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Small-toothed Palm Civet Arctogalidia trivirgata records from human-influenced habitats in Vietnam

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Abstract

Small-toothed Palm Civet Arctogalidia trivirgata is rather rarely included on mammal survey lists for Vietnamese protected areas. This has often led to its being declared rare, and therefore a priority for national small carnivore conservation. Evidence from outside Vietnam suggests that this paucity of records in Vietnam is due at least largely to the reliance on inappropriate survey methods, i.e. ground-based camera-trapping and diurnal surveys, that will fail to record this nocturnal, very arboreal civet. Presented here are several recent confirmed records from both protected and non-protected areas in Vietnam, all of which have undergone major anthropogenic disturbances, including hunting and illegal logging. The ability of this species to survive in these areas where most similar-sized or larger animal species have become reduced or extirpated indicates that it is not a conservation priority among Vietnam's mammals. Consideration of other information from throughout its range suggests that the conservation focus for this genus should be on the Javan taxon A. (t.) trilineata. These records from Vietnam have also extended the documented altitude range for this species in Vietnam to above 1,000 m a.s.l, consistent with other parts of the species's range, and have added a habitat type not previously recorded for the species: Melaleuca-dominated wetland forest.

Keywords: camera-trapping, conservation priorities, conservation status, habitat use, spotlighting

Introduction

The wide deployment of camera-traps across Southeast Asia over the last 15–20 years has generated many images of small carnivores and, although these were rarely the target species of the survey in question, where their records are collated and published, they have added considerably the understanding of species' conservation status (e.g. Holden 2006, Than Zaw et al. 2008), including of some globally threatened species (e.g. Veron et al. 2006, Dang & Le 2010, Gray et al. 2010). Small-toothed Palm Civet Arctogalidia trivirgata occurs almost throughout Southeast Asia, and into adjacent northeast India and southern China (Corbet & Hill 1992). It has been found by many surveys using methods other than camera-trapping, often frequently (e.g. Duckworth 1997, Walston & Duckworth 2003, Duckworth & Nettelbeck 2008, Eaton et al. 2010, Low 2010, Moore 2010). By contrast, most camera-trap surveys do not find this species, even when they are of long duration, use many camera-trap sites, and are within habitat-types likely to be used by this species (e.g. Azlan 2006, Azlan & Lading 2006, Suzuki et al. 2006, Than Zaw et al. 2008, Holden & Neang 2009, Johnson et al. 2009, Lau et al. 2010, Gray & Phan 2011). Although some of the former surveys might have been in areas where Small-toothed Palm Civets do not occur, there are many camera-trap surveys that have not found the species at sites where remains of dead animals or live field sightings showed it to be present (e.g. Conforti 1996, Walton & Duckworth 2003, Borissenko et al. 2004, Wells et al. 2005, Holden 2006, Long & Minh 2006, Belden et al. 2007, Wilting et al. 2010, and, apparently, Cheyne et al. 2010, Mathai et al. 2010, Brodie & Giordano 2011). By contrast, we traced no surveys where Small-toothed Palm Civet was camera-trapped, but not found by spotlighting where this latter method was used. The species is categorised as Least Concern on The IUCN Red List of Threatened Species (IUCN 2012).
Over a century ago, Small-toothed Palm Civet’s use of Coconut Cocos nucifera plantations on Bunguran, in the Natuna islands (Indonesia) was remarked (Miller 1901). Relatively few recent records from highly modified habitats have been published, such as those from Bukit Kiara Recreational Park, West Malaysia (Eaton et al. 2010) and Singapore, where Small-toothed Palm Civet is one of only two civet species (without suspicion of captive origin) persisting in the island’s remaining small forest isolates (Chua et al. 2012). The species is highly arboreal (e.g. Payne et al. 1985, Duckworth & Nettelbeck 2008), and arboreality is sometimes considered a priori to increase the sensitivity of species to human pressures, particularly habitat disruption (e.g. Ochoa & Soriano 2001). This seems reasonable, given the possibility for canopy change to affect such species’ daily movements, episodic dispersal, food sources, sleeping sites and other resources. A general, and understandable, tendency for wildlife surveys to occur in areas likely to be of high importance to threatened species means that there are few hard data giving evidence to the extent to which Small-toothed Palm Civet survives in fragmented, isolated, heavily degraded and/or heavily hunted areas.

This note presents observations of Small-toothed Palm Civets from several sites in Vietnam, in both protected and non-protected areas, where habitat has been highly degraded and fragmented. Even by regional standards, Vietnam has a high human population density, very heavy hunting (including in most protected areas) and pervasive wildlife trade, of which civets are a key part (Bell et al. 2004, Roberton 2007). It is therefore unlikely that species which are highly sensitive to hunting and/or habitat disturbance will be found widely and easily in the country away from relatively well-protected sites. Spotting has been relatively little-used as a survey technique in Vietnam to date (or, at least, there are few available survey results from the method), and some such surveys (e.g. Le et al. 1997) have focused on deciduous forest which, based on confirmed records from throughout the species’s range, is not thought to be suitable habitat for Small-toothed Palm Civet (Robertson 2007).

Records

Ke Go Nature Reserve – Khe Net proposed Nature Reserve, Ha Tinh and Quang Binh provinces
Ke Go Nature Reserve (NR) and Khe Net proposed NR comprise lowland evergreen forest but are presently ‘paper parks’. Evidence of anthropogenic disturbance, both past and current, can be seen almost throughout both nature reserves and extends into some of their least accessible parts, such as the tops of the small but fairly steep hills. There are indications of high levels of hunting (about 1,200 cable snare traps were recorded in approximately 30 km² over several weeks of surveying, in October–November 2006 and March–May 2010) and illegal logging (Wilcox et al. in prep. a). Over the course of the March–May 2010 survey, 17 illegal logging/hunting camps were recorded, chainsaws were heard on at least four occasions and approximately 130 domestic buffaloes Bubalus bubalis were recorded (Wilcox et al. in prep. a). Although there are few published quantifications of such human activities from other surveys in either protected or non-protected areas in Vietnam with which to compare, clearly many people use, illegally, the Ke Go–Khe Net lowland landscape. A 1996 survey of Ke Go NR (Le et al. 1999) classified vegetation types into four broad categories based on the level of human impact: lightly disturbed broad-leaved evergreen forest, heavily disturbed broad-leaved evergreen forest, plantation, scrub and grassland. Lightly disturbed broad-leaved evergreen is primary forest, and though commercial tree species are selectively logged from these patches of forest, much of this vegetation type remains little changed. Heavily disturbed broad-leaved evergreen includes areas that have been completely cleared and are now secondary forest, and some areas that have managed to retain some plant species and structure associated with primary forest, despite heavy anthropogenic disturbance.

A targeted small carnivore survey of approximately 100 hours of spotlighting and 1,300 camera-trap-nights during October 2006 – March 2007 and January–July 2010 recorded Small-toothed Palm Civet three times. On 18 March 2010, one individual spotlight at 20h00 in lightly disturbed primary broad-leaved evergreen forest at approximately 300 m a.s.l. (18°07′N, 105°56′E) gave a clear view for about 5 seconds only 4–5 m away. On 26 March 2010, at 20h10, one was seen in secondary broad-leaved evergreen forest at about 150 m a.s.l. (18°06′N, 105°56′E), in a small tree, about 3 m from a well-used path, 15 m from a small stream, 50 m from the field team’s camp and 100 m from an active hunters’ camp. The final confirmed record was on 28 April 2010 at 21h30, when one was seen in a tree covered with thick woody creepers in heavily disturbed primary evergreen forest at approximately 160 m a.s.l. (18°07′N, 105°55′E), 15 m to the side of the main pathway, for about 4 seconds through binoculars until it disappeared into the foliage.

The three confirmed records for Small-toothed Palm Civet at this site were more than for Common Palm Civet Paradoxurus hermaphroditus, and were exceeded, among small carnivores, only by ferret badgers Melogale. This suggests that it is one of the more common small carnivores left in this landscape.

U Minh Ha Fishery and Forestry Enterprises, Ca Mau province
On the moonless, warm and cloudy night of 4 September 2010, at about 21h30, a Small-toothed Palm Civet was seen in a Custard-apple tree Annona reticulata, a non-native fruit species, at 9°31′N, 104°57′E in the U Minh Ha Fishery and Forestry Enterprises (FFEs). Once disturbed, it ran along the main branch, down the trunk to the ground and away from view, an unusual behaviour for this arboreal species, which typically escapes through the canopy (DHAW pers. obs.). This was presumably because the Melaleuca (a species next to the A. reticulata were too weak to support the civet’s weight. This sighting was amid a young (about five years old) M. cajuplantation, with canal embankments lined with banana and other fruit trees which had been planted and left untended by local people. The nearest extensive older forest is U Minh Ha NP, which is approximately 30 years old and 40 km away. The nearest forest on dry land, of the sort sometimes assumed to be typical of the species, i.e. evergreen forest (e.g. Robertson 2007), is approximately 150 km away. The U Minh Ha FFEs are active forestry enterprises, and their M. caju and Acacia plantations are commercially harvested in large quantities (Fig. 1). Local people live within about 50 m of the observation.
site and during a previous spotlighting session (3 September 2010), two hunters were seen scouring the banks in the same area using torches, accompanied by six dogs. A bank near this sighting had six cable-snares, although only one was seen elsewhere on the survey. Relative to the authors’ observations of hunting pressures in Vietnam’s protected areas, hunting using cable-snare traps seems to be scarce, but human activity (with dogs) high. Nylon nets (strongly corded, suitable for catching medium-large species of fish; Fig. 2) were placed along most of the banks, reportedly to help catch Sunda Pangolins Manis javanica. Apparently, hunters search the banks using torches and dogs; any tree containing something marketable is cut down, while other animals are caught on the ground or in one of the nets.

Total survey effort for the U Minh Ha FFEs was approximately 800 camera-trap-nights and 40 hours spotlighting. This produced confirmed records for three other small carnivore species; six for Common Palm Civet, 23 for Leopard Cat *Prionailurus bengalensis* and five for Small Asian Mongoose *Herpestes javanicus*. These three species were recorded mainly by camera-traps. There were few suitable pathways for spotlighting in the U Minh Ha FFEs, so nearly all spotlighting involved going along canals in a small boat with a loud outboard engine, allowing search only of vegetation along the canal embankments. Controlling pace and noise, important when spotlighting for small carnivores, was difficult. The low number of Small-toothed Palm Civet records relative to the camera-trapped species may reflect limitations of spotlighting in this habitat type, more than Small-toothed Palm Civet’s relative status in this area.

**Ta Kou Nature Reserve, Binh Thuan province**

Ta Kou Nature Reserve (NR) is characterised by a dry coastal monsoon climate and includes a 10,762 ha coastal sandy flat area dominated by deciduous dipterocarp trees, and 1,000 ha of evergreen and semi-evergreen forest on the 697 m high Ta Kou Mountain (Hoang et al. 2010). Approximately 45,000 people live in the buffer zone, and the nature reserve’s biodiversity is threatened by hunting, illegal encroachment and over-exploitation of non-timber forest products (Birdlife International 2004, Luu 2008). The survey site on the mountian has evergreen forest dominated by species of figs *Ficus*. Near the top, mixed broadleaf and bamboo forest is also found.

A spotlighting survey of approximately 40 hours from 17h00 to 23h00 during May–July 2009 and January–April 2010 on Ta Kou Mountain resulted in nine sightings with a total of 18 ‘animals’ (not necessarily all different individuals) in an area within 10°48'39"–54"N, 107°53'56"–57'57"E (all coordinates for this site use the WGS84 datum), whilst about 15 hours spotlighting in the lowland area of the NR resulted in no sightings. The disturbance in the surveyed area gives it the highest level of encroachment in Ta Kou Mountain, although hunting signs were relatively few compared with the other three field sites. The area receives over 200,000 visitors (by day and night) annually, most of whom come to visit its famous pagoda, which has the largest statue of a reclining Buddha in Vietnam.

All Small-toothed Palm Civet sightings were made within about 600 m of the reclining Buddha statue and of the 1.2 ha that was cleared by the NR’s management for two pagodas, a cable car station, a guesthouse and restaurants, all for tourists. Hunting traps were rarely seen on Ta Kou Mountain during these surveys in 2009 and 2010, but a group of 20 cable-snares (with an ensnared dead Leopard Cat) and a box trap set for primates were seen. No hunting with guns or crossbows was seen.

The first sighting was made on 1 May 2009 at 19h40. One animal was observed on a small Malaysian *Eugenia* fruit tree (10°48'39"N, 107°53'56"E) planted near the edge of the forest. The distance between animal and observers was 14 m. It appeared to be a juvenile with a head-and-body length less than 400 mm (Fig. 3). The animal showed no fear and kept feeding while spotlight and photographed. After 10 minutes, it moved to another branch, away from the reach of the spotlight.

The second sighting, on 11 July 2009, at 20h45, was of one animal photographed (Fig. 4) feeding on a tall fig tree *Ficus* (10°48'43"N, 107°57'57"E). The animal, an adult male, was about 20 m above ground and about 5 m from the statue. After 5 minutes’ observation from about 25 m range, it retreated into the forest.
Two Small-toothed Palm Civets, which looked to be juveniles, were observed eating figs on 20 March 2010, at about 21h00 (10°48'53"N, 107°57'43"E). The animal–observer distance was 10 m. The animals fed on the figs for 5 minutes after being spotlit and were photographed (Fig. 6). Five days later,
at 21h00, one Small-toothed Palm Civet was observed and photographed on a fig tree (10°48′43″N, 107°57′57″E). After being spotlighted, the animal stared at the observers for about 3 minutes, and then moved to another branch, away from the reach of the spotlight.

The ninth encounter was on 27 April 2010, at 19h14. A pair of Small-toothed Palm Civets was observed climbing on a small fig tree beside a forest trail (10°48′54″N, 107°57′42″E) (Fig. 7). After observation for about 15 minutes at a distance of 7 m, both civets retreated into the thicker canopy.

Despite a survey lasting over several months, the only other small carnivore species recorded were Yellow-throated Marten Martes flaviventris and Leopard Cat, each only once or twice. Two captive Large-spotted Civets Viverra megaspila were observed in a village near the border of Ta Kou NR, and although exact provenance could not be confirmed, it is very probable they had been sourced from the protected area. The low number of records for other small carnivore species is in obvious contrast to the number of Small-toothed Palm Civet sightings.

Phuoc Binh National Park, Ninh Thuan province
Phuoc Binh National Park (NP), within 11°58′–12°10′N, 108°43′–49″E, covers 19,814 ha, and is on the margins of the Da Lat Plateau. Phuoc Binh NP is covered by hill and montane evergreen broadleaf forest, with some coniferous tree species (Birdlife International 2004). Most of its lowlands have been converted into agriculture. Forested areas up to approximately 1,000 m a.s.l. continue to experience illegal logging and exploitation of non-timber forest products (Tordoff 2002). Above this elevation the forest remains little disturbed, although hunting is prevalent and a key threat to the site’s biodiversity (Hoang 2007, Rawson et al. 2011), with over 100 cable-snares and ground-level trapping (approximately 50 non-lethal snares set over a maximum of 10 days in mixed forest) failed to find Small-toothed Palm Civet (Eames et al. 1994), as did the camera-trapping on the present surveys there (Willcox et al. in prep. a). Past camera-trapping in U Minh Thuong National Park, close to U Minh Ha FFEs, also failed to find Small-toothed Palm Civet (Nguyen et al. 2004), as did camera-trapping in U Minh Ha National Park and the U Minh Ha FFEs (Willcox et al. in prep. b). These records thus add to the many instances elsewhere in South-east Asia (see above) where Small-toothed Palm Civet did not appear on photographs from camera-traps although spotlighting or other techniques showed it to be present. Previous records of Small-toothed Palm Civet across Vietnam with altitude traced by Roberton (2007) came only from the narrow range of 600–750 m; these records extend the documented altitude range of the species from sea-level to over 1,000 m a.s.l., consistent with elsewhere (e.g. Duckworth 1995, 1997).

Dang & Pham (1974) collected two Small-toothed Palm Civet specimens in Hoa Binh province and noted that up until then very few specimens had been lodged in Vietnamese collections. Quoting the villagers around the two collection sites as saying that they very often saw and hunted the species, they themselves opined that it was probably scarce. This thinking probably guided its assignment of the ‘Rare’ category in the 2000 edition of the Vietnam Red Book (MoSTE 2000) and Near Threatened in the 2007 version (MoST & VAST 2007). Given the records in this paper, the villagers may well have been correct, and these records support Roberton’s (2007) suspicion that the species is overlooked, rather than rare, in Vietnam.

No other small carnivore species were recorded during the survey. However, Black-shanked Douc Pygathrix nigripes and Yellow-cheeked Crested Gibbon Nomascus gabriellae were both recorded. The presence of these globally threatened species, despite prevalent wildlife hunting and other anthropogenic disturbances, may indicate that the single Small-toothed Palm Civet record is due to low survey effort, rather than an indication of the species’s status, and that other small carnivore species may persist in the NP.

Discussion
A previous wildlife survey in the Ke Go Nature Reserve – Khe Net proposed Nature Reserve using diurnal direct observation and ground-level trapping (approximately 50 non-lethal snares set over a maximum of 10 days in mixed forest) failed to find Small-toothed Palm Civet (Eames et al. 1994), as did the camera-trapping on the present surveys there (Willcox et al. in prep. a). Past camera-trapping in U Minh Thuong National Park, close to U Minh Ha FFEs, also failed to find Small-toothed Palm Civet (Nguyen et al. 2004), as did camera-trapping in U Minh Ha National Park and the U Minh Ha FFEs (Willcox et al. in prep. b). These records thus add to the many instances elsewhere in South-east Asia (see above) where Small-toothed Palm Civet did not appear on photographs from camera-traps although spotlighting or other techniques showed it to be present.

Fig. 8. Small-toothed Palm Civet Arctogalidia trivirgata. Phuoc Binh National Park, Ninh Thuan Province, August 2009.
in Ke Go NR – Khe Net proposed NR produced few mammal records and the fauna was noticeably impoverished. Common Palm Civet, a species commonly active at ground level that is readily recorded using camera-trapping and is known to be tolerant of habitat disturbance (e.g. Su Su 2005), was recorded only twice over the entire survey in this landscape.

Given its persistence in sites where few other mammals of comparable size remain, Small-toothed Palm Civet is unlikely to be a conservation priority in Vietnam. More spotlight surveys in fragmented, isolated, heavily degraded and/or heavily hunted areas would allow a more confident assessment. The addition of 15–20 hours spotlighting into mammal/biodiversity surveys in known Small-toothed Palm Civet habitats could clarify the species’s geographical and altitudinal distribution in Vietnam, and keep coarse track of its conservation status, and would be relatively simple. Rigorous population quantification, by contrast, would be challenging: the basic assumptions of available techniques are very difficult to meet when surveying arboreal nocturnal species. Difficulties in applying Distance analysis (or any other line-transect-based population estimation) to nocturnal arboreal mammals were discussed by Duckworth (1998), and similar problems exist for occupancy analysis.

Conservation prioritisation at the site, landscape and species levels is invaluable in optimising the use of limited financial and human resources. The evident positive conservation status of Small-toothed Palm Civet in Vietnam, relative to other small carnivore species, means that survey and conservation resources directed towards sympatric mammal species clearly at high risk of extinction are likely to provide more information of direct management significance. However, the main technique used for intensive wildlife hunting in Vietnam presently is unlikely to affect this arboreal species of civet: ground-level trapping. Should more hunters in Vietnam adopt spotlighting techniques to target arboreal animal species, as observed in the U Minh Ha FFES, then the conservation status of Small-toothed Palm Civet could conceivably worsen. It is not possible at this stage to speculate meaningfully on how resilient Small-toothed Palm Civet would be to very heavy offtakes. Clear reporting of hunting pressures (specific types and intensities) at field sites, in addition to the spotlighting surveys mentioned in the previous paragraph, will be necessary to track any changes in the species’s conservation status.

Whilst Small-toothed Palm Civet in Vietnam presently has an evident positive conservation status, this cannot yet be confirmed for the entire genus. The conservation status of the Javan taxon Arctogalidia trivirgata remains uncertain, and given the paucity of records of it (Eaton et al. 2010, Moore 2011) and the possibility that it is a distinct species, clarification of its taxonomic and conservation status is the clear conservation research priority with this genus.

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