, comprising: Gunung Ciremai National Park (Records #1–3; Figure 3A), Kareumbi-Masigit Game

Reserve (Record #4) and two nature reserves, Gunung Tilu (Figure 3B) and Gunung Papandayan (Records #5–7). The remaining two records were obtained outside of protected areas. One was obtained near a plantation, with small patches of natural forest, and in an area with high human population density (Record #8). The other was found dead, road killed, inside a university complex (Record #9) (Y. Ishaq pers. comm. 2015) at 200 m asl.

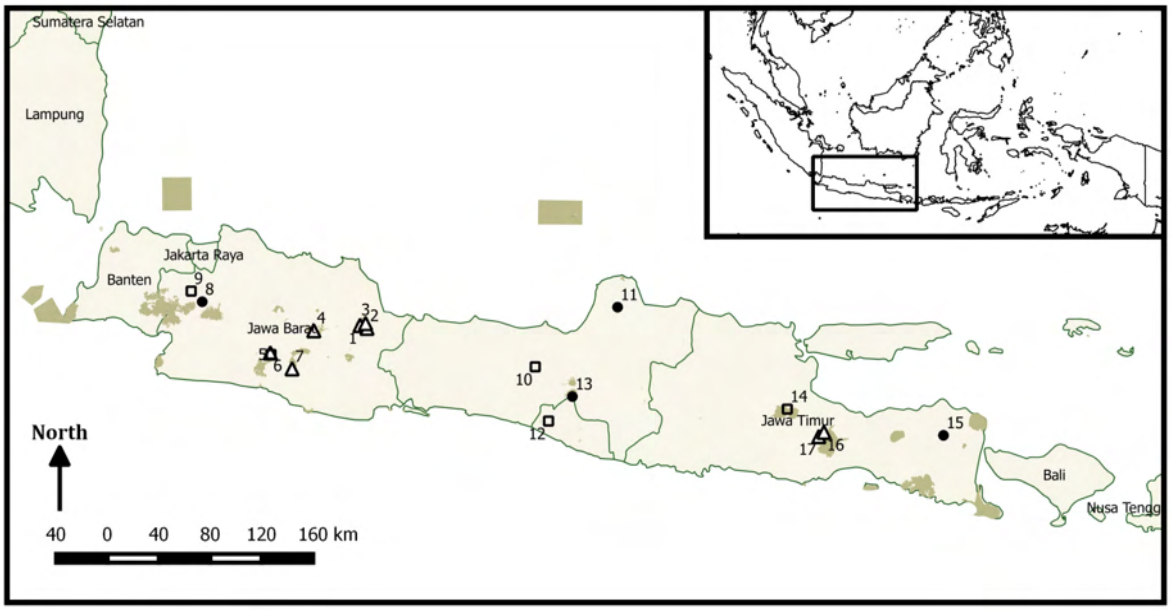

Figure 2. Previously unpublished locality records of Javan Ferret Badger on Java, 2004–2014. Closed circle represent direct sightings, open rectangle carcasses, and open triangle camera-trap records. Shaded blocks represent protected areas.

Figure 3. (A) Javan Ferret Badger *Melogale orientalis* camera-trap record in Gunung Ciremai National Park (Photo: Gunung Ciremai National Park 2013) and (B) Javan Ferret Badger found dead in a bird snare trap in Gunung Tilu Nature Reserve, 2013.

Central Java and Yogyakarta Special Region

Two records came from Central Java and two from the adjacent Yogyakarta Special Region. The two records from Central Java were located outside of protected areas; a road killed ferret badger (Record #10) was found between Temanggung city and Wonosobo in

2012 (Figure 4A), and a couple of ferret badgers (Record #11) were observed crossing a highway in a teak plantation near Tanjung Mojo village, Kudus (A.C. Adi pers. comm. 2015). In 2012, one ferret badger was rescued by a villager after being hit by a vehicle in Sendang Sari VILLAGE, Kulon Progo district, Yogyakarta (Record #13). The location is near a village, with mixed agriculture and small forest patches at 50–150 m asl (Gunawan pers. comm. 2014). Another record in Yogyakarta was in Gunung Merapi National Park by a birdwatcher in 2010 (Record #14; Figure 4B).

Figure 4. (A) Carcass of a Javan Ferret Badger found on a street between Temanggung and Wonosobo, Central Java (Photo: Didik Raharyono) and (B) Javan Ferret Badger from Gunung Merapi 2010, Central Java taken by a bird-watcher (taken from www.pedulikarnivorjawa.org).

East Java

In October 2014, a dead ferret badger was found near Lemahabang village, Batu–Malang district, apparently hit by a vehicle (Record #14; Figure 5). Previously, in 2013, a ferret badger was seen around secondary forest in Sempol village area close to Pancur–Bondowoso cities (Record #15) (H. Cahyono pers. comm. 2015). In Bromo Tengger Semeru National Park this species was captured in a camera-trap in December 2014 (Record #16). A dead ferret badger (Record #17) was found by a park ranger in August 2013 (Toni pers. comm. 2015).

Unverified indications

There were two further ferret badger records in animal trade articles or web posts, but the identity and/or origins of these animals could not be verified. Additionally, at least four web-posts were traced that advertised this animal for sale as a pet (e.g., www.kaskus.co.id).

Table 2. Previously unpublished Javan Ferret Badger *Melogale orientalis* records from Java during 2004 to 2014.

The table does not include published records in Duckworth et al. (2008) and Rode-Margono et al. (2014). Gunung (= mountain), as in Gunung

#	Locality	Province	Lat/long	Altitude (m asl)	Forest status and locality description	Year	Type of evidence	Observer
1	Gunung Ciremai NP	West Java	6°53'44.6"S 108°22'20.0"E	1270	National Park; natural forest	2013	Camera-trap	M. Ginanjar (Fig. 3A)
2			6°55'24.5"S 108°26'22.5"E	1415	National Park; natural forest	2013	Camera-trap	M. Ginanjar
3			6°52'38.8"S 108°25'33.1"E	1738	National Park; natural forest	2013	Camera-trap	M. Ginanjar
4	Kareumbi–Masigit GR		6°56'51.5"S 107°55'18.5"E	1500	Game Reserve; natural forest	2013	Camera-trap	E. Wilianto
5	Gunung Tilu NR		7°09'50.1"S 107°29'55.8"E	1797	Nature Reserve; natural forest	2013	Carcass, snared	E. Wilianto (Fig. 3B)
6	Gunung Tilu NR		7°10'40.5"S 107°30'19.1"E	1854	Nature Reserve; natural forest	2013	Camera-trap	E. Wilianto
7	Gunung Papandayan NR		7°19'06.8"S 107°42'36.7"E	1980	Natural forest	2014	Camera-trap	A. Kusumanto
8	Rancamaya		6°39'56.5"S 106°50'08.9"E	500	Small patches of natural forest. Plantation and villages; around 8–9 km from natural forest (Halimun Salak NP)	2009	Alive, rescued	E. Wilianto
9	Bogor Agriculture Institute Campus		6°33'43.5"S 106°43' 41.7"E	200	Small forest, surrounding by villages	2014	Carcass, road-kill	Y. Ishaq
10	Temanggung	Central Java	unknown	unknown	Unknown	2008	Carcass, road-kill	D. Rahayono (Fig. 4A)
11	Tanjung Mojo, Kudus		6°43'06.8"S, 0°52'41.8"E	Over 600	Natural forest, next to teak plantation and village	-	Visual, not documented	A.C. Adi
12	Kulon Progo	Yogyakarta Special Region	7°49'38.8"S, 0°12'21.8"E	50–150	Small patches of natural forest. Plantation and villages. About 6–7 km from natural forest (Menoreh Mountains)	2004	Road-kill	Gunawan
13	Gunung Merapi NP		7°35'19.7"S, 0°26'18.5"E	1100	Natural forest	2010	Photograph	Lim Wen Sin (Fig. 4B)
14	Cangar, Malang	East java	7°42'39.2"S, 2°31'47.8"E	1300	Natural forest	2014	Carcass, road-kill	H. Cahyono (Fig. 5)
15	Pancur–Bondowoso		7°57'58.8"S, 4°03'00.8"E	853	Natural forest	2005	Visual	H. Cahyono
16	Ranu Pane, Bromo-Tengger-Semeru NP		8˚01'53.5"S, 2˚57'58.1"E	1822	Bromo–Tengger National Park; natural forest	2014	Camera-trap	Toni
17	Bendo lawing Bromo-Tengger-Semeru		7˚58'40.1"S, 2˚50'12.1"E	1830	Bromo–Tengger National Park; natural forest	2013	Carcass, killed by predator	Toni

The table does not include published records in Duckworth et al. (2008) and Rode-Margono et al. (2014). Gunung (= mountain), as in Gunung Ciremai National Park = Mount Ciremai National Park. NP = National Park, NR = Nature Reserve, GR = Game Reserve.

Based on the 17 verified records, Javan Ferret Badger has a wide distribution on Java in various habitat types. Riffel (1991) noted that Javan Ferret Badger occurs throughout Java and Bali, but he did not present any records for Central Java. The records presented above for Central Java seem to be the first specific localities for the region, although earlier, Schreiber *et al*. (1989) had included an imprecise record for Central Java for which Riffel (1991) could not trace any details. While the present collation traced no reports from Bali, given the haphazard nature of collating information from the internet and the overall low number of records, nothing should be concluded about the species' current status on Bali.

Figure 5. A road-kill Javan Ferret Badger *Melogale orientalis* in Cangar, Malang, East Java, 2014 (Photo: Heru Cahyono).

Schreiber *et al*. (1989) implied, perhaps inadvertently, that Javan Ferret Badger is associated with areas above 750 m asl. The records assembled here have a wider altitudinal range, from the lowlands at 100 up to 1,900 m asl. The lowland locations such as in Kulon Progo were surrounded by cultivation and dense human populations. There is no primary forest near several Javan Ferret Badger localities, and only small patches of secondary forest. This suggests that the species is not dependent on natural or primary forest, although as yet it would not be safe to assume it can live independently of such forest: populations in non-forest areas could potentially rely for their long-term viability upon animals dispersing from natural forest.

Threats

Javan Ferret Badger could potentially be threatened by habitat degradation and hunting. Past forest conversion, fragmentation and degradation in Java have been very heavy, given the island's high human population density. Javan Ferret badger has retained a wide range despite this and is certainly not restricted to the remaining large tracts of natural forest. The real level of threat from wildlife hunting (where the species might be caught as by-catch in snares set for other quarry animals) and capture for the pet trade is difficult to assess. Presently, there is a widespread habit amongst local people on Java to shot any kinds of animal with air rifles for 'fun', such as wild pig *Sus scrofa*, small carnivores and even primates. This activity may impact wild populations of Javan Ferret Badgers more

than pet trade, within which trade volumes are lower than for various other small carnivores (Kim 2012, Shepherd, 2012). However, the trade situation can change fast, with 'fashion'; an example of this would be the emergence of the 'civet lovers' community in 2012 in Indonesia, where it suddenly became very fashionable to trade and keep various kinds of small carnivores as pets.

Conservation status

On *The IUCN Red List of Threatened Species* the Javan Ferret Badger was categorized as Data Deficient in 2008. The new occurrence and habitat information presented here fed into the 2016 assessment as Least Concern (IUCN 2016). Nonetheless, considering that these records were not based on dedicated studies, which have never occurred, long-term and range-wide surveys would be likely to reveal much more information about the distribution and population of Javan Ferret Badger, and to allow a clearer threat analysis for this species.

Acknowledgements

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IUCN/SSC Small Carnivore Specialist Group

SHORT COMMUNICATION

The first evidence of breeding of the endangered Sunda Otter Civet *Cynogale bennettii* (Carnivora: Viverridae) in Peninsular Malaysia

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Abstract.

The Sunda Otter Civet (*Cynogale bennettii*) is one of the least known of the small carnivore species occuring in the lowland rainforests of the Thai-Malay Peninsula. Threatened primarily by habitat loss and degradation, there are few observations of the species in recent years, the majority being that obtained from camera trap surveys conducted in lowland Borneo and Sumatra. Evidence of its occurrence in peninsular Thailand remains anecdotal. In Peninsular Malaysia, the Sunda Otter Civet is very rare and there have only been two records since 1990. I report on five new photographic records of the Sunda Otter Civet obtained over two months of incidental camera trap sampling at the fringes of the Lenggor Forest Reserve, a new locality for the species in the peninsula. In one observation, an adult and two young was documented foraging near an animal wallow at the interface of degraded lowland dipterocarp and freshwater swamp forest. This is one of few evidence of breeding for this rare carnivore across in recent decades and a first for the Peninsula. This record adds support to earlier observations on the species' ability to utilise disturbed habitats.

Keywords: Viverrid, lowland rainforest, swamp, carnivore, aquatic.

The rainforests of the Thai-Malay Peninsula support a rich assemblage of small mammalian carnivores, including no less than 10 species of civets (Family Viverridae) (Medway 1969, Francis 2008), and often with multiple co-occuring species at a single site. The least known of the Malayan viverrids is the Sunda Otter Civet *Cynogale bennettii* Grey 1847, an unusual member of the family given its presumed semi-aquatic habits (Heydon & Bulloh 1996, Francis & Barrett 2008, Veron *et al.* 2006) and thus strong association with water bodies (Wilting *et al.* 2010). Although apparently widespread in the lowland dipterocarp and peat swamp forests across Sundaic Southeast Asia, the majority of recent records of the species are from sites in Sumatra (i.e. Way Kambas National Park) and Borneo (e.g. Danum Valley, Deramakot Forest Reserve, Kinabatangan Wildlife Sanctuary, Bukit Sarang Conservation Area, Sabangau National Park) where the majority of records were obtained from camera trap surveys (Veron *et al.* 2006, Giman *et al.* 2007; Cheyne *et al.* 2010a, Wilting *et al.* 2010; Cheyne *et al.* 2016).

The paucity of records of the Sunda Otter Civet in its range, including the absence of documentation from surveyed areas with fairly undisturbed habitat, suggests that the species either occurs at very low densities, or that existing survey approaches may be biased against detecting the species (Ross *et al.* 2015). For instance, Cheyne *et al.* (2010b) reported only two photographs of the species from camera traps over 602 trap-nights at

Sabangau National Park, Central Kalimantan, a relatively low encounter when compared to other small carnivores recorded there. Prior to these records, there were only six reported sightings in Indonesian Borneo (Veron *et al.* 2006). Similarly, camera trap surveys in the Deramakot Forest Reserve in Malaysian Borneo yielded only 10 images of the species (<2%) out of nearly 800 images of small carnivores. Intriguingly, a survey of the civet assemblage by Heydon & Bulloh (1996) in the Ulu Segama Forest Reserve found the species in only primary forests, but not logged forests. In view of its rarity and the rapid loss of lowland forest habitat across Sundaic Southeast Asia, the species is currently classified as Endangered (Ross *et al.* 2015).

In the Thai-Malay Peninsula, there are only four recent records of the Sunda Otter Civet since 1990. Two records from Peninsular Malaysia are from the Endau-Rompin forest (Ross *et al.* 2015), a large protected block of predominantly lowland, hill dipterocarp and swamp forest along the border of Johor and Pahang state (Figure 1); records from Peninsular Thailand are from Kaeng Krachan National Park and Phru Toa Daeng Peat Swamp (Veron *et al.* 2016). Surprisingly, there are no known records from Taman Negara, the largest protected area (4,343 km²) in the Peninsular Malaysia. Here, I report on five incidental observations of the Sunda Otter Civet from two camera traps set to survey galliforms over the period of March–April 2016 at the fringes off the Lenggor Forest Reserve, Johor. Lenggor lies about 25 km to the southeast of the Endau-Rompin National Park, and constitutes pristine and logged lowland dipterocarp and freshwater swamp forests. Connectivity between Endau-Rompin and Lenggor (a part of the wider Endau-Kota Tinggi Wildlife Reserve) is broken by a patchwork landscape of deforested land, plantations and roads (i.e. Federal Route 50 linking the towns of Kluang and Jemaluang).

A total of five camera trap photographs of the Sunda Otter Civet were obtained from two camera traps over a survey period from 17 March to 12 April 2016 (Table 1) near the fringes of the Lenggor Forest Reserve (2°10'N, 103°40' E). Both camera traps were placed in logged swamp forest in the proximity of wet areas consisting of animal wallows and small pools and spaced 1.5 km apart along a logging track. While four images involved singletons, one image obtained on the 12 April comprised one adult and two young (Figure 2). All images were taken between dusk and early morning, the earliest at 19h57 and the latest at 07h20 hrs, strongly alluding to the species' primarily nocturnal foraging behaviour.

These observations of Sunda Otter Civet in Lenggor are significant as they constitute the only recent records of the species in the Malay Peninsula outside the nearby Endau-Rompin landscape. These records are also the first evidence of breeding in the peninsula for the species. Consistent with other authors, these observations indicate that the Sunda Otter Civet is able to utilise logged and degraded forest (e.g. Giman *et al.* 2007) although the extent to which it tolerates such altered, degraded and fragmented habitat remains poorly understood (Ross *et al.* 2015; Cheyne *et al.* 2016). Similarly, these observations indicate a propensity of the species to favour low-lying forest habitat with

abundant water bodies (e.g. in Cheyne *et al.* 2016), a habitat that can be difficult to survey logistically. It is possible that the drier than usual conditions at the site during the period of survey due to the El Nino phenomena, may have reduced available habitat and made the animals forage more widely.

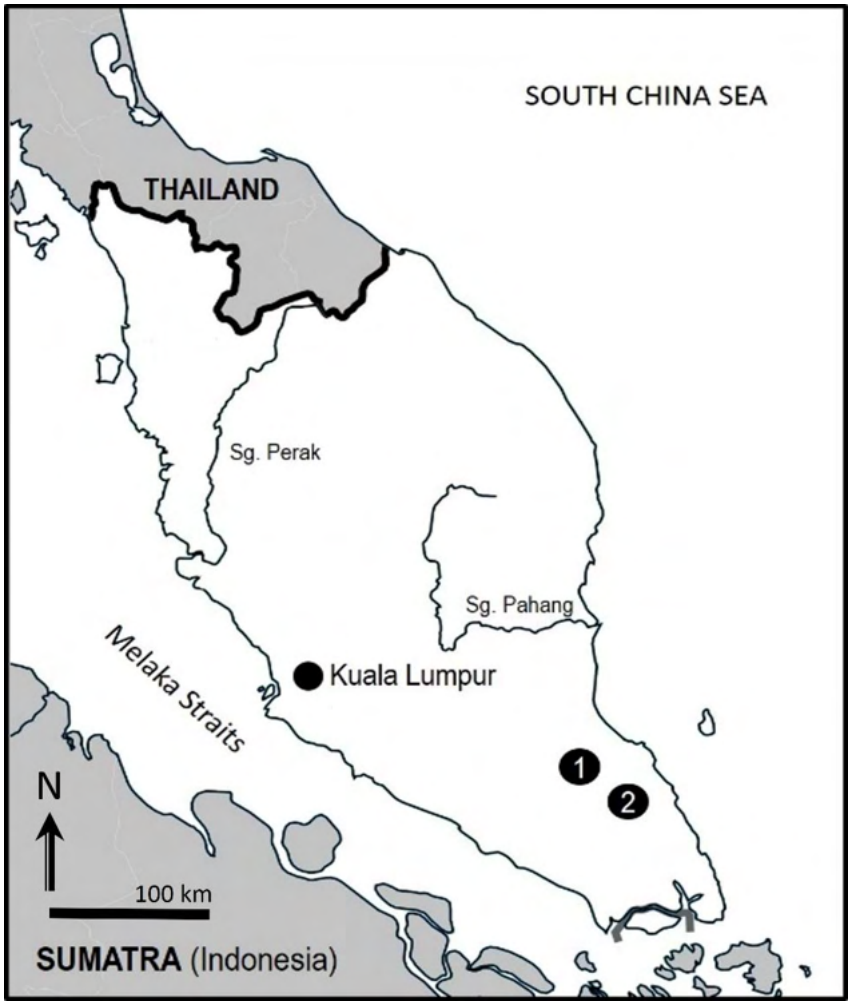

Figure 1. Recent records of the Sunda Otter Civet in the Malay Peninsula. (1) Endau-Rompin Forest, (2) Lenggor Forest Reserve (this study).

Table 1. Summary of camera trap data of Sunda Otter Civet.

Number of individuals	Date	Time (hrs)	Habitat type
1	4 March 2016	07h20	Swamp forest
1	17 March 2016	06h00	Swamp forest
1	17 March 2016	20h02	Swamp forest
1	25 March 2016	19h57	Swamp forest
3	12 April 2016	05h01	Animal wallow

The proximity of this record to the earlier Peninsular Malaysia records reported from Endau-Rompin (Ross *et al.* 2015) indicates that lowland dipterocarp and freshwater swamp forests in the southern part of the Thai-Malay Peninsula may be a stronghold for the

species. Interestingly, there has been no record of the species from the Southeast Pahang peat swamp forest from recent surveys (Lim, K.C. *in litt*. 2016), where considerable suitable habitat exists, though this is more likely an artefact of poor sampling effort. It could also be that the Sunda Otter Civet is more dependent on low-lying and swampy forests, a habitat relatively scarce further north and in much of Pahang, wherein Taman Negara National Park lies, and which tends to be hillier.

Figure 2. Adult Sunda Otter Civet seen with two young foraging by an animal wallow.

The high rates of deforestation in the state of Johor (Peh *et al*. 2006, Lim et al. 2012), and much of southern Pahang suggests that the Sunda Otter Civet may have lost a large proportion of its forest habitat in the region. Additionally, swamp forests, which are an important habitat for the species, are increasingly degraded by forest fires, logging and agricultural expansion across the region (Ross *et al.* 2015, Yong & Peh 2016). The observations here, consistent with that of others (e.g. Cheyne et al. 2010a; 2010b), suggests the Sunda Otter Civet occurs in low-lying swamp forest with many water features such as pools and animal wallows. However, the difficult terrain in both inundated freshwater and peat swamp forest, a habitat of known importance to the Sunda Otter Civet, remains under surveyed (see Mathai *et al.* 2016), and as such, little is known of the species ecology and habitat requirements (e.g. Ross et al., in press, Cheyne et al., 2016). Increased surveys for the otter civet should be conducted in remaining protected areas in Johor and southern Pahang, particularly the larger remaining forest blocks protected within the Endau-Kluang and Endau-Kota Tinggi wildlife reserves to better understand its distribution and status in the southern Malay Peninsula.

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IUCN/SSC Small Carnivore Specialist Group

SHORT COMMUNICATION

The rediscovery of Large-spotted Civet *Viverra megaspila* in China

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Abstract.

The Sunda Otter Civet (*Cynogale bennettii*) is one of the least known of the small carnivore species occuring in the lowland rainforests of the Thai-Malay Peninsula. Threatened primarily by habitat loss and degradation, there are few observations of the species in recent years, the majority being that obtained from camera trap surveys conducted in lowland Borneo and Sumatra. Evidence of its occurrence in peninsular Thailand remains anecdotal. In Peninsular Malaysia, the Sunda Otter Civet is very rare and there have only been two records since 1990. I report on five new photographic records of the Sunda Otter Civet obtained over two months of incidental camera trap sampling at the fringes of the Lenggor Forest Reserve, a new locality for the species in the peninsula. In one observation, an adult and two young was documented foraging near an animal wallow at the interface of degraded lowland dipterocarp and freshwater swamp forest. This is one of few evidence of breeding for this rare carnivore across in recent decades and a first for the Peninsula. This record adds support to earlier observations on the species' ability to utilise disturbed habitats.

Keywords: Viverrid, lowland rainforest, swamp, carnivore, aquatic.

The Large-spotted Civet *Viverra megaspila* is found in South-east Asia and southern China. It is listed as Endangered according to *The IUCN Red List of Threatened Species* (Timmins *et al*. 2016). In the last two decades, it has been recorded by direct sightings or camera-trapping in Cambodia, Vietnam, Lao PDR, Thailand, Myanmar and Malaysia (Duckworth 1994, Roberton 2007, Than Zaw *et al*. 2008, Chutipong *et al*. 2014, Gray *et al*. 2014, Hamirul *et al*. 2015). In China, the species has been recorded in southern Yunnan and southwest Guangxi (Lau *et al*. 2010), and this represents the northern limits of the species' known range (Corbet & Hill 1992, Timmins *et al*. 2016). Three individuals were recorded in Mengla and Jinghong, Xishuangbanna, Yunnan province in 1983 (Xu *et al*. 1987), and eight pelts were collected by hunters from Yunnan and Gaungxi provinces between the 1970s to 1998 (Wang 1998). It is considered to be very rare in China (e.g. Lau *et al*. 2010).

Xishuangbanna is a prefecture of Yunnan province, China (21°08′–22°36′N and 99°56′–101°50′E). The elevation ranges from 475–2,430 m asl, and it is on the northern edge of the tropical zone (Li *et al*. 2009). In 2012 a monitoring programme for ground-dwelling mammals and birds in Xishuangbanna was established. Camera-traps were set on trees, 0.5–2.0 m from the ground, depending on the topography and shrub height. No baits or artificial lures were used. In total, 138 camera-trap stations were set from approximately 500–2,000 m asl, covering around 200 km² of forested habitat. The total survey effort was in excess of 30,000 camera-trap-nights.

A single Large-spotted Civet was camera-trapped three times in quick succession on 16 August 2015 (Figure 1) in a 3 km^2 patch of forest that bordered rubber plantations. This record is around 5 km away from the nearest large forest patch (i.e. one of more than 100 km^2). Although only part of the animal is visible in the camera-trap photograph, it can be identified by the incomplete white bands on the tail (see Duckworth 1994).

Figure 1. Large-spotted Civet photographed in Xishuangbanna, China on 16 August 2015.

The camera-trap station was set at 560 m and in tropical seasonal evergreen forest with *Parashorea chinensis* as the dominant species, close to a human settlement, and 15 m away from a stream. Considering the hunting pressure is very high in Xishuangbanna (Sreekar *et al*. 2015) and the area of the forest is small, we have kept the specific coordinates of the record confidential. The same camera-trap station also recorded multiple Leopard Cats *Prionailurus bengalensis* (20 capture events, including at least three individuals). Masked Palm Civet *Paguma larvata*, Small Indian Civet *Viverricula indica*, Red Junglefowl *Gallus gallus*, Emerald Dove *Chalcophaps indica* and rats (Muridae) were recorded in the same patch of forest at different stations, indicating that the camera-traps were set at the correct height to record small carnivore species, and therefore that the single Large-spotted Civet record from this patch of lowland forest, is likely to indicate genuine scarcity.

Most records of Large-spotted Civet come from below 300 m, but some are from as high as 780 m in places with gentle terrain (Chutipong *et al*. 2014, Timmins *et al*. 2016). The habitats it which the species has been recorded varies from evergreen forest, semi-evergreen forest and deciduous dipterocarp forest to oil palm plantations (Than Zaw *et al*. 2008, Chutipong *et al*. 2014, Gray *et al*. 2014, Hamirul *et al*. 2015). This record from 560 m in Xishuangbanna is consistent with the species preferring low-elevation habitat, as in the rest of its range. A decrease in its number in Yunnan is implied by the lack of any other recent records. Such a decline may be due to the extensive conversion of lowland forest into rubber plantation in Xishuangbanna (Li *et al*. 2009), as well as hunting. We will collaborate with local government and scientists to ensure good conservation of this species. We also hope more detailed research work can be done on the ecology of this species.

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IUCN/SSC Small Carnivore Specialist Group

SHORT COMMUNICATION

First confirmed record of the Striped Hog-nosed Skunk *Conepatus semistriatus* from peri-urban Bogotá, Colombia

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Abstract.

The Striped Hog-nosed Skunk *Conepatus semistriatus* is widespread Neotropical carnivore species, with a disjunct distribution from Mexico to Brazil. Poorly known across its range, in Colombia the species is mostly known only from scarce and sporadic records, but with no information for most aspects of its ecology or conservation status. Here we present the first record of the species for a peri-urban area of Bogotá, capital city of Colombia. Our record is the first for a large city across its range, located outside previous range estimates and confirming its presence for the tutelar mountains of the city. Although this record does not expand significantly the range of the species, it represents an important addition to the fauna of Bogotá, highlighting the importance of improving conservation measures for this important forest patch, and thus ecological integrity, in one of the largest cities in the Neotropics.

Resumen.

El Mapurito *Conepatus semistriatus* es una especie de carnívoro Neotropical de distribución amplia y disyunta desde México hasta Brasil. Poco conocida a través de su distribución, en Colombia se conoce principalmente sólo de registros escasos y esporádicos, pero sin información para la mayoría de aspectos de su ecología y estado de conservación. Se presenta el primer registro de la especie para un área peri-urbana de Bogotá, capital de Colombia. El registro es el primero para una ciudad grande a lo largo de su distribución, y se ubica fuera de las distribuciones previas estimadas lo que confirma su presencia para los cerros tutelares de la ciudad. A pesar de que el registro no expande significativamente la distribución de la especie, representa una adición importante a la fauna de Bogotá, resaltando la importancia de mejorar las medidas de conservación de este importante parche de bosque, y por ende su integralidad ecológica, en una de las ciudades más grandes del Neotrópico.

Keywords: Cundinamarca, Mephitidae, Neotropics, urban wildlife.

The Striped Hog-nosed Skunk *Conepatus semistriatus* is a widespread Neotropical small carnivore species, distributed from Mexico, continuously down to Peru and Venezuela and a disjunct population in Brazil (Cuarón *et al.* 2016). Despite its large range, and that is considered locally common, most aspects of its ecology and distribution are still unknown (González-Maya *et al.* 2011; Kasper *et al.* 2009), including some aspects of its taxonomy and biogeography (Kasper *et al.* 2009).

In Colombia, the species has also a widespread distribution, been recorded along the Andes, the Inter-Andean valleys, Caribbean, Orinoco and Sierra Nevada de Santa Marta regions, between 0 and 3,100 m asl (Fernández-Rodríguez & Ramírez-Chaves 2015), including the type locality in the North-east region of the country (Pamplona, Norte de Santander; Wozencraft 2005, Fernández-Rodríguez & Ramírez-Chaves 2015). Most aspects

of the species in the country are still unknown (Andrade-Ponce *et al.* 2016; Fernández-Rodríguez & Ramírez-Chaves 2015), and it has been previously prioritized for distribution and biogeographic study (González-Maya *et al.* 2011). In terms of political distribution, the species has been reported to occur in Antioquia, Cesar, Cundinamarca, Magdalena, Nariño and Norte de Santander departments (Solari *et al.* 2013), but with few supporting evidence for such statement; recent accounts however, propose the distribution also for La Guajira, Magdalena and Córdoba departments (Andrade-Ponce *et al.* 2016).

Despite the scarce information, the species is known to occupy both natural and intervened habitats (Cuarón *et al.* 2016) and exploit exotic food resources (Cavalcanti *et al.* 2014), been considered to tolerate high proximity to human settlements and activities (Kasper *et al.* 2009), but to our knowledge, with no records on large cities in the Neotropical region. Here we present the first records of the Striped Hog-nosed Skunk in the peri-urban areas of Bogotá, capital city of Colombia.

The Reserva Forestal Protectora Bosque Oriental de Bogotá (Bogotá's Eastern Forest Protection Forestry Reserve: RFPBOB) is located on a small mountain range along the Eastern limit of the urban portion of the city's territory, covering approximately 14,000 ha, and ranging between 2,500 and 3,600 m asl, been managed by the city's government in conjunction with the Regional Environmental Authority of Cundinamarca (CAR; CAR & CI 2009). The RFPBOB is the largest and closest continuous peri-urban forest patch (Cerros Orientales) to Bogotá, considered the tutelary mountains and main "lung" of the city. Bogotá, additional to be the capital city of the country, is also a ~10 million people mega urban city, been the most important commercial, administrative, financial and political centre in the country.

Between February 2016 and November 2016, a 49 camera-trap (Bushnell Trophy Cam and Cuddeback) stations' array was established along the northern limits of the RFPBOB. Surveys were aimed to estimate occupancy of medium and large sized mammals along the most important peri-urban forest of the city. Camera-trap stations were located along a regular 1 km^2 grid, covering the entire portion of the reserve, between Bogotá's 7th avenue and the rural areas of La Calera municipality. In order to assess the context and highlight the importance of our record, we compared its location to the historical records of the species in the country (via GBIF; Global Biodiversity Information Facility 2016) and the proposed distribution polygon by Cuarón *et al.* (2016).

With a total sampling effort of 13,965 camera-trap days, we obtained a single record of *Conepatus semistriatus* on September 7, 2016 at 21h05 (Figure 1). The record was obtained on a natural forest, approximately at 1.1 km from the main city's avenue (7th Av.) and 85.5 m from the nearest house at 04°49'57.60''N and 74°01'08.36''W at 2,830 m asl (Figure 2). Previous historical records, based on specimens in collections available through GBIF or direct inspection at natural history collections and with complete locality

description (Figure 2), indicate the confirmed presence of the species in six departments, with four previous records for Cundinamarca department: two for Choachí municipality (Museum of Comparative Zoology – Harvard University: MCZ 27218 and MCZ 27219; approximately 17 km from Bogotá and 35 km from our record), one for Fúquene (Instituto de Ciencias Naturales: ICN 283), approximately 74 km from Bogotá and 66 km from our record, and one with locality in Bogotá (National Museum of Victoria: NMV-C 29994) but with no date, collector or any other related information. Other close records were reported by Liévano Latorre & López Arévalo (2014) for a locality approximately 14,75 km from our study site in Tabio and by Muñoz-Saba *et al.* (2000) from Ubaté, approximately 57 km from our record. Regarding the distribution proposed by Cuarón *et al.* (2016), our record is located ~95 km from the nearest edge of the estimated range.

Figure 1. First record of the Striped Hog-nosed Skunk, *Conepatus semistriatus*, from a peri-urban area of Bogotá, Colombia.

Our record represents the first confirmed for the urban/peri-urban area of the largest and capital city in the country, and highlight the importance of the RFPBOB for Bogotá. However, the low capture frequency during our survey and its absence on previous surveys by our team and other studies (CAR & CI 2009), remark the potential rarity of the species in the area. RFPBOB is highly influenced by the city mostly in terms of pressures derived

from urban expansion, hunting, pollution and feral and domestic animals, which has been previously identified as the most important threats for mammals on the surrounding areas of the city (obs. pers.). Furthermore, the Reserve is almost completely isolated from surrounding forests, being completely embedded on a matrix of agricultural, urban and industrial activities, posing a significant challenge for the conservation of Bogotá's mammals, and especially for carnivores.

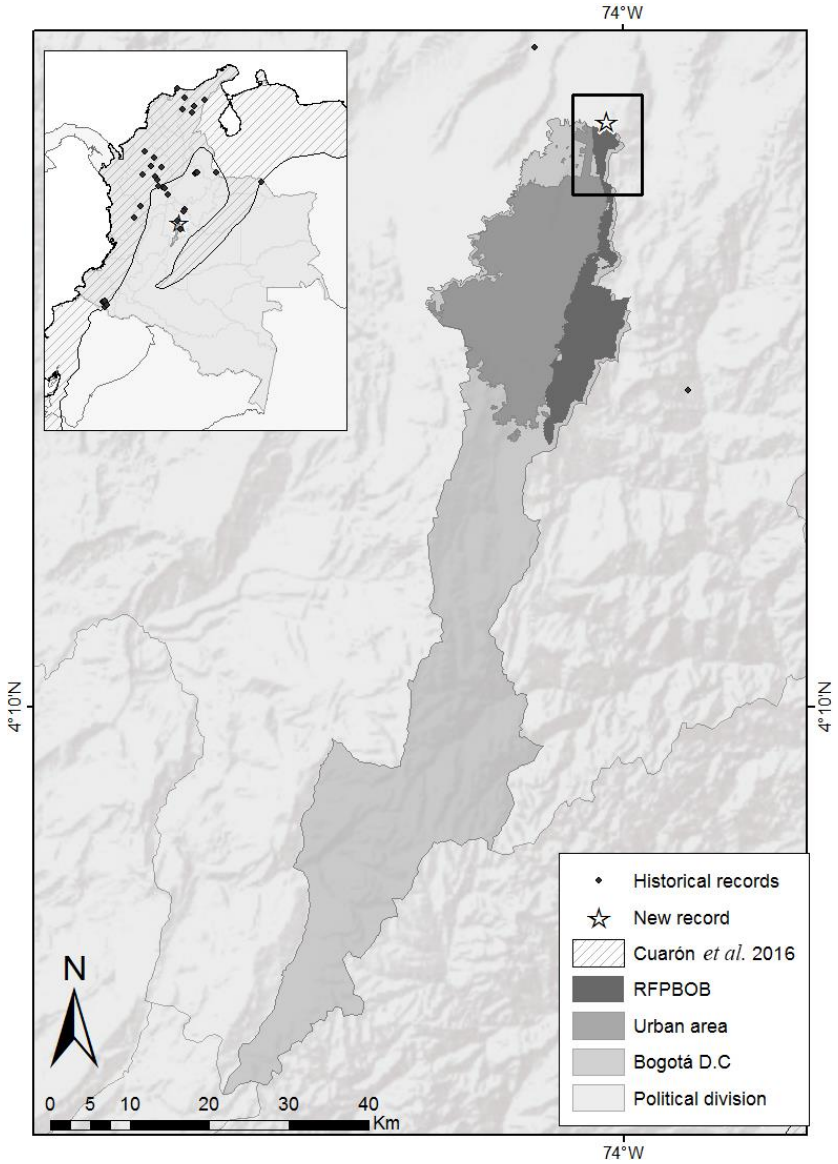

Figure 2. Location of the first record of the Striped Hog-nosed Skunk, *Conepatus semistriatus*, from a peri-urban area of Bogotá, Colombia, including proposed distribution from Cuarón *et al.* 2016 and previous (historical) records.

Morphologically, our record is similar to those from Northern Colombia (e.g. Instituto Alexander von Humboldt - IAvH 1970), and Panama (Esser *et al.* 2012), whereas, specimens from the Andes of southwestern Colombia (e.g. Universidad del Valle: UV 8103, UV 13287) and central and northern Ecuador (e.g. Naturhistoriska riksmuseet: NRM

A581107, NRM A590306) are slightly larger and have longer hair, reason why a taxonomic review of Colombian *Conepatus* has been suggested (Ramírez-Chaves & Noguera-Urbano 2010, Fernández-Rodríguez & Ramírez-Chaves 2015).

Our record does not expand the known distribution for the species in the country, although could expand the distribution proposed by Cuarón *et al.* (2016), but represents a significant addition to the peri-urban fauna of one of the largest cities in the Neotropics. This addition highlights not only the importance of the surrounding forests of Bogotá, especially RFPBOB, but also the need for urgent conservation measures of this peri-urban reserve, especially in terms of its functional connectivity with other forest patches, and ideally, the re-connection with protected areas at the national level (e.g., Chingaza National Park). It is important to highlight the critical importance of the Thomas van der Hammen Forestry Reserve, as it is the only connection for the RFPBOB with the Bogotá river zone and other forest patches on the Western side of the city and into the larger Bogotá Sabana (Bogotá's main ecological structure); currently under severe threat for urbanization promoted by the current city's administration. Conservation of these areas seems warranted in order to retain healthy and functional ecosystems that improve ecological integrity as the basis for human wellbeing in growing, yet demanding and challenging developing cities such as Bogotá.

Acknowledgements

The record presented herein is part of a larger ongoing project called Bogotá Biodiversa aimed towards characterizing biodiversity in the capital city, and raising awareness and empowering citizens towards the important biodiversity still present on the urban and peri-urban areas of the city. Funding for the present study was provided by Conjunto Residencial Portal de Fusca, Bosques de Torca and Floresta de la Sabana, ProCAT Colombia and S.P.E.C.I.E.S. Special thanks to Mauricio González, Antonio Uribe, Isabel Aragón, Martha Giraldo, Estefanía Cabo, Martha Millán, Jaime Bobilla (Floresta), Aristobulo Ruíz, Maritza Ruíz (Miravalles), Germán Quiroga, Alberto Esparza, Campo Elías Aguilar (Torca) and Rubén Darío Herrera and Angel Sánchez (Fusca) for the continued support to our project.

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IUCN/SSC Small Carnivore Specialist Group

SHORT COMMUNICATION

Record of Crab-eating Mongoose *Herpestes urva* from Parsa Wildlife Reserve, central Nepal

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Abstract.

Crab-eating Mongoose *Herpestes urva* is categorised as Vulnerable in Nepal's National Red List. Records of Crab-eating Mongoose in Nepal with specific locality information are scarce. This note presents a record of Crab-eating Mongoose from Parsa Wildlife Reserve, central Nepal, where a single individual was photographed along a stream bank during a camera-trap survey targeting Fishing Cat *Prionailurus viverrinus*.

Keywords: Herpestid, Herpestidae, Lowland Forest, carnivore.

Four species of mongoose are recorded from Nepal: Small Indian Mongoose *Herpestes* (*javanicus*) *auropunctatus*, Indian Grey Mongoose *H. edwardsii*, Crab-eating Mongoose *H. urva* (Baral & Shah 2008, Thapa 2014) and Ruddy Mongoose *H. smithii* (Subba *et al*. 2014). According to Jnawali *et al.* (2011) Crab-eating Mongoose occurs in Nepal from 100to 1300 m asl (meters above sea level) and is fairly common in the lowland forests in the country's east. Its conservation status has been assessed as Vulnerable in *The Status of Nepal Mammals: The National Red List Series* (Jnawali *et al*. 2011).

Consistent with this conservation assessment, Thapa (2013) highlighted the rarity of documented locality records of Crab-eating Mongoose from Nepal, tracing only the following: specimens from Gorkha, in the central hilly region of Nepal, Chengli (perhaps today's Chyangli Village Development Committee in Gorkha district), and Boitari, also in Gorkha district (all in Fry 1925); listing, without any verifiable details, as occurring in the Annapurna Conservation Area, Chitwan National Park, Bardia National Park, Suklaphanta Wildlife Reserve and Ilam (Suwal & Verheugt 1995, Majupuria & Kumar 2006); and a photo-validated direct sighting in the eastern part of Sankhuwasabha district. Additionally, during a relatively intensive survey effort (4793 camera-trap-nights from 310 stations) in Chitwan National Park, targeting Tiger *Panthera tigirs*, Karki (2011) recorded the species frequently with 52 photographs from 18 camera-trap stations. However, no photographs of the species are presented in Karki (2011) and the validity of all 52 photographs has not yet been triangulated.

This note presents, with photo-documentation, the first confirmed record of Crab-eating Mongoose from Parsa Wildlife Reserve in the central lowlands of Nepal, obtained during camera-trapping for Fishing Cat *Prionailurus viverrinus.*

Parsa Wildlife Reserve (WR) lies within an elevation range of approximately 100–950 m asl. Four types of forest have been identified in the reserve: Sal *Shorea robusta* with Terai Mixed Hardwood Forest, Sal Forest, Terai Mixed Hardwood Forest, and Riverine Forest (see Yadav *et al*. 2013). Thapa (2014) highlighted that human-wildlife conflict and unsustainable natural resource use by local people were the major threats for Parsa WR and its wildlife. The reserve is part of the Siwalik Hills and its forests are contiguous with Chitwan National Park to the west. Flooded by the Rapti, Narayani and Reu rivers, the habitat of Chitwan National Park is relatively wetter than that of Parsa WR. Records for this species in Nepal are in Figure 1.

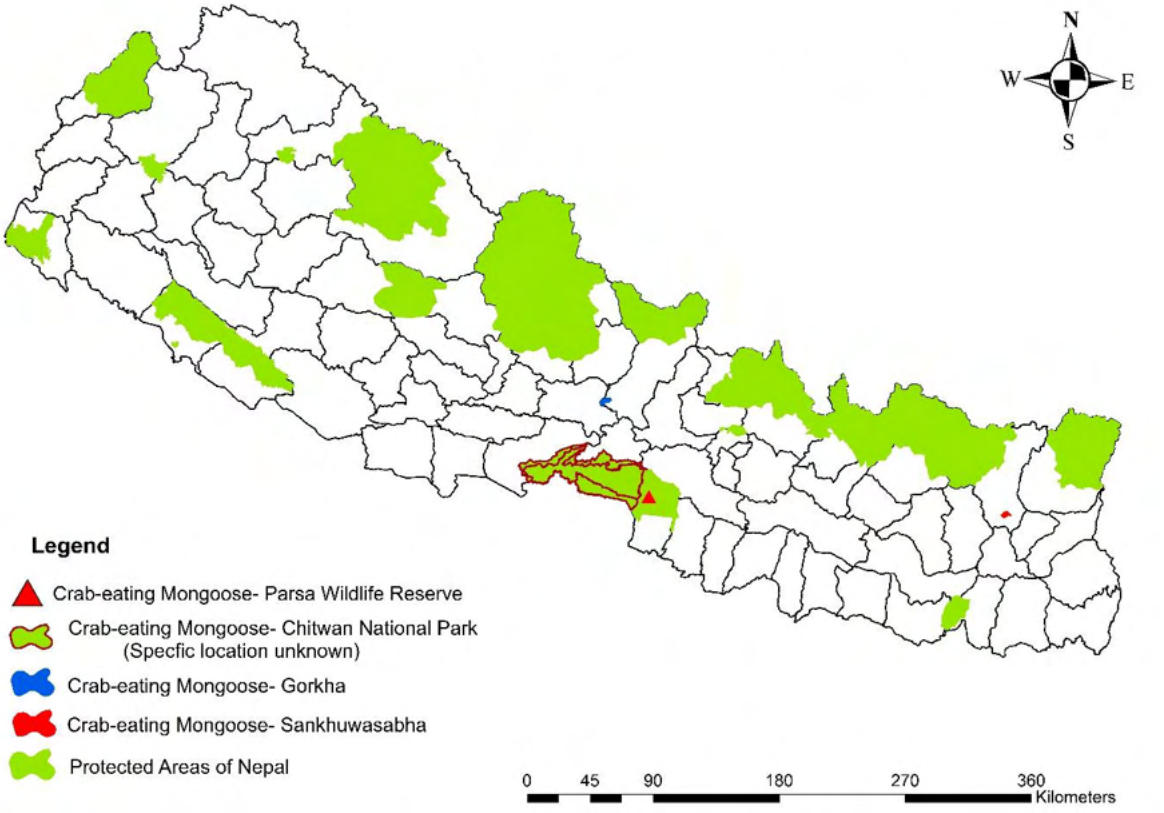

Figure 1. Confirmed records of Crab-eating Mongoose *Herpestes urva* in Nepal.

The Fishing Cat survey in Parsa WR used a total of 22 camera-trap stations with eight (five paired and three single camera-trap stations) in the Pratapur area of Makwanpur district and 14 (five paired and four single camera-trap stations) in the Bhata Khola area of Parsa district (Figure 2). Since the survey's main objective was to determine the presence of Fishing Cat, a species that is closely associated with wetlands, most camera-trapping was focused on riverside banks and stagnant water sources. Reconyx RM45 camera-traps were

used for the survey. Camera-traps were placed at each station for at least eight nights. There was a total survey effort of 64 camera-trap-nights in Paratpur and 180 camera-trap-nights in Bhata. The camera-traps were placed at a height of 30–40 cm and no artificial lures or baits were used. The survey was from 18 April to 4 May 2014.

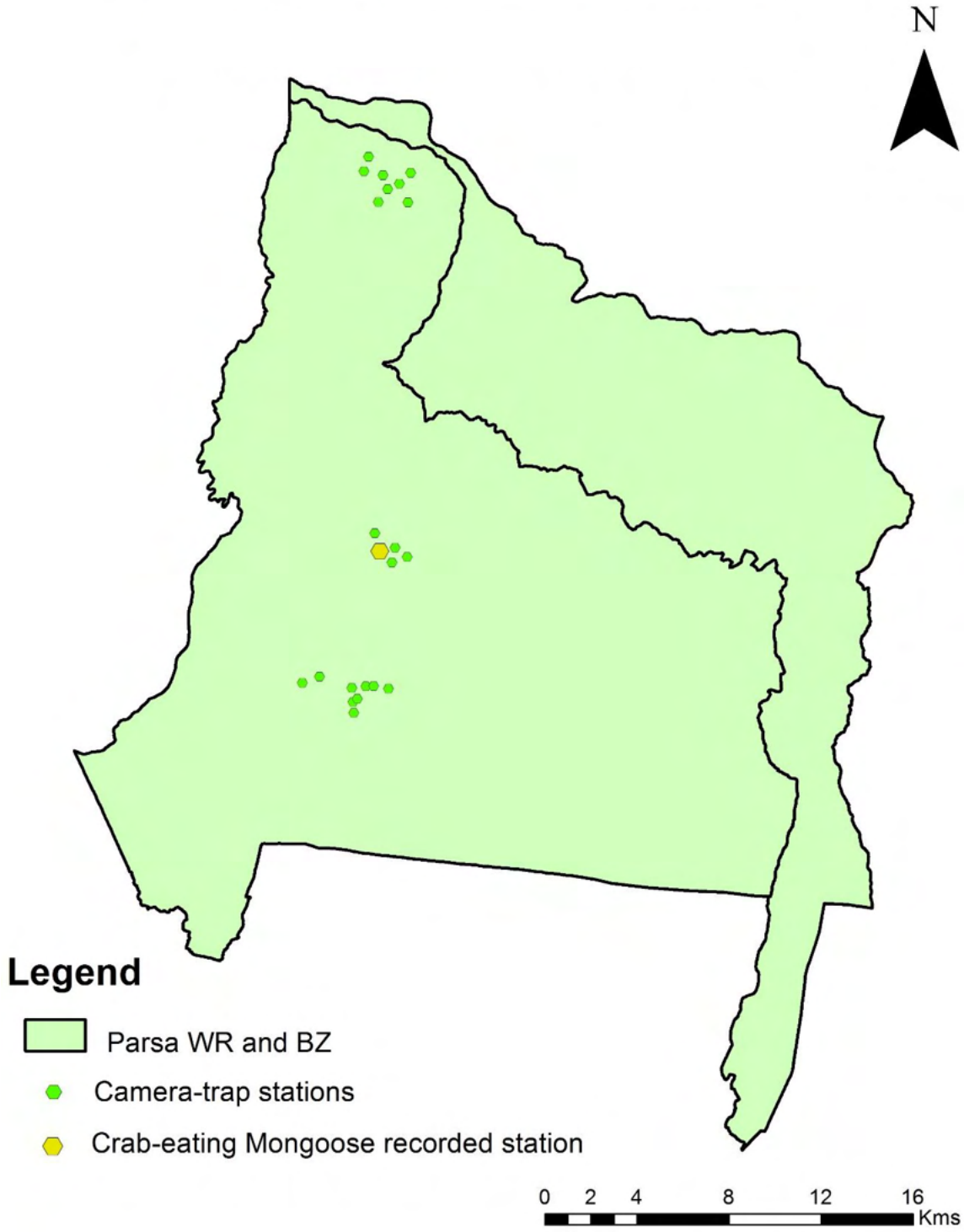

Figure 2. Location of camera-trap stations in Parsa Wildlife Reserve, Nepal.

A single Crab-eating Mongoose was camera-trapped with three images in quick succession (photographs were less than 15 seconds apart) from a station near the Ghodemasan area, Bhata (27°22′39″N, 84°48′21″E; elevation of 330 m asl) on 1 May 2014 at 12h30 (Figure 3). The record's location is deep inside the core area of Parsa WR. The camera-trap station was on a stream bank, densely covered with over one meter tall *Imperata cylindrica*, and with dense Sal Forest on both sides of the stream (Figure 4).

Figure 3. Camera-trap photograph of a Crab-eating Mongoose *Herpestes urva* at the Ghodemasan area, Parsa Wildlife Reserve on 1 May 2014. Credit: Biodiversity Conservation Centre, National Trust for Nature Conservation, Chitwan, Nepal.

In recent years, there have been extensive camera-trapping efforts in Nepal, particularly for Tiger *Panthera tigris*, which have also revealed information about small carnivores (e.g. Lamichhane *et al*. 2014, Subba *et al*. 2014). In spite of such efforts, the ongoing scarcity of camera-trap records of Crab-eating Mongoose suggest that the species might be rare, localised or that the information has not come out, as the priorities of such surveys are often large charismatic mammals such as Tiger and Leopard *Panthera pardus*.

Nepal lies at the western edge of the global range for Crab-eating Mongoose. The low number of records of Crab-eating Mongoose in Nepal contrasts with that in the core of its range, South-east Asia, where it is commonly recorded by both camera-trapping and

direct observation (e.g. Duckworth 1997, Than Zaw *et al*. 2008, Chutipong *et al*. 2014). Chitwan National Park and Parsa Wildlife Reserve lie approximately 400 km West of Madi, Sankhuwasabha district, the only other recent verified locality record for this species from Nepal (Thapa 2013). Although there are historical records from approximately 200 km further west in Gorkha (Fry 1925), continued occurrence in this area has not been documented. In India, this species is thought to be restricted to the north-eastern region including Assam, Arunachal Pradesh and northern West Bengal, where it is considered fairly common (Menon 2003, Datta *et al*. 2008, Choudhury 2013). Parsa Wildlife Reserve and Chitwan National Park are therefore the western-most recent locality records in the world.

Figure 4. Habitat at the camera-trap station which recorded (on 1 May) a Crab-eating Mongoose *Herpestes urva* in Parsa Wildlife Reserve, 4 May 2014.

Crab-eating Mongoose is categorised as Vulnerable in Nepal because of a suspected decline due to poaching for the fur trade and habitat destruction (Jnawali *et al*. 2011). Despite surveying in the core area of Parsa Wildlife Reserve, there were many human disturbances recorded, including several camera-trap photographs of people coming illegally to fish in the area. At the time of survey, a fair in the area drew hundreds of people to camp and travel in the reserve. These fairs are organised six to seven times a year and are

part of a deal that the local authorities made when the reserve was being demarcated and the villages that were within it resettled. Although no direct evidence of hunting was observed during the survey, the impact on wildlife could be significant from these encroachments; many groups of people were observed picnicking in the area during the survey, and many hundreds of people travel to these fairs. Locally, overfishing, habitat loss and destruction, and the poisoning of waterholes (a common method of illegal fishing) are suspected to be three possible threats to the species, and during our survey some local people were found guilty for poisoning rivers in the reserve. Discussions with the reserve's staff revealed that cases such as these are quite common.

Very little specific information is known about the Crab-eating Mongoose in Nepal. This record, combined with the relatively recent camera-trapping of the species in Chitwan NP, constitute the western-most recent locality records in the world. However, its status in the country is not well understood and difficult to assess because of the scarcity of records. Publication of similar records such as this could rapidly increase understanding of this species' status and distribution in Nepal.

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IUCN/SSC Small Carnivore Specialist Group

SHORT COMMUNICATION

A note on coat colour variation in Common Palm Civet *Paradoxurus hermaphroditus*

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Abstract.

We report coat colour variations in Common Palm Civet *Paradoxurus hermaphroditus* based on the observations from Karnataka and Maharashtra states, India. In both cases, individuals resemble each other in terms of brownish patch on the back, lack of black pigmentation on the leg extremities and approximately half of the tail length with white coat colour unlike typical Common Palm Civet.

उदमांजरातील (*Paradoxurus hermaphroditus*) वेगळ्या रंगस्वरूपाची नोंद

सारांश

भारतातील महाराष्ट्र आणि कर्नाटक येथून नोंदवलेल्या निरीक्षणांच्या आधारे आम्ही उदमांजरातील (*Paradoxurus hermaphroditus*) वेगळ्या रंगस्वरूपाची नोंद करत आहोत. दोन्हीं निरीक्षणांमधील उदमांजरात पाठीवरील तपकिरी भाग, पायांच्या खालच्या भागात काळ्या रंगाची कमतरता आणि अंदाजे शेपटीच्या अर्ध्या भागात पांढऱ्या रंगाचे साधर्म्य दिसून आले. या निरीक्षणांमध्ये नोंदवण्यात आलेली उदमांजरांची रंगसंगती हि साधारणतः दिसून येणाऱ्या उदमांजरापेक्षा वेगळी आहे.

Keywords: Common Palm Civet, coat colour variation, Dandeli, Kaas, Karnataka, Maharashtra.

The Common Palm Civet *Paradoxurus hermaphroditus* has a widespread distribution from central to south-eastern Asia (Jennings & Veron 2009). In India, this species has been recorded as far north as the Narbada (Narmada) river (Pocock 1939) along with certain parts such as Himalayan foot hills, Lower Bengal, Sikkim and Assam in the North-East India (Blanford 1888–91, Choudhury 2013). This species is nocturnal and omnivorous, usually preferring primary to secondary evergreen and deciduous forests, plantations, logged forests and human settlements as their habitats (Grassman1998).

Variations in coat colour of the Common Palm Civet have been observed from various localities in different climates (Pocock 1939). The typical coat colour ranges from brownish-grey to ashy-black along with longitudinal stripes. However, in case of short fur, these stripes are replaced by rows of spots. In case of long hair, under fur could be brown to grey with black tip. Head usually has pale-whitish band across the forehead extending to ears along with a whitish spot below the eye (masked face), vibrissae may appear black and sometimes with white at the base. Legs and tail are nearly black and paler towards extremities (Blanford 1888–91, Pocock 1939; Figure 1). Hitherto, Sharma (2004) has recorded an albino individual of the Common Palm Civet from Rajasthan, India, but the occurrence of different coat colours has not been reported to date, especially from these parts of the country.

Figure 1. Common Palm Civet, photographed from Maharashtra, India on 15 September 2009, showing pelage typical of the species. Note the masked face, absence of - white tail, brownish patch on the back side and white under fur on the anterior side. (Photo: Amod Zambre).

Figure 2. Coat colour variation in Common Palm Civet observed from Dandeli-Anshi Tiger Reserve, India on 2 July 2015. Note the brownish patch on the back, white underfur on anterior side, lack of black pigments on the leg extremities. Mammary gland is also visible on an upper side of the leg. (Photo: Aaditya Naniwadekar).

On 2 July 2015, at around 22:30h, the first three authors (HC, AP, CG) sighted an unusually-looking civet while driving a car on a road near Dandeli - Anshi Tiger Reserve (Karnataka state) at 15°16'21.76"N, 74°32'9.26"E (recorded elevation 501 m asl). Only the eye shine was seen initially. Due to the lights of the car the animal quickly moved into the road side vegetation and climbed up a tree. At first sight, it appeared to be a *Paradoxurus* species in brownish-black pelage with partially white tail. We photographed the animal which was about 4 m above the ground, using Point and shoot and DSLR cameras. The individual (Figure 2) had a combination of brown-black coat colour on the dorsal side. Underfur appeared whitish along with pinkish leg extremities. Tail emerged white and black when it was crossing the road, we tried to photograph the tail when it was on the tree (Figure 3). It appeared to be a fully grown female as the mammary glands were slightly visible in the photographs (Figure 2).

Figure 3. Another image of the same Common Palm Civet (Figure 2) showing white tail photographed on 2 July 2015. (Photo: Anish Pardeshi).

Another individual with the same features was sighted by the fourth author (RS) and his team near Kaas plateau, Satara, Maharashtra at 17°42'56.13"N, 73°47'53.83"E (recorded elevation 1,186 m asl) on 1 November 2015 at 21:30h. This civet appeared juvenile with black coat colour having similar golden-brownish patch on its back. Approximately half of the tail emerged to be off-white (Figure 4). A second observation (most probably the same individual) took place on 13 December 2015 at 20:40h on the same location (Kaas plateau, at 17°42'56.18"N, 73°47'53.66"E, recorded elevation 1,176 m

asl) by the first three authors. Unfortunately, due to the quick movement and disappearance of it in the nearby thicket, we could not photograph this individual.

Figure 4. The second individual of Common Palm Civet with colour variation sighted at Kaas, Maharashtra on 1 November 2015. (Photo: Rohit Shinde).

Brown Palm Civet and Common Palm Civet are sympatric species in the Western Ghats (Bhosale *et al*. 2014). Though the tail of both of the sighted civets appeared to be off-white, which is the characteristic of Brown Palm Civet (Blanford 1888–91), some individuals of Common Palm Civet with off-white tail tip have been observed during the camera trap survey in Sabah, Malaysia (Wilting *et al*. 2010). Presence of the typical masked face, the shape of the pointed ears, head and snout, colour of vibrissae and variation in the fur length of both the sighted individuals suggested that they were Common Palm Civet rather than Brown Palm Civet (Mudappa – pers. comm.).

Coat colour variations in Viverrids have been reported in Banded Palm Civet *Hemigalus derbyanus*, Owston's Civet *Chrotoga leowstoni* and Javan Small-toothed Palm Civet *Arctogalidia* (*trivirgata*) *trilineata* (Veron *et al*. 2004, Eaton *et al.* 2010). Polymorphism is a phenomenon that describes two or more morphologically distinct phenotypes within one or various populations of a single species (Farallo & Forstner 2012). On the basis of primary observations in the wild, we report that sighted Palm civets are *Paradoxurus hermaphroditus* and thus further studies are needed to understand if the species shows polymorphic phenotypes. Nevertheless, Veron *et al*. (2015) suggested the

possibility of 2–3 subspecies within *Paradoxurus hermaphroditus* and thus molecular studies of this morph are needed to reveal the complexity among *Paradoxurus* species.

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Hairy-nosed Otter *Lutra sumatrana* (Photo: D. Willcox)

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