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NUISANCE BEHAVIORS OF MACAQUES IN PUERTO PRINCESA SUBTERRANEAN RIVER NATIONAL PARK, PALAWAN, PHILIPPINES

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Abstract: Different nuisance behaviors of macaques have been reported in different parts of the world where humans and macaques have been living in the same habitats and sharing the same resources. In this study, nuisance behaviors of Long-tailed Macaques were documented in Puerto Princesa Subterranean River National Park using direct observation, survey questionnaire and by visiting the complaint section database. The attitudes and practices of the locals towards the macaques were also investigated. From the result of the study, it was observed that the most common nuisance behavior of macaques in Central Park Station was littering, while according to the locals, eating of crops was the most common nuisance behavior. There was no existing tourist complaint about the macaques in the area, however, park personnel reported that aggressive tourist-macaque encounters sometimes happened. These nuisance behaviors were observed to be linked to food security of the animals which results in negative interaction. Meanwhile, it was also observed that the practices of most people towards macaques in the area are still relatively positive despite the nuisance behaviors of the macaques. Only a small percentage of respondents hunted macaques, experienced keeping macaques as pets or experienced eating macaque meat. The direct observations revealed that the degree of human-macaque interaction in the park was relatively mild compared to the reports in other countries, partly because of the positive human attitudes towards the animals and the effective management practices in the area.

Keywords: Human-macaque interaction, nuisance behaviors.

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INTRODUCTION

Human-wildlife conflict (hereafter referred to as interaction) is one of the greatest challenges for the conservation of biodiversity (Madden & McQuinn 2014). In monkeys, the genus *Macaca* has been reported to have high interactions with humans which increases the encounters and often results in problems (Hsu et al. 2009). Such human-macaque interactions have been reported from many habitat countries where macaques are sympatric with humans.

Macaques near humans exhibit different nuisance behaviors. In agricultural areas, macaques are reported to raid crops in Sulawesi (Riley 2007) and in Kuala Selangor (Hambali et al. 2012). Although crop raiding could also have been done by different wildlife species, macaques could be more conspicuous because they are diurnal animals (Riley 2007). Additionally, the large number of macaques during crop raiding makes them more obvious compared to other animals as shown in the study by Hill (1997) on baboons.

Although macaques sometimes attract large numbers of visitors, different nuisance behaviors are also present in tourist areas. In Singapore, the degree of human and Long-tailed Macaque interaction in tourist sites is higher compared to the urban areas (Sha et al. 2009). This is because of the food provided by the tourists to macaques which could also result in direct aggression towards the tourists (Orams 2002). Biting tourists by Barbary Macaques was observed to be very frequent in Upper Rock Nature Reserve, Gibraltar (Fa 1992).

Long-tailed Macaque is the only monkey in the Philippines and is widely distributed in the country. There are two subspecies of Long-tailed Macaques in the country, *Macaca fascicularis fascicularis* inhabiting the southern Philippines and *Macaca fascicularis philippensis* which is present in most of the islands of the country (Smith et al. 2014). According to the IUCN Red List (Ong & Richardson 2008), *Macaca fascicularis philippensis*, which is the subspecies present in Palawan, is considered as Near Threatened.

In the Philippines, there are still very limited studies about human-wildlife interactions, in particular on macaques. There are no studies on human-macaque interactions in Puerto Princesa Subterranean River National Park (PPSRNP) and in the country as a whole. In this study, the current human macaque interaction was documented in terms of assessing the macaque's nuisance behaviors in PPSRNP through direct observation, survey questionnaire and by visiting the park's complaint database. This was done to determine

the most common nuisance behaviors brought by Long-tailed Macaques to park personnel, local community and to tourists. The study also aimed to know the local peoples' practices and attitudes towards macaques in the area.

METHODS

Study site

Puerto Princesa Subterranean River National Park is a UNESCO World Heritage Park (10.192°N & 118.926°E), which spans 210km² of mosaic of dipterocarp, molave, karst, and montane forests (Mallari et al. 2011). In the park, Long-tailed Macaques are numerous present in the central park station, tourist area of the Underground River and in areas near human settlements.

Direct observation

Direct observation of the nuisance behaviors was done from August to September 2017 for 15 non-consecutive days in the Central Park Station (CPS) where macaques and some park personnel reside (Fig. 1). Continuous all-occurrences sampling on nuisance behaviors was done as there were only very few occurrences of these measured behaviors (Lehner 1992). The time of observation was 06:00h to 17:00h, totaling 165h of observation.

Survey questionnaire

The questionnaire was designed to know the peoples' encounters with the macaques and the nuisance behaviors shown by the animals toward the local people. Furthermore, the peoples' attitudes towards macaques were also determined through the questionnaire that included questions on hunting, eating, feeding and keeping macaques as pets.

The questionnaire was given to 303 households living inside the park (Fig. 1). The households were selected randomly and the answer was provided by one of the family members, preferably the head of the household (Mir et al. 2015). The respondents were not forced to answer all of the questions in the questionnaire. Privacy and confidentiality were maintained throughout the study.

Complaints from the tourists

The complaint section database of the park was visited to document the nuisance behaviors of macaques towards tourists in the area. Park personnel in the tourist areas of the park were also questioned about the

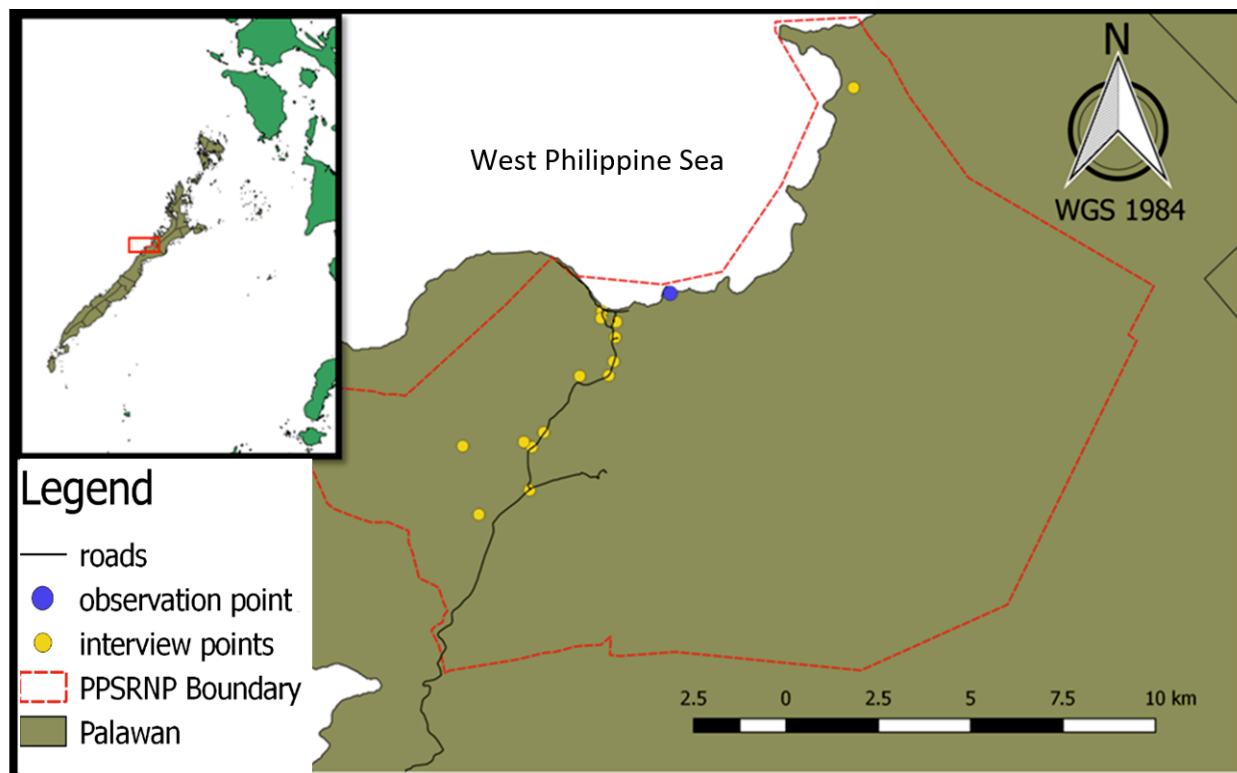


Figure 1. Central Park Station (Observation Site) and the interview sites in Puerto Princesa Subterranean River National Park (PPSRNP), Palawan, Philippines.

nuisance behaviors of macaques towards the tourists.

Data analysis

Chi-square test was used to test the differences in frequency among the different types of nuisance behaviors and/or between the answers of the respondents. This allows the researcher to know if a certain answer or a certain type of nuisance behavior is more common than the other/s (Sha et al. 2009). All statistics were carried out using Statistical Package for the Social Sciences (SPSS). Statistical significance for all tests was set at $P \leq 0.05$.

RESULTS

Nuisance behaviors towards park personnel

A total of 21 events of nuisance behavior of macaques were observed (Fig. 2). Littering, mostly in the form of messing up of garbage bins was the most common pest behavior ($n = 9$; 42%; $X^2 = 5.524$, $p = 0.03$). Aggressive behaviors such as provoking alarm calls and lunging were also observed ($n = 8$; 38.1%), especially when the macaques were provoked by humans whenever the animals were in proximity to the facilities. During the

observations, a troop was observed once to damage the rooftop of a facility ($n=1$; 4.8%), though the indications were there of such behavior in the past. This action was related to the stealing nuisance behavior ($n=3$; 14.3%) as there was a macaque inside the house during the encounter. The other two stealing encounters happened when a door of the kitchen was left open. Lastly, there were no chasing and biting records throughout the observation.

Nuisance behaviors towards the local community

From 303 respondents, 50.8% reported that they observe macaques near their houses, mostly through direct observation ($X^2 = 0.08$, $p = 0.774$). Only one of the respondents reported the macaque's presence hearing a call. Macaques were also reported by some of the respondents (44%) to bring inconvenience to them ($X^2 = 3.17$, $p = 0.075$). From the survey, five types of nuisance behaviors from macaques were reported by the respondents (Fig. 3). The most common of these was macaques eating crops especially in rice fields ($n=127$), during harvest season ($X^2 = 458.41$, $p = 0.0001$). The reported crops/fruits which are raided by macaques were cassava, corn, sweet potato, banana, coconut, jackfruit, mango, papaya, santol, pineapple,

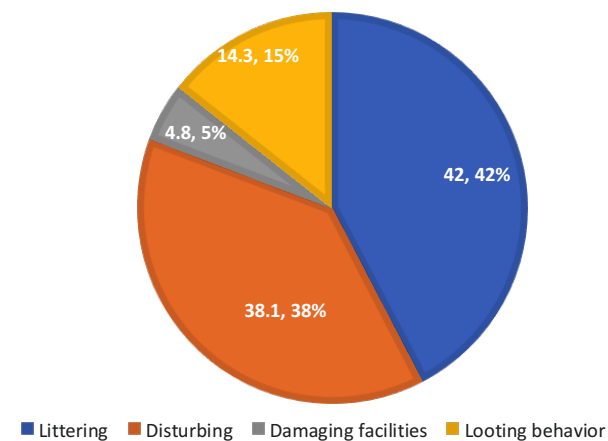


Figure 2. Proportion of the nuisance behaviors of Long-tailed Macaques directly observed in Puerto Princesa Subterranean River National Park (PPSRNP), Palawan, Philippines.

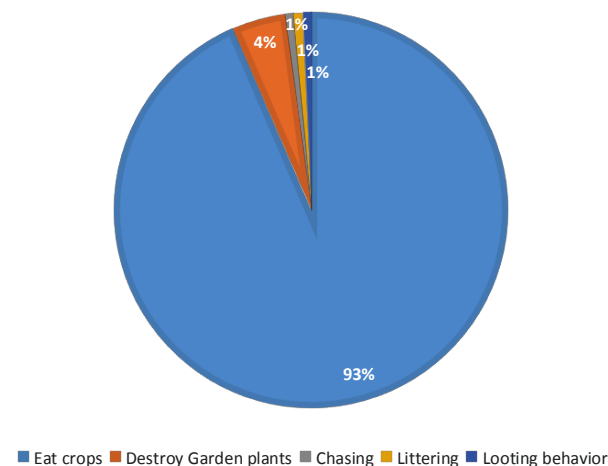


Figure 3. Proportion of the nuisance behaviors of Long-tailed Macaques reported by the respondents in Puerto Princesa Subterranean River National Park (PPSRNP), Palawan, Philippines.

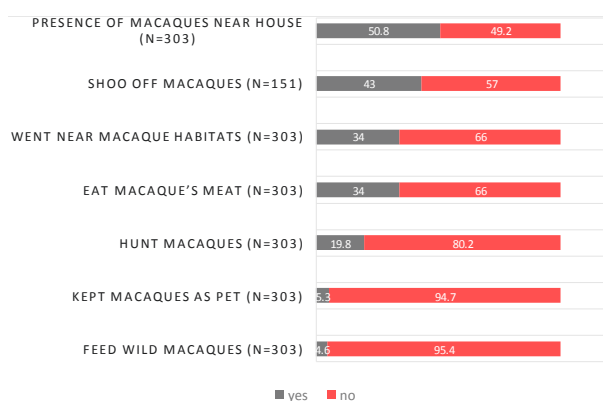


Figure 4. Responses of the respondents on their behavior towards Long-tailed Macaques and the presence of the animals in Puerto Princesa Subterranean River National Park (PPSRNP), Palawan, Philippines.

watermelon, and cucumber. Destroying of garden plants were also one of the problems reported by some people in the area (n=6).

Out of the 154 respondents who reported the presence of macaques near their houses, 32% reported to have observed one to three individuals a day ($X^2 = 43.727$, $p = 0.0001$); however, 37 reported that they could observe more than 15 macaques a day. Most of the sightings were also associated with the availability of food as most of the encounters were observed during crop raiding according to them. Due to this conflict, the farmers tried to protect their crops from raiding macaques. Sixty-five of the respondents (43%) scared off macaques by slingshots, making loud noises and using dogs to chase macaques away ($X^2 = 43.727$, $p = 0.0001$). Chasing (n=1), littering (n=1) and stealing (n=1) were also reported by a few respondents by their pet macaques.

Aside from inconvenience caused by macaques to the local people, the locals' attitudes and practices toward macaques in the area were also investigated (Fig. 4). Thirty-four percent (n=103) of the respondents had eaten macaque meat ($X^2 = 31.053$, $p = 0.0001$), while only 19.8% had experienced hunting macaques ($X^2 = 110.525$, $p = 0.0001$) in the past. Only 4.6 % (n=14) of the total respondents reported feeding wild macaques ($X^2 = 249.587$, $p = 0.0001$). Lastly, only 5.3% (n=16) of the respondents had experienced keeping macaques as pet ($X^2 = 242.380$, $p = 0.0001$).

Nuisance behaviors towards tourists

In the complaint section, there were no recorded complaints from tourists involving macaques; however, according to the present park personnel in the area, macaques were intentionally fed by the park rangers and tourists in the past, which resulted in their dependence on food provisioning.

DISCUSSION

Nuisance behaviors towards park personnel

In CPS, macaques were always present in the area during the entire duration of this study, ranging from 2–60 macaques present per day. Damaging facilities, littering by rummaging through garbage cans, stealing, and disturbing though aggressive actions were the observed nuisance behaviors of the macaques in the area.

Similar to the study of Hambali et al. (2012), littering was the most common nuisance behavior of macaques

observed in this study. This behavior was also observed in a study in Cagar Alam in Bahasa (a nature reserve) and in Taman Wisata Alam (Nature Recreational Reserve). Macaques are opportunistic omnivores which leads them to exhibit dietary plasticity. This plasticity, together with the changes in behavior, leads macaques to get food from human's houses, in addition to their natural food (Nila et al. 2014). The second most common nuisance behavior exhibited by the macaques was disturbing through aggressive behavior towards the park personnel in CPS. The aggressive behaviors were mostly executed by the alpha male in a troop residing approximately 50m from the station. Although macaques could be present any time of the day (05.00–18:00 h), it was observed that the whole troop usually got near the facility approximately around 11.00–15.00 h, suggesting that the animals were aware that food was available during lunch time. This could be the result of indirect feeding done by the macaques which includes foraging over leftover foods. In CPS, however, direct feeding was never observed as the park personnel were instructed by the management not to feed wildlife. This was also done in Universiti Kebangsaan Malaysia where interaction with macaques also occurs (Md-Zain et al. 2014) when food is available (Fuentes et al. 2008). The least observed nuisance behaviors of macaques were damaging a facility and stealing which are also associated with resource competition with humans. The results of the negative interaction in the Central Park Station suggest that the interaction between humans and Long-tailed Macaques is relatively less intense where there were more occurrences of nuisance behaviors. This could be the result of the effort of the current park management to avoid food provisioning of macaques, and shooing them away from the station.

Nuisance behaviors towards the local community

During the survey of the local communities in the park, the respondents were observed to be knowledgeable about Long-tailed Macaques' diet, group characteristics (e.g. presence of alpha), and the protection the animals get from the park.

As the natural habitat of macaques are increasingly degraded, the animals tend to become "agriculturalized" to survive. Due to encounters between macaques and people in agricultural areas, this would inevitably result in negative interaction (Priston & McLennan 2013). Similar to the results of this study, Long-tailed Macaques were also reported as crop raiders in Thailand (Aggimarangsee 1992), Indonesia (Loudon et al. 2006) and Malaysia (Hambali et al. 2012). On the other hand,

crop raiding could also be done by different animals such as rats and squirrels, as reported by a few of the respondents in this study. But because macaques are much larger compared to squirrels and rats, they are more conspicuous when they exhibit crop raiding in farms (Riley 2007).

Due to the behavior of macaques as crop raiders, most farmers considered them as pests which sometimes results in hunting. Macaque hunting in the park was reportedly done for consumption, keeping as pets and even just to scare other macaques during crop raiding, mostly done using an invasive trap locally called 'ipit-ipit'. Macaque meat in the area was famous as a food accompaniment for alcoholic drinks as they believe that the meat is very clean, however, macaques, including Long-tailed Macaques were reported to carry a lethal zoonotic disease such as Macacine herpesvirus 1 (Lee et al. 2015). Transmission due to contact of simian bodily fluids could possibly happen during hunting, consumption or butchering of the macaque meat (Jones-Engel et al. 2005). Besides hunting, most of them also used dogs as deterrence. This kind of method to prevent macaques from crop raiding was described to be effective according to Priston & McLennan (2013) and was also reported by (Nahallage et al. 2008) in Sri Lanka, and in other countries such in Saudi Arabia to scare off baboons (Biquand et al. 1994).

A small number of houses have reported keeping macaques as pets, where only one house was currently keeping a juvenile macaque. Making pets of Long-tailed Macaques is widespread in Southeast Asia. Usually, these macaques become pets during their juvenile stage, either through buying or direct capturing. As pet macaques become adults, they tend to become aggressive (Fuentes 2013). In relation to this change in behavior, macaques also tend to steal food and litter inside the house, which was also reported in this study. These nuisance behaviors were also reported in the surveys done in nature parks (Hambali et al. 2012; Riley 2007; Sha et al. 2009), temples (Fuentes 2010), and even in a university (Md-Zain et al. 2014). Moreover, keeping them as pets could result in health problems of the animals. Pet macaques in the area were observed and reported by the respondents to be tethered to the waist connected to a rope. This could result in abrasions to the waist as the macaque ages.

Feeding of macaques could result in habituation of macaques near human's houses (Hambali et al. 2012). Since very few people in PPSRNP feed macaques intentionally, stealing inside houses and aggressive negative interaction was not observed from roaming

macaques in local-habituated areas.

PPSRNP is a national protected area which conserves the habitat and the wildlife species in Palawan. Strict implementation of wildlife law in the area results in the reduction of hunting, keeping macaque as pets, and eating macaque's meat. However, the presence of working ipit-ipit traps in the farms suggests that hunting of Long-tailed Macaques is still present in the park as the farmers considered them as pets.

Nuisance behaviors towards tourists

Due to the presence of macaques in the area, encounters including nuisance behaviors happen, as reported by the park personnel. In PPSRNP, macaques are one of the major tourist attractions. Macaque tourism is a practical way of engaging humans for macaque conservation and their habitats, however, this often results in negative behavioral changes in the animal and increases the possibility of zoonotic diseases in tourist places. Presently, tourists are instructed not to carry foods and plastic bags going to the Underground River area. This is to avoid aggressive encounters between the macaques and tourists in the area, however, although minimized, direct and indirect feeding is still reported in the tourist area according to the personnel, which could be the cause of some aggressive interactions between tourists and macaques (Loudon et al. 2006; Hsu et al. 2009). The macaques in the area were reported by park personnel to steal food from the bags and grabbing plastic bags. Although rare, chasing and scratching were also reported from the macaques in the area. According to the personnel, these usually happen when macaques were deprived of food by the tourists. Food provisioning of Long-tailed Macaques by tourists was reported by Fuentes & Gamel (2005) in Indonesia, Fuentes et al. (2008) in Singapore, and Hambali et al. (2012) in Malaysia, which also was the cause of aggressive behavioral changes in the animals in those regions. Aside from the negative interaction between humans and macaques, it was also observed that the macaques in the area are relatively thin with several bruises, indicating that intra-troop fighting happens. This is possibly due to intra-troop competition during food provisioning by the tourists. In the study in Mudumalai Wildlife Sanctuary, Tamil Nadu, southern India, food provisioning by tourists to Bonnet Macaques resulted in increase of intra-troop tension between troop members (Ram et al. 2003).

Additionally, food provisioning for the macaques could increase the risk of anthroozoonotic diseases transmission between tourists and the animals

(Goldberg et al. 2007; Muehlenbein et al. 2010). This could not only pose risk to the health of the macaque population in ecotourist spots, but also for those park personnel and tour guides working near the macaque population.

Conservation implications of the observed nuisance behaviors

Based on the results, varying nuisance behaviors of Long-tailed Macaques towards humans are present in the park. The park personnel observed that the most common problem was the "littering" behavior of the macaques in the Central Park Station due to scavenging of leftover foods. Littering of garbage bins through scavenging left over foods was also observed in the study of Md-Zain et al. (2014) in a university in Malaysia. In the present study, this nuisance behavior was only observed in the CPS, and there were no reported cases in the local community based on the results of the survey questionnaire. Thus, it could be argued that it would be helpful to use secured lids of garbage bins in the Central Park Station to stop the macaques from littering the area. The efficient garbage management should not only be done only in the CPS, but also outside the station to prevent "littering" to spread across the local communities. It was also observed that the CPS serves as an overlapping range of two Long-tailed Macaque troops, thus efficient management of leftovers should be done for the welfare of the animals as this could result in frequent troop encounters.

Interaction between humans and macaques over resources are the product of disturbance of macaque habitats and human agricultural expansion. In PPSRNP, it was reported by the locals that the most common nuisance behavior of Long-tailed Macaques is crop raiding, most specially to rice during harvest season. Although "scaring" by different means could be an effective deterrence of macaques as reported by the locals, a long-term solution of the problem should be found. This includes proper and effective management of agriculture-forest ecotones (Siex & Struhsaker 1999). Management strategies, such as encouraging fruit-bearing fruits trees beside agricultural plantations, should be supported by scientific research. Moreover, more research about behavioral adaptations and dietary requirements of macaques in human-modified habitats, where macaques are naturally occurring, should also be taken up. Although minimized by the current management of wildlife conservation in the area, negative attitudes of humans are still present in the park, such as the presence of hunting and feeding wild

macaques. Knowledge dissemination about the animals should be conducted by the park management for the local people. This will increase their awareness and appreciation in terms of the importance of Long-tailed Macaques in the area.

According to park personnel, stealing of plastic bags, scratching and aggressive chasing were the reported nuisance behaviors in tourists' areas due to the presence of foods brought by tourists. These could be the result of food provisioning by the tourists from the past as this was the practice before, according to the park personnel. Food provisioning is not allowed in the park at the present time, and should continue to be done to avoid aggressive macaque interactions with humans. Indirect food provisioning (in terms of scavenging leftover foods from tourists and park personnel), however, should also be controlled and avoided as this could still result in habituation of Long-tailed Macaques in tourist areas.

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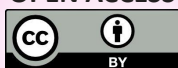
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Articles

‘Non-protected’ primates as bushmeat, pets and pests in southeastern Democratic Republic of Congo

– Paul Kaseya Kazaba, Pp. 13251–13260

Diversity, structure and natural history of amphibians in the upper Claro River basin, a buffer zone of the National Natural Park Los Nevados, Central Cordillera of Colombia

– Julián Andrés Rojas-Morales & Mateo Marín-Martínez, Pp. 13261–13277

Communications

Medium and large-sized mammals in an Atlantic Forest fragment of Brazil: recording of threatened species

– Vinícius Nunes Alves, Caroline Marques Maia, Telma Regina Alves & Renata Cristina Batista Fonseca, Pp. 13278–13286

Nuisance behaviors of macaques in Puerto Princesa Subterranean River National Park, Palawan, Philippines

– Lief Erikson Gamalo, Joselito Baril, Judeline Dimalibot, Augusto Asis, Brian Anas, Nevong Puna & Vachel Gay Paller, Pp. 13287–13294

Current data on the reproduction of Four-horned Antelope *Tetracerus quadricornis* in zoological parks

– Gérard Dubost, Stéphane Labes & Armelle Lutz, Pp. 13295–13303

Characterization of dorsal guard hair of the wild goats and sheep (Bovidae: Caprinae) occurring in the Himalaya and Western Ghats of India

– Manokaran Kamalakannan, Pp. 13304–13309

Rediscovery of the ‘extinct’ bee *Hesperocolletes douglasi* Michener, 1965 (Colletidae: Colletinae: Paracolletini) in Western Australia and first description of the female

– Juliana Pille Arnold, Mark V. Murphy, Raphael K. Didham & Terry F. Houston, Pp. 13310–13319

Butterflies of the myristica swamp forests of Shendurney Wildlife Sanctuary in the southern Western Ghats, Kerala, India

– Prabhakaran Chandrika Sujitha, Gopal Prasad & Kalesh Sadasivan, Pp. 13320–13333

Pollination ecology of three ecologically valuable carpetweed herbs, *Mollugo cerviana*, *M. nudicaulis* and *M. pentaphylla* (Molluginaceae)

– Maddala Sulakshana & Aluri Jacob Solomon Raju, Pp. 13334–13349

Sacred groves: a traditional way of conserving plant diversity in West Midnapore District, West Bengal, India

– Uday Kumar Sen, Pp. 13350–13359

Review

Media reporting on the protected areas in Maharashtra, India: a thematic analysis

– Trupthi Narayan & Pankaj Sekhsaria, Pp. 13360–13376

Short Communications

Avian survey in tourist sites near Putao in northern Myanmar

– Alexey E. Scopin, Vladimir N. Sotnikov, Dmitry V. Skumatov & Alexey A. Sergeev, Pp. 13377–13384

New record of Blue-eyed Eastern Spadefoot Toad *Leptobrachium bompu* (Amphibia: Megophryidae) from Sarpang District in Bhutan

– Jigme Tenzin & Jigme Tshelthrim Wangyal, Pp. 13385–13389

New record of Low’s Flatfaced Longhorn Beetle *Sarothrocerus lowii* White, 1846 (Coleoptera: Cerambycidae: Lamiinae: Lamiini) in Nagaland, India, along with first-time descriptions of male and female genitalia

– Kolla Sreedevi, Manisha Sharma & Hemant Vasant Ghatge, Pp. 13390–13394

On the rediscovery of *Onychomesa susainathani*, an emesine bug endemic to India (Heteroptera: Reduviidae: Emesinae)

– Hemant Vasant Ghatge & Balasaheb Sarode, Pp. 13395–13401

First record of the callianassid ghost shrimp *Neocallichirus jousseumei* (Nobili, 1904) (Decapoda: Axiidea) from India

– Imtiyaz Beleem, Paresh Poriya & Bharatsinh Gohil, Pp. 13402–13405

New distribution records of four species of crop wild relatives to India

– K. Pradheep, K. Joseph John, G.D. Harish, S.M. Sultan, I. Jaisankar, K. Naveen, S.P. Ahlawat & Manish Kanwat, Pp. 13406–13414

Note

Animal-fungal interactions 3: first report of mycophagy by the African Brush-tailed Porcupine *Atherurus africanus* Gray, 1842 (Mammalia: Rodentia: Hystricidae)

– Todd F. Elliott, Camille Truong, Olivier Séné & Terry W. Henkel, Pp. 13415–13418

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