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A Review of the Distribution of Grey Slender Loris (Loris lydekkerianus) in Sri Lanka

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Abstract: *Loris lydekkerianus* is known to be the most widespread among two currently recognized species of slender loris in Sri Lanka. Here I review the distribution of *L. lydekkerianus* in the island, based on recent literature and data collected over fifty years ago by W. C. Osman Hill and William W. A. Phillips. According to the early literature, *L. l. nordicus* was distributed in the lowland dry zone of north and east Sri Lanka, while *L. l. grandis* was found in hills in the Central Province. Information gathered in this review along with an observation by the author, extends the distribution of *L. lydekkerianus nordicus* towards the southeastern coastal belt of Sri Lanka, and suggests that the actual range of the species could be larger than previously known. Recent observations raise a number of questions on the range, abundance, variation and the biogeography of the hitherto known and possibly unknown forms of slender loris, stressing the need for further studies on these little known taxa.

Key words: Grey slender loris, Loris lydekkerianus, Lorisidae, distribution, Sri Lanka

Introduction

Slender lorises are small, nocturnal primates of the family Lorisidae. There are two species, *Loris tardigradus* Linnaeus, 1758 and *Loris lydekkerianus* Cabrera, 1908, and six subspecies endemic to India and Sri Lanka. Their taxonomy has been revised through museum specimens based on morphology (Groves 1998, 2001). These have been confirmed with behavioral and morphological evidence from wild populations (Coultas 2002; Nekaris 2002; Nekaris and Jayewardene 2002, 2003) and verified by phylogenetic studies of museum specimens (Nekaris *et al.* 2006).

The slender loris in Sri Lanka was formerly regarded as a single species, *Loris tardigradus*, comprising four subspecies: *L. t. tardigradus* (Western Ceylon slender loris); *L. t. nyctice-boides* (Ceylon mountain slender loris), *L. t. grandis* (Highland Ceylon slender loris) and *L. t. nordicus* (Northern Ceylon slender loris) (Hill and Phillips 1932; Hill 1933, 1942, 1953; Phillips 1935). Recent studies, however, have revealed that the Sri Lankan races in fact belong to both species of slender loris. *Loris tardigradus* (Sri Lanka red slender loris), endemic to the island, has two recognized subspecies: *L. t. tardigradus* (Linnaeus 1758) and *L. t. nycticeboides* Hill, 1942. *Loris lydekkerianus* (the grey slender loris) is represented in Sri Lanka with two subspecies endemic to the island: *L. l. grandis* Hill and

Phillips, 1932 and *L. l. nordicus* Hill, 1933 (Groves 2001; Nekaris and Jayewardene 2002, 2003, 2004; Weerakoon and Goonatilake 2006; Bernede and Gamage 2006; Gamage *et al.* 2006). All four taxa have been assessed as Endangered (IUCN 2008).

Loris t. tardigradus is distributed in the southwestern wet zone of Sri Lanka, while L. t. nycticeboides is found in the upper montane cloud forests. Loris l. grandis and L. l. nordicus, which occur in the hill country and dry zone, respectively, are considered by Groves (1998, p.22; 2001, p.98) to be synonyms—he "could not distinguish grandis from nordicus externally, though the single skull examined of the former is but marginally distinguishable." Although the form nycticeboides was described as a subspecies of L. lydekkerianus by Groves (2001) based mainly on its size, it has now been accepted as a subspecies of L. tardigradus (Roos 2003; IUCN 2008), as verified by phylogenetic studies of museum specimens; morphology and molecular genetic data (Nekaris et al. 2006). The main reasons underpinning such taxonomic confusions are undoubtedly the lack of specimens, especially in rarer forms, and the lack of information on their range boundaries (where one taxon intergrades with another).

Literature on the Distribution of *Loris lydekkerianus* in Sri Lanka

There is a fair amount of recent literature available on the distribution of *Loris lydekkerianus* in Sri Lanka (Hladik and Petter 1970; Petter and Hladik 1970; Eisenberg and Lockhart 1972; Jenkins 1987; Dharmasena 1989; Meier 1989; Bambaradeniya 1996; Nekaris 2003a, 2003b; Walker and Molur 2003; de Silva and de Silva 2004; Nekaris and Jayewardene 2004; Perera *et al.* 2005; Schulze 2005; Bernede and Gamage 2006; Gamage *et al.* 2006), and a considerable amount of data was collected over fifty years ago by W. C. Osman Hill and William W. A. Phillips (Phillips 1926, 1931, 1935; Hill and Phillips 1932; Hill 1933, 1953).

Although its taxonomic status is still being researched, the form we refer to as *Loris lydekkerianus* is known to be the most widespread species in Sri Lanka (Nekaris and Jayewardene 2003, 2004; Bernede and Gamage 2006; Gamage *et al.* 2006). The exact geographic ranges of the two endemic subspecies, *grandis* and *nordicus*, however, have yet to be determined. Here I review the distribution of *L. lydekkerianus* on the island of Sri Lanka based on literature listed above as a step towards an attempt to determine the range of two subspecies.

Historical Distribution of *Loris lydekkerianus* (More Than 50 Years Ago)

According to early literature, *L. l. nordicus* was distributed in the lowland dry zone of north and east Sri Lanka, including the Jaffna peninsula (Hill 1953). *L. l. grandis* was found in hills in the eastern Matale District of the Central Province at altitudes between 330 m and 1,050 m (Hill and Phillips 1932). Hill (1953) found that the range merged with *tardigradus* at lower altitudes, but did not meet the range of *nycticeboides*. Phillips (1980) suggested that the range of *grandis* may have been contiguous with *nycticeboides* before montane forests were felled for cultivation.

Loris lydekkerianus grandis in historical records

The type locality of *Loris l. grandis* is Mousakanda, Gammaduwa in the East Matale Hills or the Knuckles Range (Hill and Phillips 1932). Phillips (1935) argued, however, that "it is possible that this race occurs also throughout the lower foot hills of the mountain cluster of the Central and Uva Provinces" (p.35). It has also been recorded from Opalgalla, on the other side of the ridge where Mousakanda is located (Hill and Phillips 1932), while reports of large lorises from Badulla and Bandarawela were also suspected to be *grandis* (W. W. A. Phillips, quoted by Hill 1933). A specimen of *grandis* from Namunukula was deposited in the British Museum of Natural History (Jenkins 1987).

Loris lydekkerianus nordicus in historical records

The type locality of *L. l. nordicus* is Talawa (Hill 1933). It has also been recorded from Mannar, Jaffna, Anuradhapura,

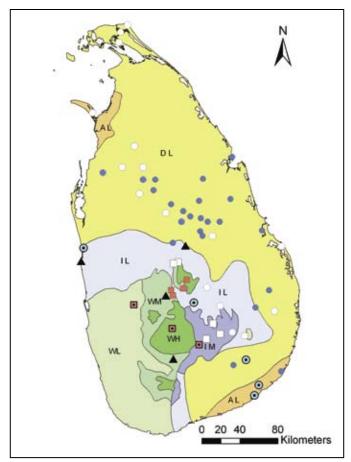


Figure 1. Distribution of grey slender loris, *Loris lydekkerianus*, in Sri Lanka: *L. l. grandis* (squares), *L. l. nordicus* (circles), and intermediate forms (triangles); shaded—recorded within last 50 years; shaded with a central dot—recorded within last 50 years and subspecies suspected; clear—recorded more than 50 years ago and no recent records. **WL** = Wet Lowlands, **IL** = Intermediate Lowlands, **DL** = Dry Lowlands, **AL** = Arid Lowlands, **WM** = Wet Midlands, **IM** = Intermediate Midlands, **WH** = Wet Highlands. Map courtesy of GIS laboratory, Faculty of Geomatics, Sabaragamuwa University.

Tammannewa, Wilachchiya, Chavakachcheri, Kekirawa, Sigiriya and Cheddikulam (Phillips 1935; Hill 1933, 1953). Four specimens collected from Anuradhapura, Wilachchiya, Chavakachcheri, and Monaragala in, respectively, 1913, 1914, 1933 and 1939, and a fifth from Point Pedro in Jaffna (date of collection unknown) are deposited in the British Museum of Natural History (Jenkins 1987). Phillips (1935, p.37) also reported that "Although specimens have been obtained from the northern part of the island only, there are persistent rumours of lorises being present in the dry zone jungles of the eastern and south-eastern districts." He also mentioned that *nordicus* occurs throughout the dry zone, but is not common anywhere in its range.

Lorises have also been recorded from several other sites without positive confirmation of the subspecies, but within the suspected range of *nordicus*. These records include oral reports (quoted by Hill 1933) from localities such as Batticaloa, Tamankaduwa, and Monaragala, wider areas named as Wellassa District, and Bintenna District, as well as two old specimens in the British Museum of Natural History (date

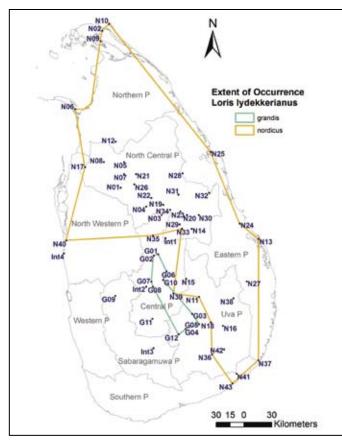


Figure 2. Extent of occurrence of *Loris lydekkerianus grandis* and *Loris lydekkerianus nordicus* shown on a map of administrative provinces of Sri Lanka (P = Province). See Table 1 for details of localities depicted by codes: G = grandis, N = nordicus and Int = intermediate forms. The localities of G09 and G11 are exempted from the extent of occurrence of *L. l. grandis*, as further clarification is needed as to which of the subspecies they belong. Map courtesy of GIS laboratory, Faculty of Geomatics, Sabaragamuwa University.



Figure 3. A young *Loris lydekkerianus nordicus* from Wilpattu National Park, Sri Lanka. Photograph by M. S. J. Perera.

of collection unknown), from Monaragala and Badalkumbura (Jenkins 1987). During early surveys, Phillips recorded the strange, shrill cry of a loris without a confirmed sighting in Marai villu of Wilpattu National Park (Phillips 1933).

Intermediate forms in historical records

An intermediate of *L. l. nordicus* and *L. l. grandis* was recorded from Elahera (Hill 1933). Intermediate forms between *L. tardigradus* and *L. lydekkerianus* have also been recorded from three other localities as follows: intermediates between *L. l. grandis* and *L. t. tardigradus* were recorded from Peradeniya and Balangoda (Phillips 1926, 1935; Hill 1933); and an intermediate between *L. l. nordicus* and *L. t. tardigradus* from Chilaw—the oldest known locality of a loris from Sri Lanka (Tannent 1861; Hill and Phillips 1932; Hill 1933).

Recent Records of *Loris lydekkerianus* (Within the Last 50 years)

Loris lydekkerianus grandis in recent records

Specimens of *Loris l. grandis* in the Field Museum of Natural History, Chicago, were collected by E. C. Fernando from Pindeniya and Digana, in 1961 and 1966, respectively (Schulze 2005). *Loris l. grandis* has recently been recorded from Udawattekele Sanctuary (Petter and Hladik 1970; Dharmasena 1989; Nekaris and Jayewardene 2004), Kandyan Home Gardens (Petter and Hladik 1970) and the Knuckles Range—the type locality (Walker and Molur 2003; Nekaris and Jayewardene 2004).

The specimen from Pindeniya needs to be re-examined and its locality checked, as it lies in the wet lowlands of Sri Lanka, which is otherwise inhabited by *L. t. tardigradus*. Lorises considered to be *L. l. grandis* from Talawakele (Dharmasena 1989), also need a reconfirmation, as this location shows a discontinuity of the geographic range, and is within the wet highlands above the usual altitudinal range of the taxon that could have been inhabited by *L. t. nycticeboides*.

Walker and Molur (2003), in their report of the Conservation Assessment and Management Plan Workshop on Status of South Asian Primates, reported the presence of lorises in Thangamalai Sanctuary, in addition to the Knuckles Range.

Loris lydekkerianus nordicus in recent records

There are a number of opportunistic records of *L. l. nordicus* after 1965: a specimen from Habarana, collected by E. C. Fernando in 1965, deposited in the Field Museum of Natural History, Chicago (Schulze 2005); Polonnaruwa (Hladik and Petter 1970; Petter and Hladik 1970); and Wilpattu National Park (Eisenberg and Lockhart 1972; M. S. J. Perera pers. obs. 2005). The record of a loris from Victoria-Randenigala-Rantambe Sanctuary (Bambaradeniya 1996) is also suspected to be *nordicus* (see Walker and Molur 2003). Walker and Molur (2003) reported the presence of *L. l. nordicus* in Mihintale Sanctuary, Giritale Nature Reserve, Sigiriya Sanctuary, Ampara Sanctuary, Kanthale Forest Reserve,

Table 1. Sources of information for the distribution of grey slender loris, Loris lydekkerianus, in Sri Lanka (see Fig. 2).

Code	Locality	Source(s) of Information
G01	Mousakanda, Gammaduwa – Knuckles Range (type locality of <i>grandis</i>)	Phillips (1931); Hill & Phillips (1932); Hill (1933); Specimen at British Museum of Natural History, date of collection unknown (Jenkins 1987); Phillips (1935)
G02	Opalgalla	Hill & Phillips (1932)
G03	Badulla	Phillips quoted by Hill (1933)
G04	Bandarawela	Phillips quoted by Hill (1933)
G05	Namunukula (Tonacombe Estate)	Specimen at British Museum of Natural History, date of collection unknown (Jenkins 1987
G06	Knuckles range	Walker & Molur (2003); Nekaris & Jayewardene (2004)
G07	Udawattekele Forest Reserve	Petter & Hladik (1970); Dharmasena (1989); Nekaris & Jayewardene (2004)
G08	Kandy	Petter & Hladik (1970); Walker & Molur (2003)
G09	Pindeniya	Specimen in the Field Museum of Natural History, Chicago, collected by E. C. Fernando in 1961 (Schulze 2005)
G10	Digana	Specimen in the Field Museum of Natural History, Chicago, collected by E. C. Fernando in 1966 (Schulze 2005)
G11	Talawakele	Dharmasena (1989)
G12	Thangamalai Sanctuary	Walker & Molur (2003)
N01	Talawa (type locality of nordicus)	Hill (1933); Phillips (1935)
N02	Jaffna	Hill (1933); Phillips (1935)
N03	Sigiriya Sanctuary	Hill (1933); Phillips (1935); Walker & Molur (2003)
N04	Kekirawa	Hill (1933); Phillips (1935)
N05	Tammannewa	Mayor, quoted by Hill (1933); Phillips (1935)
N06	Mannar	Mayor, quoted by Hill (1933); Phillips (1935)
N07	Anuradhapura	Mayor, quoted by Hill (1933); Phillips (1935); specimen at British Museum of Natural History, collected in 1913 (Jenkins 1987); Nekaris & Jayewardene (2004)
N08	Wilachchiya	Mayor, quoted by Hill (1933); Phillips (1935); specimen at British Museum of Natural History, collected in 1914 (Jenkins 1987)
N09	Chavakachcheri	Specimen at British Museum of Natural History, collected in 1933 (Jenkins, 1987)
N10	Point Pedro	Specimen at British Museum of Natural History, date of collection unknown (Jenkins 1987
N11	Monaragala, Uva	Specimen at British Museum of Natural History, collected in 1939 (Jenkins 1987)
N12	Cheddikulam	Hill (1953)
N13	Batticaloa	Oral reports quoted by Hill (1933)
N14	Tamankaduwa	Oral reports quoted by Hill (1933)
N15	Bintenna district (Mahiyanganaya)	Oral reports quoted by Hill (1933)
N16	Monaragala and Wellassa district	Oral reports quoted by Hill (1933)
N17	Wilpattu National Park	Phillips (1933); Eisenberg & Lockhart (1972); B. Meier in 1972 and Verner-Carlsson in 1984 quoted by Schulze (2005); Walker & Molur (2003); M. S. J. Perera (pers. obs. 2005)
N18	Badalkumbura	Specimen at British Museum of Natural History, collected in 1955 (Jenkins 1987)
N19	Habarana	Specimen in the Field Museum of Natural History, Chicago, collected by Fernando, E.C. in 1965 (Schulze 2005)
N20	Polonnaruwa Sanctuary	Hladik & Petter (1970); Petter & Hladik (1970); Meier in 1980 (1989); Walker & Molur 2003; Nekaris & Jayewardene 2004
N21	Mihintale Sanctuary	Walker & Molur (2003); Nekaris & Jayewardene (2004)
N22	Ritigala Strict Nature Reserve	Nekaris & Jayewardene (2004)
N23	Giritale Nature Reserve	Walker & Molur (2003); Nekaris & Jayewardene (2004)
N24	Maduru Oya National Park	Nekaris & Jayewardene (2004)
N25	Trincomalee	Nekaris & Jayewardene (2004)
N26	Forests around Nachchaduwa and Turuwila Tanks	R. Jayewardene pers. comm. quoted by Nekaris & Jayewardene (2004)
N27	Ampara Sanctuary	Walker & Molur (2003)
N28	Kanthale Forest Reserve	Walker & Molur (2003)
N29	Angammedilla National Park	Walker & Molur (2003)
N30	Flood Plains National Park	Walker & Molur (2003)
N31	Kaudulla National Park	Walker & Molur (2003)
N32	Somawathie National Park	Walker & Molur (2003)
N33	Wasgomuwa National Park	Walker & Molur (2003)
N34	Minneriya National Park	Walker & Molur (2003)
N35	Menikdena Forest Reserve	Walker & Molur (2003)

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Table 1. continued from previous page

Code	Locality	Source(s) of Information
N36	Demodara, north-western boundary of Ruhunu National Park	S. Gamage (pers. comm. 2006); Bernede and Gamage (2006)
N37	Kumana National Park	Bernede and Gamage (2006)
N38	Galoya National Park	Bernede and Gamage (2006)
N39	Victoria-Randenigala-Rantambe Sanctuary	Bambaradeniya (1996); Walker & Molur (2003)
N40	Anawilundawa Sanctuary	Perera et al. (2005)
N41	Thalgasmankada, Ruhunu National Park	Photographed in 1970s (S. Gunasekara pers. comm. 2007)
N42	Block IV, Ruhunu National Park	de Silva & de Silva (2004)
N43	Block I, Ruhunu National Park	M. S. J. Perera (pers. obs. 2004); Perera et al. (in press)
Intl	Intermediate between nordicus and grandis – Elahera	Hill (1933)
Int2	Intermediate between grandis and tardigradus – Peradeniya	Phillips (1926); Specimen at British Museum of Natural History, date of collection unknown (Jenkins 1987); Phillips (1935)
Int3	Intermediate between grandis and tardigradus – Balangoda	Phillips (1926); Hill (1933)
Int4	Intermediate between nordicus and tardigradus - Chilaw	Tannent (1861); Hill & Phillips (1932); Hill (1933)

Angammedilla National Park, Flood Plains National Park, Kaudulla National Park, Somawathie National Park, Minneriya National Park and Wasgomuwa National Park, in addition to the sites mentioned earlier.

The reconnaissance survey for slender loris of Nekaris and Jayewardene (2004) included 31 sites in all the bioclimatic zones of the island: 10 of them in the known range of *L. l. nordicus*. It was recorded from only seven sites, namely Polonnaruwa Smithsonian Primate Research Camp, Anuradhapura, Mihintale Sanctuary, Ritigala Strict Nature Reserve, Minneriya Giritale Nature Reserve (earlier referred to as Minneriya Giritale Sanctuary), Maduru Oya National Park, and Trincomalee. Lorises have also been detected from forests around Nachchaduwa and Turuwila Tanks (R. Jayewardene pers. comm. in Nekaris and Jayewardene 2004).

Loris specimens observed by the author in Anawilundawa Sanctuary (Perera *et al.* 2005) were identified as *L. l. nordicus* based on their general appearance. Some of their coats were reddish rather than grey, suggesting they may have been intermediate forms between *L. t. tardigradus* and *L. l. nordicus* (M. S. J. Perera pers. obs. 2005). Anawilundawa is only about 10 km north of Chilaw from where Tannent (1861) recorded a red slender loris, later also suspected to be an intermediate between *tardigradus* and *nordicus* (Hill and Phillips 1932; Hill 1933). The specimen could, however, have been a juvenile *nordicus* with the reddish color typical of immature animals (Hill and Phillips 1932).

Lorises were not recorded from Wilgamuwa scrub jungle in Matale District, within the known range of *L. l. nordicus*, nor at Elahera and Udawalawe National Park, where Nekaris and Jayewardene (2004) suspected the occurrence of intermediate forms of *nordicus* with other races. Nekaris and Jayewardene (2004) were unable to record lorises from six other sites in southeastern Sri Lanka where they suspected the occurrence of *L. l. nordicus*: Wellawaya (Rosbery Estate and Buttala road), forests around Handapangala tank and Pelwatta, Yala (Ruhunu) National Park, Bundala National Park, Kataragama forest patches, and Nimalawa sanctuary. They noted that "the probability is high that lorises are indeed

absent from these areas, have migrated for the time being, or that their densities are low" (Nekaris and Jayewardene 2004, p.329).

Even though historical records and the broad reconnaissance survey conducted by Nekaris and Jayewardene (2004) do not include the southeastern dry zone in the range of L. l. nordicus, a few recent records reveal its presence in Ruhunu National Park and adjacent areas. A slender loris, most probably nordicus, was recorded in the early 1970s from Thalgasmankada, in Ruhunu National Park more than 5 km inland from the southeast coast (S. Gunasekara pers. comm. 2007). De Silva and de Silva (2004) recorded L. lydekkerianus (suspected to be *nordicus*) from block IV of the Ruhunu National Park, more than 20 km inland from the coast. Recent surveys conducted by S. N. Gamage have recorded nordicus from several locations in southeast Sri Lanka (unpubl. data). They include Galoya and Kumana (Yala East) National parks and the Demodara area on the northwestern boundary of Ruhunu National Park (S. N. Gamage pers. comm. 2006; Bernede and Gamage 2006). An observation, made by the author on the night of 8 October 2004, extends the range of L. lydekkerianus to block I of the Ruhunu National Park, nearly 1 km from the southeastern coast of the island. The animal could not be identified to subspecies level but it is most likely to be L. l. nordicus (Perera et al. in press).

Concluding Remarks

Even though *L. l. nordicus* has recently been recorded from many new localities, it is interesting to note that they include only three sites with historical records, namely Anuradhapuara, Wilpattu National Park and Sigiriya Sanctuary. This does not necessarily mean the disappearance of lorises from other localities, but the lack of recent surveys covering its historical range. *L. l. grandis* has been recorded only from the Knuckles Range, within its historically known distribution. All other recent records of this race are from areas around Kandy plateau, along with some other localities with records which have not been confirmed as *grandis*. There are

many sites from which both above races are recorded historically, where no attempt been made to confirm their presence today. While there is less emphasis on *grandis* in recent studies, there is an urgent need for a detailed distribution study on both subspecies. It should also be noted that only three of 12 localities of *grandis* and 23 of 43 localities of *nordicus* are within the existing protected area network managed by the Department of Wildlife Conservation and the Forest Department of Sri Lanka.

The distribution map (Fig. 1) shows the ranges of the two subspecies of *L. lydekkerianus* in the different bioregions of Sri Lanka (Sri Lanka, Ministry of Forestry and Environment 1999). *L. lydekkerianus* has never been recorded from the wet lowlands with characteristic tropical lowland evergreen (rain) forest and annual rainfall of 2,500 to 5,000 mm.

Loris 1. nordicus is found only in the dry arid and intermediate lowlands and not farther up in the hills. Dry lowlands are characterized by dry mixed-evergreen (monsoon) forest and secondary scrub forest ranging in altitude from 0 to 500 m, and receiving an annual rainfall of 1,250–1,900 mm. The annual rainfall is between 1,900 and 2,500 mm in the intermediate lowlands, ranging in elevation from 0 to 1,000 m, with characteristic tropical moist evergreen forest. Arid lowlands receive a rainfall of less than 1,250 mm annually and are characterized by tropical thorn scrub with isolated trees.

Loris l. grandis is found in wet and intermediate midlands ranging in altitude from 1,000 to 1,500 m, and seems to prefer the intermediate climate over the wet. Wet midlands are characterized by tropical sub-montane evergreen forest, with rainfall of 2,500 to 5,000 mm per year, while intermediate midlands are characterized by dry patana grassland and associated moist evergreen forest with 1,900 to 2,500 mm annual rainfall. They do not ascend into the wet highland areas in the central mountain massif (1,500–2,500 m above sea level) with wet patana grassland and tropical montane (cloud) forest, which are inhabited by L. t. nycticeboides.

Figure 2 shows the extent of occurrence (IUCN 1994) of *L. l. nordicus* and *L. l. grandis* with codes for their localities that refer to the location names and sources of information given in Table 1.

Information gathered in this review along with an observation by the author, extends the distribution of *L. lydekkerianus* towards the southeastern coastal belt of Sri Lanka, and suggests that the actual range of the species could be larger than previously known. It confirms that even though they are not as abundant as in the northern parts of the island *L. lydekkerianus* is still present in the south. Whether the southern population belongs to the race *nordicus* or to a different race needs to be addressed in future through detailed surveys in the area.

Recent observations raise a number of questions on the range, abundance, variation and the biogeography of the hitherto known and possibly unknown forms of slender loris, stressing the need for further studies on these little known taxa. The 2007 Red List of Threatened Fauna and Flora of Sri Lanka (IUCN-Sri Lanka and the Ministry of Environment and Natural Resources 2007) recorded that *Loris tardigradus* has already been subject to local extinctions, mainly as a result of habitat loss. Researchers have recommended that *Loris lydekkerianus* and *Loris tardigradus* be considered as distinct species for conservation measures (Groves 1998, 2001; Nekaris and Jayewardene 2003). Hence, identification of threats and conservation opportunities within their exact ranges is of vital importance for their survival.

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