

# Recent camera-trap records of Malay Weasel *Mustela nudipes* in Sabah, Malaysian Borneo

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## Abstract

Malay Weasel *Mustela nudipes* is rarely detected in wildlife surveys, despite occupying habitats ranging from primary forest to disturbed village areas across a wide range of elevations. We report some of the few camera-trap detections of this species, including the first records from an oil palm plantation, and quantitative data showing that Malay Weasel is diurnal. A possible reason that it remains so infrequently detected by camera-trapping is that most surveys use unbaited camera-traps and place them in locations that are inefficient hunting areas for Malay Weasels, so are thus avoided by them.

**Keywords:** diel activity pattern, mustelid, oil palm plantation, photographic records

## Rekod rekod baru Pulasan Tanah *Mustela nudipes* dari perangkap kamera di Sabah, Borneo Malaysia

## Abstrak

Pulasan Tanah *Mustela nudipes* jarang dikesan semasa menjalankan pemantauan hidupan liar, walaupun spesis ini bertaburan meluas, dari hutan primer (tanpa pembalakan) hingga ke kawasan perkampungan yang terganggu, dan taburannya merentasi pelbagai ketinggian. Di sini, kami melaporkan jumlah penemuan spesis ini yang sangat kurang melalui kaedah perangkap kamera, termasuk rekod pertama spesis ini dari ladang kelapa sawit. Kami juga melaporkan corak aktiviti spesis ini sepanjang hari dengan menggunakan data kuantitatif. Pulasan Tanah aktif pada siang hari. Satu sebab mengapa spesis ini jarang ditemui dengan perangkap kamera ialah kerana kebanyakan kerja pemantauan tidak menggunakan umpan semasa memasang perangkap kamera. Selain itu, perangkap kamera diletakkan di lokasi yang tidak seiras dengan gaya pemburuan Pulasan Tanah, jadi spesis ini megelakkan lokasi lokasi sedemikian.

## Introduction

Malay Weasel *Mustela nudipes* is a small carnivore found in southern Thailand, Malaysia, Brunei and western Indonesia (Sumatra and Kalimantan). Originally believed also to exist on Java, it is now thought to be absent from that island (all the few indications being either in error or, at best, inconclusive; Duckworth *et al.* 2006). Throughout its range Malay Weasel exhibits some habitat plasticity; it has been recorded from sea-level up to 1,700 m asl on Borneo (Mount Kinabalu, Sabah, Malaysia; Payne *et al.* 1998) and up to 1,300 m asl on Sumatra (Duckworth *et al.* 2006). It uses a range of natural habitats including tropical heath forest, swamp forest, montane forest and montane scrub along with lowland and hill mixed dipterocarp forests (Duckworth *et al.* 2006). The extent to which it is forest-dependent is unclear. Records exist from a range of anthropogenically modified habitats, including exotic timber plantations (Belden *et al.* 2007), mixed rainforest-rubber plantations (Franklin & Wells 2005), highly degraded areas, villages and even suburbs (Duckworth *et al.* 2006), although it is not clear if these modified habitats can support populations, or whether, for example, these observations are of dispersing individuals. Because its relationship with forest cover and quality is uncertain, it is not known how recent and current forest loss and degradation are impacting the species. On Borneo, at least in some areas, it is reportedly used medicinally and as food, and the fur is burnt by some ethnic groups in exorcism rituals (Puri 2001). However, it does not seem to be specifically targeted by hunters across most of its range. Given these attributes, particularly the number of reports from non-forest habitats and at high elevations (where for-

est conversion is considerably slower than in the lowlands), and the lack of any evidence for trade-driven hunting, it is currently categorised as Least Concern by *The IUCN Red List of Threatened Species*, although its population is believed to be in decline (Duckworth & Kanchanasaka 2008).

Malay Weasel has never been studied in the wild and in most forms of modern wildlife survey it is recorded rather rarely. Despite the increasing use of camera-traps in its range, the species is rarely photographed; the first camera-trap record for this species was in 2000, obtained by Siew Te Wong during a survey of the Ulu Segama Forest Reserve, Sabah (Duckworth *et al.* 2006). Since this initial detection, Malay Weasels have been camera-trapped in at least three other areas in Sabah: Deramakot Forest Reserve (Samejima & Ong 2012), a forest fragment in an oil palm plantation adjacent to Tabin Wildlife Reserve (H. Bernard *in litt.* 2013), and in Kalabakan Forest Reserve (O. R. Wearn *in litt.* 2013). Here we detail the only other camera-trap records of Malay Weasel of which we are aware, obtained from intensive camera-trap surveys from a range of habitats within Sabah, including the first records from oil palm plantation habitat. For the first time, there are enough records to quantify the species's diel activity pattern as past statements on this topic are conflicting (Duckworth *et al.* 2006).

## Survey areas and methods

As part of an investigation of Bornean cat (Felidae) ecology, nine study areas in Sabah, Malaysian Borneo, were camera-trapped between November 2006 and October 2012. This included seven

forest areas (Danum Valley Conservation Area, Ulu Segama, Malua and Kabili-Sepilok Forest Reserves, Tabin Wildlife Reserve, Lower Kinabatangan Wildlife Sanctuary and Crocker Range National Park) and two oil palm plantations (Danum Palm and Minat Teguh; Fig. 1, Table 1). Danum Palm was cleared and planted in 2000, Minat Teguh in 1995; both plantations comprised mature fruiting palms, with a largely open understory. Neither plantation retained any forest patches within the surveyed area, but both were adjacent to extensive areas of dipterocarp forest. In addition, Danum Palm contained areas of semi-natural scrub vegetation along one large river and one stream, and the southern border of Minat Teguh was fringed with mangrove.

The 497 camera-trap stations across the study areas used passive infrared digital camera-traps: Snapshot Sniper

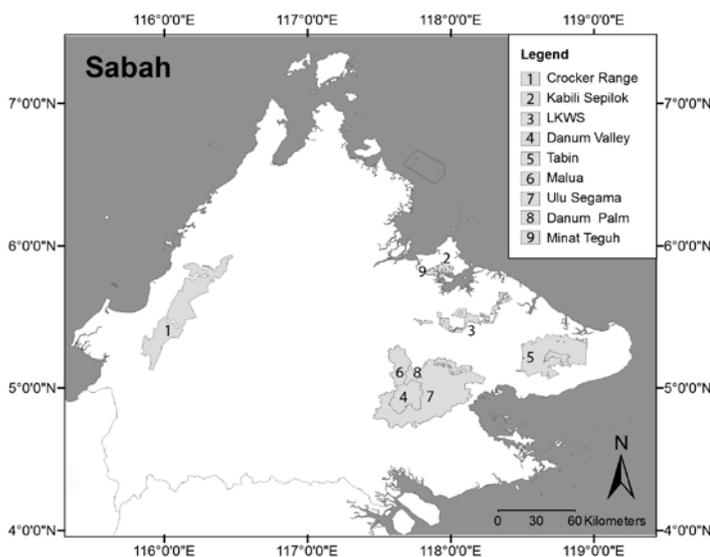


Fig. 1. Sabah, Malaysian Borneo, depicting the nine survey areas. LKWS = Lower Kinabatangan Wildlife Sanctuary.

P41 (Snapshot Sniper LLC, OK, USA), Cuddeback Capture (Non Typical Inc., WI, USA), Bushnell Trophycam 2010 (Bushnell Corporation, KS, USA), Reconyx HC500 (Reconyx Inc., WI, USA) and Panthera V3 (Panthera, New York, NY, USA). Camera-trap stations were unbaited and were located approximately 1–2 km from one another in all areas except Danum Palm, where they were roughly 500 m apart. They were on animal and man-made trails (existing and freshly cut) and old logging roads in the forest areas, and on roads and existing access paths in the oil palm plantations. The passive infrared sensor was set approximately 40–50 cm above the ground. All cameras were set to operate for 24 hours each day, and recorded the time and date of each detection. All photographs of suspected Malay Weasels were meticulously inspected in order to prevent misidentification with the sometimes similarly coloured and sympatric Collared Mongoose *Herpestes semitorquatus* (Giordano & Brodie 2012, Ross *et al.* 2012). Detections were counted treating any number of photographs per calendar day per camera-trap station as one record, whereas investigation of activity pattern considered any number of detections per clock-hour, per day, per camera-trap station as a record. Elevations were measured with a Garmin GPSMap 60 CS unit, using the averaging function to increase accuracy.

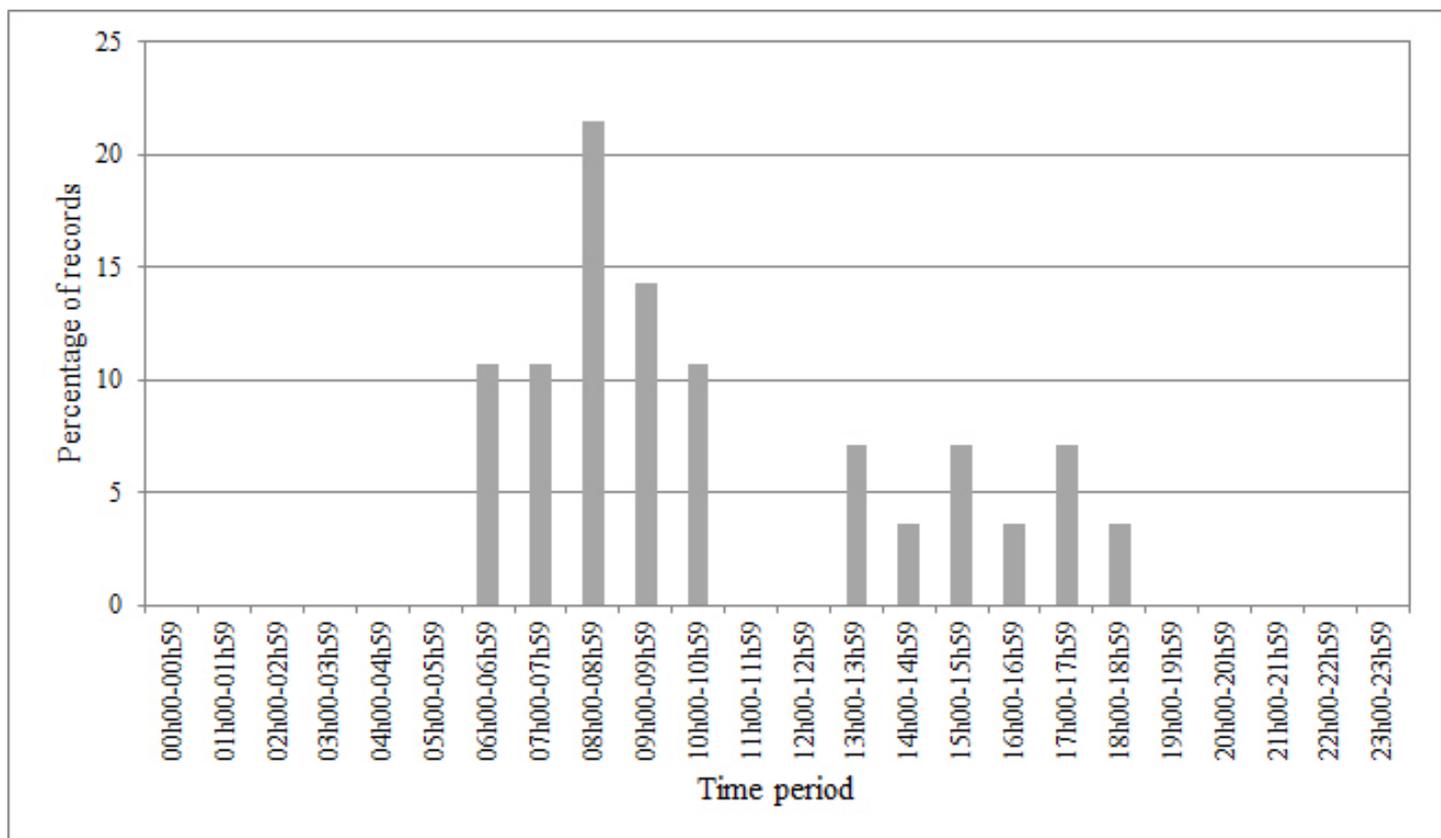
## Results

A total of 40,524 camera-trap-days resulted in over 200,000 photographs of wildlife, representing 50 identified wild mammal species. Malay Weasel was detected 28 times in total, at only four of the nine study areas, over an elevation range of 68–1,342 m (Table 1; Appendix 1). The species was detected in all months except July – September. The several records within oil palm habitat lay 200 m, 840 m and 1.5 km respectively from the nearest semi-natural vegetation. All images were of single animals. All records were obtained during the day, with a slight peak (perhaps merely a vagary of the small sample size) between 08h00 and 10h00 (Fig. 2; all sites' records pooled).

Table 1. Summary of Malay Weasel *Mustela nudipes* detections in nine study areas, Sabah, Malaysia.

Study area	Habitat	Survey period	Camera-trap-days	Camera-trap stations (mean elevation)	Malay Weasel detections* (stations)	Detection rate (detections*/100 camera-trap-days)
Danum Valley	Primary lowland dipterocarp	Oct 2006 – Jun 2007; Oct 2007 – Sep 2008; Mar 2012 – Oct 2012	6,228	157 (325 m)	0	0
Ulu Segama	Logged dipterocarp	Nov 2006 – Oct 2007	4,154	40 (254 m)	0	0
Malua	Recently logged dipterocarp	Sep 2008 – Feb 2009	3,343	36 (177 m)	1 (1)	0.030
Danum Palm	Oil palm	Mar 2009 – Jun 2009	1,941	21 (210 m)	9 (4)	0.464
Tabin	Logged dipterocarp	Aug 2009 – April 2010	6,172	72 (177 m)	1 (1)	0.016
LKWS	Logged riverine	Jul 2010 – Dec 2010	3,997	65 (34 m)	0	0
Kabili-Sepilok	Lowland mixed dipterocarp, heath forest, mangrove	Feb 2011 – May 2011	3,755	35 (66 m)	0	0
Minat Teguh	Oil palm	May 2011 – Aug 2011	1,920	35 (23 m)	0	0
Crocker Range	Primary hill dipterocarp/sub montane	Oct 2011 – Feb 2012	3,999	36 (1,032 m)	17 (9)	0.425

\*A 'detection' comprises any number of photographs per calendar day per camera-trap location. LKWS = Lower Kinabatangan Wildlife Sanctuary. 'Mean elevation' refers to the elevation of the camera-trap stations.



**Fig. 2.** Diel activity pattern of Malay Weasel *Mustela nudipes*, derived from 28 detections from pooled camera-trap data across nine study areas in Sabah, Malaysia.

## Discussion

These records include the first known Malay Weasel records from oil palm plantation habitat. They suggest that it tolerates some degree of habitat alteration, corroborating previous records (Duckworth *et al.* 2006) and confirming the speculation of Duckworth *et al.* (2006) that it will (at least under certain circumstances) use oil palm plantations. The record furthest from semi-natural vegetation, in this case the logged forest–plantation boundary, was 1.5 km. However, because of the shape of Danum Palm Plantation (roughly triangular with semi-natural vegetation along two borders) this distance was also the furthest from more natural vegetation that was surveyed. Therefore, it remains unclear whether this highly modified habitat can support a sustainable population or whether these animals depend on adjacent forest. Malay Weasels lack finely patterned coats, hampering distinction between individuals on photographs, and rendering it unclear how many individuals were photographed in Danum Palm; the maximum distance between detections here was 2.4 km. In Crocker Range, however, one animal differed strikingly in coloration from the others (Ross *et al.* 2012: Fig. 7b) and proved that at least two individuals were detected at one camera station. The maximum distance between detections of animals with typical pelage was 13.8 km and, even with no information on home range in the species, it is likely that several individuals must have been camera-trapped in at least this area.

The highest detection rates across the nine areas were in high-elevation primary forest and lowland oil palm plantation, two very different habitats. Surveys of other primary for-

est and oil palm areas resulted in no detections, despite previous records of the species in some of them (Duckworth *et al.* 2006), and consistent survey methods across areas. Only four sites (470 camera-trap days) at elevations higher than 1,342 m were surveyed and so the upper limit of these records does not necessarily indicate the upper limit of Malay Weasel occurrence; it is possible that even within Crocker Range National Park Malay Weasel occurs at higher elevations than those at which we detected it. The lack of Malay Weasel detections during July – September is probably biologically uninformative: neither Crocker Range nor Danum Palm (the two areas with highest detection rates) were surveyed during these months.

Daytime activity seems typical for the species. Of the 59 records collated by Duckworth *et al.* (2006) that had temporal information, 53 (89.8%) were during daylight. While this pattern may have been strongly influenced by the timing of human activities, round-the-clock camera-traps removes this potential bias.

Malay Weasel diet is poorly known, but is thought to include rodents (Franklin & Wells 2005) and reptiles (Jentink 1898). Possibly, higher densities of some rodents (e.g. *Maxomys whiteheadi*; Rajaratnam *et al.* 2007) and/or higher hunting success in oil palm plantations might encourage movement into, or allow elevated abundances in this habitat. Indeed, this may be so for Leopard Cat *Prionailurus bengalensis* (Scott *et al.* 2004, Rajaratnam *et al.* 2007). Presence of Malay Weasel would then benefit plantation owners insofar as it preys on rodent pests. Certainly, this species is welcomed in the farmlands surrounding Kerinci Seblat National Park, Sumatra, where it is perceived to control vermin (Franklin & Wells 2005).

The increasing use of camera-traps in South-east Asia records Malay Weasel very infrequently. This rarity in camera-trapping is shared by at least some other weasels, such as Stripe-backed Weasel *M. strigidorsa* (Abramov *et al.* 2008), Least Weasel *M. nivalis* (García & Mateos 2009), Long-tailed Weasel *M. frenata* (Gompper *et al.* 2006, Ordeñana *et al.* 2010) and Yellow-bellied Weasel *M. kathiah* (Supparatvikorn *et al.* 2012). Whether this generally low camera-trapping rate is a true reflection of a low population density, or arises from behavioural traits that result in few photographic records, is unclear. Malay Weasels apparently show little fear (e.g. Franklin & Wells 2005, Duckworth *et al.* 2006). Several photographed during the present surveys seemed to be curious of the cameras; some even climbed over the unit. It is, therefore, perhaps unlikely that Malay Weasels avoid camera-traps because of fear. Inappropriate camera-trap height might reduce the likelihood of detecting this relatively small carnivore. However, this seems unlikely in at least our surveys, where detection rates were low despite the cameras being close enough to the ground to record, frequently, similar-sized mammals such as mongooses *Herpestes* and smaller ones such as small rodents. When camera-trap surveys are targeted to specific species, or even when surveys are designed for assessment of mammal communities, cameras are often placed on perceived travel routes (often logging roads and forest trails) for those species. These habitat sub-types might be avoided by Malay Weasels. Observations reported in Duckworth *et al.* (2006) detail animals hunting amongst fallen logs and entering holes. Malay Weasels might have a tendency to avoid clear forest trails and logging roads, perhaps unrelated to fear but because they are not very good foraging areas. It is possible that Malay Weasels spend a great deal of time hunting rodents in dense vegetation at which camera-traps are not usually directed. Cameras set at more typical locations might, therefore, be unlikely to detect Malay Weasels. It is also possible that Malay Weasel's movements, perhaps often fast and zigzagging (e.g. Giordano & Brodie 2012, Perrotto 2012) result in low detection probabilities in camera-trap surveys. Detections might be increased by targeting areas of dense vegetation, and the use of a suitable lure. The former, however, would result in vastly suboptimal locations for the target species of most camera-trapping surveys and so the number of Malay Weasel detections is unlikely to increase from typical camera-trap surveys in the future.

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**Appendix 1.** Details of Malay Weasel *Mustela nudipes* detections in nine study areas, Sabah, Malaysia.

Survey area	Location of detections	Elevation (m)	Date	Time
Malua	5°09'02"N, 117°41'29"E	184	27 Dec 2008	07h04
Danum Palm	5°04'54"N, 117°46'04"E	231	27 Mar 2009	09h31
Danum Palm	5°04'54"N, 117°46'04"E	231	29 Mar 2009	15h26
Danum Palm	5°04'54"N, 117°46'04"E	231	06 Apr 2009	10h23
Danum Palm	5°04'54"N, 117°46'04"E	231	11 Apr 2009	17h24
Danum Palm	5°04'45"N, 117°45'44"E	241	11 May 2009	08h39
Danum Palm	5°04'45"N, 117°45'44"E	241	21 May 2009	06h45
Danum Palm	5°04'45"N, 117°45'44"E	241	27 May 2009	09h15
Danum Palm	5°05'10"N, 117°46'01"E	202	21 Jun 2009	16h08
Danum Palm	5°05'29"N, 117°46'47"E	199	25 Jun 2009	08h32 <sup>a</sup>
Tabin	5°16'16"N, 118°30'20"E	68	10 Mar 2010	08h17
Crocker Range	5°25'31"N, 115°59'24"E	1,120	11 Oct 2011	10h05
Crocker Range	5°24'18"N, 116°02'39"E	1,287	03 Nov 2011	06h03 <sup>b</sup>
Crocker Range	5°22'13"N, 116°02'08"E	885	04 Nov 2011	07h20
Crocker Range	5°26'46"N, 116°05'30"E	789	10 Nov 2011	15h52
Crocker Range	5°23'18"N, 116°03'04"E	1,186	18 Nov 2011	07h40 <sup>c</sup>
Crocker Range	5°26'33"N, 116°03'32"E	1,342	04 Dec 2011	08h19
Crocker Range	5°22'13"N, 116°02'08"E	885	05 Dec 2011	09h31
Crocker Range	5°22'13"N, 116°02'08"E	885	06 Dec 2011	10h28
Crocker Range	5°26'33"N, 116°03'32"E	1,342	12 Dec 2011	08h36
Crocker Range	5°22'13"N, 116°03'20"E	964	29 Dec 2011	14h44
Crocker Range	5°25'31"N, 115°59'24"E	1,120	01 Jan 2012	06h59 <sup>d</sup>
Crocker Range	5°28'52"N, 116°00'02"E	694	05 Jan 2012	08h09
Crocker Range	5°22'13"N, 116°02'08"E	885	09 Jan 2012	09h20
Crocker Range	5°26'33"N, 116°03'32"E	1,342	01 Feb 2012	18h25
Crocker Range	5°26'33"N, 116°03'32"E	1,342	02 Feb 2012	17h26 <sup>e</sup>
Crocker Range	5°26'34"N, 116°00'04"E	1,131	15 Feb 2012	13h42
Crocker Range	5°22'13"N, 116°02'08"E	885	21 Feb 2012	13h03
LKWS*	5°24'59"N, 118°02'05"E	18	17 Jun 2012	07h00

<sup>a</sup>Sequence of five images, three at 08h33 and the fifth at 08h35, all probably the same individual<sup>#</sup>; <sup>b</sup>sequence of three images of the same individual<sup>#</sup>, all at 06h03; <sup>c</sup>sequence of two images of the same individual<sup>#</sup>, both at 07h40; <sup>d</sup>sequence of three images of the same individual<sup>#</sup>, all at 06h59; <sup>e</sup>another image at 17h50, unclear whether of the same individual.

<sup>#</sup>Considered to be the same individual because of the animal's position in subsequent images relative to that in the first image.

Geographical coordinates according to the WGS84 datum.

\*Video record (Perrotto 2012) from Lower Kinabatangan Wildlife Sanctuary (= LKWS), the time is approximate. No Malay Weasel was camera-trapped during the survey in this area.