

# Sharing Space with Monkeys and Human Tolerance Are Critical Supplements to Primate Conservation, but Not Substitutes for Protected Nature Reserves: A Long-Term View from Sri Lanka, with a Reply to Rudran [2021]

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## Keywords

Conservation · Human-monkey conflict · Ethnoprimatology · Sri Lanka primates · Review

## Abstract

Many investigators of human-monkey competition (HMC) in Sri Lanka have revealed some common threads. Except at temple and protected sites, all monkeys were considered as household or agricultural pests wherever they shared space with humans. This included the widely distributed toque macaque (*Macaca sinica*), the grey langur (*Semnopithecus priam thesites*) of the Dry Zone, and the purple-faced langur (*S. vetulus*) of the southwestern and central rain forests where human densities and habitat fragmentation were greatest. People sharing space with monkeys resorted to various non-lethal methods to chase monkeys away from their properties and most preferred to have monkeys removed to protected areas; such translocations have been politically popular, though contrary to ecological principles. The main cause of HMC near primate habitats has been environmental conversion to agriculture, whereas in many towns the refuse generated in the wake of widespread growing tourism lured omnivorous macaques towards human habitation and stimulated macaque population growth. While most Sri Lankans

share space with monkeys reluctantly, only a minority, flouting cultural restraints, want monkeys destroyed. Nonetheless, a major threat to primate conservation has been habitat loss and the killing of monkeys, especially in the densely populated southwestern area of the island where recent surveys showed that most macaques have been wiped out. Two subspecies, *S. v. nestor* of the rain forest lowlands and *M. s. opisthomelas* of the montane forests, are Critically Endangered. Sharing space with monkeys rests on public tolerance, understanding, and empathy with monkeys. Religious concepts venerating monkeys provide fertile ground for this. Our science-based educational documentaries ( $n > 35$ ), among other efforts, also have contributed to these human sentiments in Sri Lanka and globally. The trends in HMC suggest that protected nature reserves for all wildlife are more secure for primate survival than ethnoprimatology by itself would be. Rudran [*Folia Primatologica* 2021, DOI: 10.1159/000517176] criticized our recent publication on HMC in Sri Lanka [Dittus et al., *Folia Primatologica* 2019, 90: 89–108]. We consider his comments as misconstruing efforts in primate conservation through denying the importance of traditional protected areas, overlooking our achievements in educating the public and reducing HMC, as well as misunderstanding the limits of marketing monkeys to tourists as a source of income to support conservation.

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## Introduction

The *National Biodiversity Strategic Action Plan 2016–2022* of Sri Lanka states: “As the human population expands and natural habitats shrink, people and animals are increasingly coming into conflict over living space and food. Judging by the current trends in human population and land use patterns, it can be predicted that human-wildlife conflicts will continue to increase and will become one of the most significant impediments to conservation of endangered species” [MoMDE, 2016, p. 75]. The Sri Lankan situation is not unique to this trend even though there are global regional differences in economies, histories, cultures, and conservation traditions.

With a focus on the conflict between humans and primates (HMC), a new discipline of ethnoprimateology [Sponsel, 1997] has emerged that aims to integrate the needs of humans with those of wild primate populations and proposes that conservation action on behalf of non-human primates must include the human dimension [Fuentes and Wolfe, 2002; Hill, 2002; Riley, 2007; Jones-Engel et al., 2011a, b; Fuentes, 2012; Kothari et al., 2013]. Stated succinctly, to assure the survival of nonhuman primate populations we have only two options: set aside wildlife protected refuge areas large enough to accommodate their populations or enable primates to live alongside the human populations which occupy and exploit their habitats [Lee, 2010; Dittus et al., 2019]. Sharing space requires that humans accept the need to share space with primates even though these primates can negatively impact human livelihoods or well-being through crop loss, attacks, or generally being a nuisance [Lee, 2010].

With the aim of promoting primate conservation a growing number of studies have surveyed the impact of monkeys on human interests [Else, 1991; Naughton-Treves, 2001; Fuentes and Wolfe, 2002; Fuentes et al., 2008; Hambali et al., 2012; Barua, 2013; Habiba et al., 2013; Garriga, 2014; Chakravartty, 2015; Saraswat, 2015], human attitudes towards monkeys in places where natural primate habitats have been converted for human use [Bishop et al., 1981; Harcourt, 1986; King and Lee, 1987; Siex and Struhsaker, 1999; Lee and Priston, 2005; Srivastava and Begum, 2005; Watanabe and Muroyama, 2005; Sha et al., 2009; Campbell-Smith et al., 2010; Chauhan and Pirta, 2010; Habiba et al., 2013; Regmi et al., 2013] as well as suggestions on how best to reduce HMC [e.g., Silero-Zubiri and Switzer, 2001; Hill, 2002; Chakravarthy and Thyagaraj, 2005; Osborne and Hill, 2005; Riley, 2007; Shek and Cheng, 2010; Jones-Engel et al., 2011a, b; Sharma et al., 2011; Nowak and Lee, 2013; Chaturvedi and Mishra, 2014; Singh, 2019; Rudran et al., 2020].

## Primate Conservation via Noah’s Ark

The Sri Lankan island landscape is varied with rain forests from low to high elevations mostly in the southwestern and central regions of the island, while the eastern and northern regions are dry lowlands grading to arid habitats [Mueller-Dombois, 1968]. Much of the flora and fauna are diversified according to phytoclimatic zones. The nonhuman primates, for example, occur as 3 genera, 5 species, and 12 subspecies (ssp.): 2 species of loris *Loris tardigradus* (1 ssp.) and *L. lydekkerianus grandis* (3 spp.), 1 gray langur *Semnopithecus priam* (1 monotypic spp.) that is confined to the low and midland Dry Zone, 1 purple-faced langur *S. vetulus* (4 ssp.) that is most prevalent in the wet and moist habitats at all elevations, and the toque macaque *Macaca sinica* (3 ssp.), which occurs in all habitats where monkeys have access to open water [Dittus, 1977a]. Three species and all subspecies are endemic. Pastorini et al. [2021] provide updated distribution maps and taxonomic reviews of these taxa. Many are illustrated and described [Nekaris and de Silva Wijeyeratne, 2009; Pethiyagoda et al., 2012; Yapa and Ratnawira, 2013]. *Semnopithecus priam thersites* (Blyth, 1844) is Vulnerable [Dittus, 2020a], the two subspecies *Semnopithecus vetulus nestor* (Bennett, 1833) [Rudran et al., 2020] and *Macaca sinica opisthomelas* (Hill, 1942) [Dittus and Gamage, 2020] are Critically Endangered, and the other 9 primate taxa are Endangered [IUCN, 2020].

In most cases, primate conservation translates into the preservation of their natural habitats that are also home to other plants and animals. Therefore, primate conservation (involving species considered as pests) may find a more supportive cultural and political audience if it were promoted in the context of a more inclusive “Noah’s Ark” for all threatened wildlife [e.g., Dittus 2017, 2018]. Accordingly, and with an eye towards the conservation of all mammalian diversity, Dittus [2013] argued that not only species, but also their subspecies should be considered as the critical units of biodiversity conservation [Ryder, 1986], especially among the primates, where subspecific phenotypes are marked [Gippoliti and Amori, 2007].

## HMC in Sri Lanka

Within Sri Lanka, several authors have contributed to a better understanding of the competitive relations between humans and nonhuman primates, of the ecological and economic conditions under which these occur, and primate conservation. Much interest has been shown in

primates that inhabit the southwestern lowland rain forests where human population densities are the greatest, and where much of the forests have been destroyed or fragmented [Wikramanayake and Gunatilleke, 2002; Kathriarachchi, 2012]. The Critically Endangered subspecies of the purple-faced langur *S. v. nestor* has received greatest attention [Dela, 2004, 2011; Rudran, 2007; Parker et al., 2008; Nijman and Nekaris, 2010; Nekaris et al., 2013; Cabral et al., 2018a, b; Panagoda and Weerasinghe, 2019; Rudran et al., 2020; Wijethilaka et al., 2021]. The loris of this region [Nekaris et al., 2012] as well as in other areas [Nekaris and Jayewardene, 2004] and of the disturbed montane forests also have been reviewed [Gamage et al., 2014, 2017]. The gray langur, whose distribution is confined to the Dry Zone, has been assessed regarding HMC issues [Unanthanna and Wickramasinghe, 2010; Dittus et al., 2019]. Conservation and HMC focusing on the toque macaques have been reviewed by Dittus [1977a, 2012a, b] and by Nahallage and Huffman [2013]. Comprehensive comparisons of HMC issues involving all diurnal species of Sri Lankan primates at different geographical locations, but particularly in the central and southern regions of the island, have been considered by Nahallage et al. [2008], Cabral et al. [2018a] and by Rudran et al. [2021]. The published ethnoprimate perspective to the conservation of Sri Lankan primates was introduced by Nekaris et al. [2013] but overlooked by Rudran et al. [2020, 2021].

Recently, we [Dittus et al., 2019] sought to expand the knowledge base of HMC issues in Sri Lanka based on decades (from 1968 to 2021) of population and ecological research centered in the Dry Zone mainly at Polonnaruwa, and as observed at other sites, for example in the hill town of Kandy. For a better grasp of HMC issues from the human perspective we conducted a survey of peoples' opinions about HMC in 13 villages in the northeastern Dry Zone where humans and 4 non-human primate species share space. The survey was executed in March 2010. These quantitative data supplemented understanding of the issues as experienced not only by us, but also as published by other Sri Lankan biologists (cited above) and as reported in the media. The take-away messages from these combined considerations of different authors reflecting on HMC in Sri Lanka can be summarized as follows.

### *Pest Monkeys*

Monkeys considered as pests are the toque macaques island-wide wherever they overlap with human habitation, gray langurs whose distribution is confined to the

Dry Zone wherever they come close to human produce [Unanthanna and Wickramasinghe, 2010], and similarly the purple-faced langurs in the lowland Wet Zone where human populations, home gardens, and commercial agricultural estates are at their densest. The highly arboreal purple-faced langurs were not considered as pests in the Dry Zone [Dittus et al., 2019] where their distribution is confined to moist forests, mostly alluvial. Both langur species are heavy bodied and may damage roofs when travelling over them. The lorises are not considered pests [Nahallage et al., 2008; Dittus et al., 2019] but are subject to risks such as electrocution, pet trade, and use in local medicinal practices [Nekaris and Jayewardene, 2004].

### *Surveys of Human Attitudes towards Commensal Monkeys*

Humans perceive monkeys as a threat mostly to their crops and food sources and less so to their infrastructure (except to roofs by langurs). Injury from monkey bites were rare. Our survey centered in the Dry Zone whereas the one by Nahallage et al. [2008] and that by Cabral et al. [2018a] and Rudran et al. [2020] were wider ranging but focused mainly on the central montane and southern regions of the island. The reports by Cabral et al. [2018a] and Rudran et al. [2020] were based on written complaints to the wildlife authorities, supplemented by field surveys [Rudran et al., 2021]. The wide-ranging surveys by both sets of authors indicated local geographic variations in the monkey species that was reported as most troublesome and in the degree to which people were disturbed by them. These variations were related to human population densities, environmental histories, agricultural and income practices, differences in the geographic distribution of primate subspecies, the distance of human habitation from natural forests harboring primates [Nijman and Nekaris, 2010; Wijethilaka et al., 2021], as well as survey methods.

### *Translocating Troublesome Monkeys*

Survey respondents had varied opinions of how best to deal with HMC. Most people liked or at least tolerated monkeys but would prefer to have them removed from their property to an area where monkeys are safe but not troublesome [Nijman and Nekaris, 2010; Nahallage and Huffman, 2013; Cabral et al., 2018a; Dittus et al., 2019]. Indeed, in attempts to reduce HMC in towns and popular visitation sites, "pest" macaques (and occasionally purple-faced langurs) have been trapped and transported away for release into state-protected areas, such as National Parks, or similar rural areas. Pressure from agricul-

tural interests in northern Sri Lanka has resulted in the translocation of many gray langurs to an arid zone National Park with insufficient carrying capacity. The negative impacts of this politically popular practice for both monkeys and humans at sites of the monkeys' release has been reviewed [Dittus, 2012a]. The practice was not favored by people subjected to translocated monkeys [Cabral et al., 2018a].

#### *Repelling and Killing Monkeys*

Most respondents claimed to repel monkeys by throwing stones, using catapults, making noise, firecrackers, dogs, and more recently air rifles. Wijethilaka et al. [2021] reported that villagers subject to crop damage from the highly arboreal purple-faced langurs removed tall trees near their homesteads and grew shorter ornamental plants instead of crop trees, but at a loss of income. Few people, however, wanted monkeys harmed or killed in keeping with cultural and religious values or simply in appreciation of monkeys and nature. A minority espoused the killing of monkeys as pests, for food, or medicinal purposes [Dela, 2004, 2011; Parker et al., 2008; Nijman and Nekaris, 2010; Nahallage and Huffman, 2013] and neither the macaque nor the gray langur are protected by law [Fauna and Flora Protection Ordinance, 2009].

#### *Community Conservation Efforts*

Rudran et al. [2020] initiated a project of community conservation to promote the survival of Critically Endangered populations of the purple-faced langur with the aim of enhancing stakeholders' livelihoods and environmental awareness in exchange for their help to conserve the langur. The approach is reminiscent of that espoused by Ferraro and Kiss [2002] in an article entitled "Direct payments to conserve biodiversity."

#### *Communicable Disease with Monkeys*

Disease transmissions between humans and monkeys have been suggested as potentially zoonotic [Huffman et al., 2013] especially when people eat monkeys [Lamabadusuriya et al., 1992]. On the other hand, humans and their domestic animals are known to introduce disease, including toxoplasmosis [Ekanayake et al., 2004], cryptosporidium and some nematodes [Ekanayake et al., 2006] to wild monkeys.

Taken together these considerations from different investigators of HMC in Sri Lanka reflect a constructive approach to understanding HMC and solutions that have been tried.

## **Resolving Controversy in Sri Lankan Primate Conservation**

Rudran [2021] commented on Dittus et al. [2019]. We aim here to clarify topics related to HMC where controversy may have arisen.

#### *Sharing Space with Monkeys and Protected Nature Reserves*

Rudran [2021] wrote "... the authors ... reject the ethnoprimateological approach of sharing space with monkeys and coexisting with them in peace." On the contrary, in our abstract we wrote: "In an effort to contribute to an ethnoprimateological approach to conservation, i.e., promote the coexistence and sharing of habitat between humans and monkeys ...." We extend on this in the paper by devoting two sections (pp. 102 and 103–104) to the importance of humans sharing space with monkeys, and we suggested how best to achieve it. Our long-term approach to conservation is reflected also in our website [www.primates.lk]. We have practiced "ethnoprimateology" since before the term was coined [Sponsel, 1997] (Fig. 1).

The main conclusion in Dittus et al. [2019] was in two parts. First, although sharing of space with monkeys peacefully is a positive step towards primate conservation, it is not, by itself, a guarantee for primate survival in a shared environment where the welfare of monkeys is subordinate to that of humans. We reflected on human behavior where intolerance among different human tribes has had genocidal consequences throughout history [Dimijian, 2010], and that it may be unrealistic to expect humans to tolerate other species in close competition where humans perceive that their well-being is threatened by animals. One need not look far for evidence, because in Sri Lanka where high human population density and macaques formerly overlapped in the southwestern lowland and midland rain forested regions, as well as in the central highlands, macaques are mostly absent in the entire range of the two subspecies *M. s. aurifrons* and *M. s. opisthomelas* that are native to these areas, respectively [Pastorini et al., 2021; Cabral et al., 2018a, for the Galle District], having been wiped out through a combination of natural forest loss and killing. Respondents to questionnaires attribute the killing of primates mostly to past events or to others, and given cultural mores are reluctant to communicate about this [Dela, 2004, 2011; Parker et al., 2008; Nahallage and Huffman, 2013; Nekaris et al., 2013; Dittus et al., 2019]. The surveys indicate that people prefer monkeys to be removed from their

**Fig. 1.** Macaques shown on TV inside the house drew these commensal macaques to watch with heightened territorial curiosity through our window at the monkey camp at Polonnaruwa (Smithsonian Primate Research Station). While of interest to us, not all people share our tolerance (photo, Wolfgang Dittus).



proximity and some politicians promote not only translocation, but also advocate culling as practiced in some other Asian nations [e.g., Chakravarthy and Thyagaraj, 2005; Sprague and Iwasaki, 2006; Eudey, 2008]. Private businesses openly advertise the use of air rifles to shoot macaques, as well as other animals considered as pests [Rodrigo, 2011]. In the rural area at Polonnaruwa over many years we have intervened in numerous HMC events at the request of members of the local community that genuinely care about monkeys and wildlife. The sentiment and involvement of this majority is highly appreciated and a positive for conservation, but people differ in their attitudes and the monkeys rarely fare well in HMC at the hands of a less tolerant minority. Some monkey fatalities are incidental to other human encroachment by way of road accidents, well drownings, overpopulation of stray dogs, and electrocutions. At Polonnaruwa we have implemented methods to prevent the electrocution of monkeys [Dittus, 2020b].

Taken together, these circumstances indicate that despite animal-friendly cultural attitudes, the conversion of natural habitat for economic gain and the actions of a minority of humans that are intolerant of monkeys, effectively create an atmosphere whereby the sharing of space between humans and monkeys is fraught with high risk of extinction for monkeys. It is for this reason that Dittus et al. [2019] concluded that protected reserves for wildlife are essential for the conservation of primates and other biota. The rationale for this recommendation is similar to that for the establishment of protected areas in the 20th century, and indeed, in ancient times. Conservation-

minded kings included Devanampiyatissa who established probably the world's first nature reserve at Mihintale in the second century BC [Geiger, 1905], Mahinda 4th (956–972) at Anuradhapura [Wickremasinghe, 1912], and Nissankamalla at Polonnaruwa (1186–1197) [Wickremasinghe, 1923].

Rudran [2021], however, writes that “this recommendation is the same antiquated method still used to exclude local communities from areas officially gazetted to protect Sri Lanka’s wildlife [Fauna and Flora Protection Ordinance, 1993].” Instead, Rudran [2021] proposed what he considered an ethnoprimate approach whereby “outdated practices” are removed and replaced by the “sharing of space with monkey populations” under a plan [Rudran and Kotagama, 2016] for “... the establishment of Community Conservation Areas (CCAs) designed to provide material benefits to local communities while conserving and coexisting with monkeys and other wildlife.” Contrary to assertions by Rudran [2021] and Rudran et al. [2020], the plan [Rudran and Kotagama, 2016] has not been adopted by the Sri Lankan government [MoMDE, 2016].

Community-based participation [CBC] in conservation is an ethical ideal. Rudran [2021] and Rudran et al. [2020, 2021] hold it up as a model to apply to primates and cite some examples of CBC projects namely: the black rhino in Namibia, the vicuna in Peru, several ungulate species in Tanzania, and sea turtles in Costa Rica. These are positive outcomes; however, these animals are either marine or hoofed vegetarians and are not skilled inveterate primate raiders that may damage roofs, gardens, or



**Fig. 2.** Well-intentioned pilgrims feed cooked rice to leaf-eating grey langurs thereby creating pests that are destined to be persecuted by residents of Polonnaruwa in the Dry Zone (photo, Wolfgang Dittus).

home interiors [Cabral et al., 2018a]. The point is that animal species differ in their suitability for the ideal of CBC, even among primate species [Pebsworth and Radhakrishna, 2021; Rudran et al., 2021]. Although Nahallage and Huffman [2013] suggested that many religious and tourist sites in Sri Lanka might be considered as CBCs, this unfortunately can lead to enhanced HMC with communities surrounding these sites [Nekaris et al., 2013; Dittus et al., 2019] (Fig. 2). Even where CBC has been attempted among primates in Peru, investigators consider such measures as fallback choices in face of the absence of effective conservation in protected areas [Fuentes et al., 2005; Shanee et al., 2018]. Such dire conditions prevail for the Critically Endangered subspecies of purple-faced langur in Sri Lanka (Fig. 3), and it is hoped that the establishment of a protected reserve for this subspecies [Jinie Dela, pers. commun.] and/or the CBC approach may benefit its conservation [Cabral et al., 2018a; Rudran et al., 2020, 2021]. Hill [2002] points out the limits to CBC objectives in preventing primates' vulnerability to extinction given their sensitivity to human activities.

How suited are protected areas for primate conservation? Approximately 26% of Sri Lanka's land area comprises protected areas administered by the Departments of Forestry and Wildlife Conservation. But people can reside in some protected areas such as Sanctuaries and "other state forests" where the promotion of tolerance towards primates would be particularly appropriate. More than 80% of protected areas occur in dry and arid regions that are poorly suited for cultivation. Natural forest productivity in these

areas is low [Hladik and Hladik, 1972], thus sharply limiting their overall carrying capacity for all primate species. The distribution of primates in these vast dry areas tends to be confined to the narrow belts of riparian forests where plant diversity and productivity are comparatively benign [Hladik and Hladik, 1972]. Fortunately, some newly established National Parks in the Dry Zone (since 1997) have added moister forests where primate densities are estimates as moderate [Dittus, 1977a]. Protected areas in the lowland, midland, and highland rain forests areas are the most restricted in size (<5% of protected areas) and threats of extinction are high outside of these refugia; for example, 60% of all mammal taxa are threatened in the low and midland rain forest regions [Dittus, 2018].

Two thirds of surveyed persons with experience of sharing space with monkeys liked monkeys, and one third did not, and 80% of them wanted monkeys removed from their proximity and translocated to a more suitable monkey-friendly protected habitat [Dittus et al., 2019]. This revelation highlights peoples' appreciation of protected areas as safe zones for primates and other wildlife and can be taken as democratically representative of citizens' will. On the other hand, translocation of wildlife considered as pests to protected areas is an unfortunate popular misconception and should be avoided because it is inimical to humans and animals alike [Craven et al., 1998; Dittus, 2012; Fernando et al., 2012]. Conservation policy should heed its citizenry for the need of protected areas [Pethiyagoda, 2013], and politicians should respect this historical and legal precedent because human encroachment of

**Fig. 3.** The highly arboreal and Critically Endangered subspecies of purple-faced langur (*S. v. nestor*), which normally occur in one-male harems of 6–11 members, may manifest abnormal group structure and large size [Cabral et al., 2018b] and face an uncertain future where expanding construction replaces remnants of forest at Pelawatta, near Colombo, in the northern lowland Wet Zone (6.895376° N, 79.928409° E) (photo, Wolfgang Dittus).



even these refugia is on the rise [Weerakoon, 2001; Wikramanayake and Gunatilleke, 2002; Santiapillai and Wijeyamohan, 2003; Jayasuriya et al., 2009; Weerathunghe et al., 2017]. Dittus et al. [2019, p. 104] concluded that “human sympathy towards nonhuman primates might be most productively used to support the strengthening of exclusive protected nature reserves for all wildlife, with habitat-sharing as a secondary and supplemental option.” Given that many monkeys exist outside of strictly protected areas, the benefits of human tolerance and habitat sharing should not be underestimated.

The urgency of supporting existing protected areas is underscored by recent political events in Sri Lanka where many areas of natural forest, known as “other state forests,” have been released for agriculture and development [Rodrigo, 2020]. Untold numbers of elephants, primates, and other fauna are dependent on these habitats. In the wake of this decision, the Ministry of Environment has recruited scientists, W.D. included, to advise on the selection of environmentally sensitive areas for mammal conservation.<sup>1</sup>

<sup>1</sup> Advice and its implementation can be poles apart. Threats to biodiversity have been pointed out decades ago [Eisenberg and Lockhart, 1972; McKay, 1973; Crusz, 1973; Senanayake, 1977; Gunatilleke and Gunatilleke, 1983], the scientific and technical communities have charted the way forward to ameliorate them [e.g., Jayasuriya et al., 2006; Wikramanayake and Buthpitiya, 2017]. If Sri Lanka’s natural heritage and aims to safeguard it [MoFE, 1999; MoMDE, 2016] are to be taken seriously, the urgency for meaningful protection requires an upgrade in conservation policy and its implementation [Pethiygoda, 2013; Miththapala, 2015; Wikramanayake, 2018].

#### *The Costs and Benefits of Buffer Zones*

Survey respondents complained about a loss of crops to monkeys. As the installation of ditches, walls, and electrical fences is useless as barriers to prevent monkeys from entering agricultural properties, preventative options are limited [Garriga, 2014]. We know, however, that open areas without trees are shunned by toque macaques, especially by purple-faced langurs, and less so by gray langurs. Reiterating [Dittus, 1977a], we [Dittus et al., 2019] suggested buffer zones of 100–200 m without trees as effective barriers. National Parks in Sri Lanka and some sanctuaries are legally required to have far more extensive peripheral restricted zones, although not treeless. Rudran [2021] suggests that a treeless buffer zone of 100–200 m would encourage corrupt politicians to engage in gainful deforestation and result in loss of primate habitat. Although our recommendations are based on biological principles to prevent HMC, we understand that losing some trees in primate habitat is a cost and would require transparency and judicious application. The downside of such barriers, like that for electrical fences against elephants, is the cost of maintenance. The cost:benefit ratio of implementing would require closer scrutiny and may be inappropriate in some areas such as critical natural habitat in montane and other rain forests, riverine forests, or areas where primates already share habitat with agricultural estates including rubber, coconut, and home gardens [e.g., Dela, 2004]. An alternative to physical barriers involves human guardians where this cost can be borne

(e.g., tourist hotels and some commercial estates) and perhaps organized community brigades [Rudran et al., 2021]. Given our concerns for the negative impacts of deforestation on biodiversity [Dittus, 1977a, 1985a, b, 2017, 2018], we favor protecting and expanding forested habitat.

*Marketing Primates to Support Conservation*

Under our nonprofit Association for the Conservation of Primate Diversity, we maintain the “monkey camp” at Polonnaruwa that serves as a center for research, education, and conservation. It offers accommodations for research staff, students, volunteer research participants, and occasional visitors with a special interest in primate biology. Contrary to Rudran’s [2021] assertion, R.R. was never a participant at the “monkey camp” established by W.D. in 1977. R.R. was, however, briefly a beneficiary of a similar facility at a different location established by Dr. Suzanne Ripley and Melvin Lockart in 1966.


Rudran [2021] writes, “... it is regrettable..., etc. It would have been far better for the authors to have highlighted the profitable business model to promote primate conservation,... the ‘monkey camp’ business model could be launched in other parts of the country to promote primate conservation through peaceful coexistence between local communities and all Sri Lankan monkey subspecies.”

We agree with this vision and in keeping we have launched many projects to engage and educate the local community over the last four decades. Through our training programs for nature tour guides, public lectures, and the employment of our former research assistants and students in a diversity of jobs, we have disseminated science-based knowledge about Sri Lankan primates and wildlife to all levels of Sri Lankan society. That is in addition to the millions of Sri Lankan citizens as well as international audiences that have been exposed to our ethic of “tolerance and appreciation of monkey life” by way of more than 35 televised nature programs (BBC, Disney-Nature, Discovery, Terra Mater, among others).


Rudran [2021] and Rudran et al. [2021] depict our research facility, the monkey camp, as a “profitable business model,” i.e., marketing monkeys to tourists to raise cash for conservation. Simple economics dictate that the widespread replication of such a model would fail in the absence of consumer demand. The wildlife most sought by local and foreign visitors are: Asian elephants *Elephas maximus*, leopards *Panthera pardus*, whales, and birds. Unlike some of the great apes in other nations, macaques and gray langurs are common, often considered a pest,

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- මේ සතුන් ඔබට කරදරයක් බවට පත්වී ඇත්තේද?
- මේ ගැටළුවෙන් මිදීමට පහසු මගක් තබනා බව ඔබ දන්නෙහිද?



අවබෝධය සහ සහයෝගීතාවය මගින් ගැටළු වලට විසඳුම් සොයමු



මිරිසිදු පරිසරයක් නිරෝගී ජීවිතයක් ලබාගත හැකි අපේ භැග්



**Fig. 4.** With corporate support we promote the home use of monkey-proof compost bins to reduce food litter in the environment and the HMC that it invites. The caption translates “Working together with understanding we may come up with solutions.”

may harass tourists, and are hard to sell for observation. An expert in Sri Lankan nature tourism, De Silva Wijeyeratne [2009, 2013], points out the challenges of specialist nature promotion in Sri Lanka and mentions efforts of naturalists such as Dr. Anna Nekaris and W.D. Our popular films and other communications, apart from educating the public, have the secondary benefits of creating consumer demand for science-based monkey lore where-in we highlight the charisma of our common monkeys. Our products have been used to advertise nature tourism by some airlines and hotels, the latter also have employed our graduates as nature guides. In other words, the essence of our monkey camp is a common feature in the Sri Lankan landscape of nature appreciation, education, conservation, and tourism.



**Fig. 5.** Concentrated food refuse is a magnet that saves monkeys, like these toque macaques, hours of foraging effort in their forest habitat where foods are widely dispersed in small quantities (see also Fig. 2). This man-made ecology leads to monkey population growth and HMC [Dittus, 2004; Dittus et al., 2019] (photo, Wolfgang Dittus).



#### *Population Ecology and Long-Term Trends in HMC*

The face of HMC can vary widely depending on species, country, and local circumstances; therefore, generalizations about the causes and effects of HMC and its amelioration may find variable interpretation [Baker et al., 2017]. Nonetheless, some relationships stand out to clarify the dynamics of HMC.

Macaque populations in natural undisturbed stable forest habitat are limited in their growth and geographical distribution by the availability of food and water resources; thus, the carrying capacity for primates can vary widely depending on habitat quality [Dittus, 1977a, 1980]. An imbalance between the availability of limiting resources and population numbers can occur either through a reduction of resources as occurs in droughts, cyclones, and habitat destruction [Dittus, 1977b, 1985a], or through their surplus, usually human sourced. Macaque groups may fission under an imbalance created either when the food supply is reduced [Dittus, 1988] or when group numbers outgrow the supply [Dittus et al., 2019, Fig. 7], and the daughter groups disperse into new environments [Dittus et al., 2019, Fig. 8]. These socioecological trends combined with human encroachment into primate habitat and the attendant introduction of easily accessed crops and food scraps draw humans and monkeys into proximity. A link between food supply and population numbers would be expected in the langurs as well even though the dynamic details might vary, for example in relation to reproductive patterns [Rudran, 1973].

Rudran [2021] writes, “... the title [of Dittus et al., 2019] creates the impression that the authors devoted 50 years to assess public perceptions of HMCs in Sri Lanka. In fact, 50 years ago HMCs were not considered a serious problem in Sri Lanka, and the first publication on HMCs by the principal author of Dittus et al. [2019] appeared less than a decade ago [Dittus, 2012].”

Our intent was not to have claimed to have studied HMC, per se, for 50 years. Notwithstanding, the more than 50 years of monitoring population and ecological trends at our study site has provided the baseline for empirical measures to quantify the increase in HMC over that long period. Our ad libitum observations of HMC events over many years at different locations have contributed to this understanding. Furthermore, decades ago Dittus [1977a] recommended ways to reduce HMC as observed in the period 1968–1976. In line with other contemporary conservation concerns [Crusz, 1973; Senanayake et al., 1977], Dittus [1977a] also highlighted the plight of the subspecies *M. s. opisthomelas* in the progressively fragmented montane habitats [Wikramanayake and Gunathilleke, 2002; Wijesundara, 2012]. It was only 43 years later that this taxon was updated to Critically Endangered in the IUCN Red List [Dittus and Gamage, 2020], a sign of the long time gap between scientific identification of an environmental issue and the first official steps to at least acknowledge it, not to speak of resolving it [Karlsson and Gilek, 2020].

The increase in HMC in the last few decades varies in locality, time, species, and cause, and respondents to sur-

veys reflect this. Much of the southwest lowland and lower montane rain forests were cleared in the latter part of the 19th century primarily for the expansion of plantation agriculture and attendant anthropogenic influences, and more than 40% have been lost since the mid-1960s [Guntatilleke et al., 2005; Lindström et al., 2012]. The attrition of these rain forests over 200 years was not the result of the civil war (1983–2009) as Rudran [2021] and Rudran et al. [2021] imply. While restricted localities in the Dry Zone have been cultivated and then abandoned over many centuries [Perera, 2012], recent forest loss and fragmentation is attributed to development schemes in the 1960s and 1970s, to the recent civil war and its aftermath [Santiapillai and Wijeyamohan, 2003; Suthakar and Bui, 2008; Lindström et al., 2012; Weerathunge et al., 2017]. When natural monkey habitat of limited productivity [Hladik and Hladik, 1972] is replaced with easily accessible crops, garbage, and water, it attracts not only monkeys, but also other wildlife [Dittus, 2012a].

The ecological stage differs somewhat in towns, and popular tourist sites where recent deforestation has been minimal, but local and foreign tourism has increased 60-fold since 1971 [SLTDA, 2018]. The burgeoning number of widely distributed hotels, guest houses, and food services generates refuse that, in the absence of environmentally friendly disposal systems (Fig. 4), spills incidentally into the open environment attracting animals considered as pests (Fig. 5). Monkey population growth and HMC are restricted to sites near human habitation but give the public the illusion of country-wide overpopulation of monkeys and is a source of unjustified poor “public relations” for monkeys.

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The authors have no ethical conflicts to disclose.

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