2 *Distribution and current status of long-tailed macaques (*Macaca fascicularis aurea*) in Myanmar*

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We have collected data on the distribution and status of local groups and habitat conditions of long-tailed macaques (*Macaca fascicularis aurea*) throughout Myanmar using interviews, pet observation, and direct field surveys from July, 2004 to March 2009. The long-tailed macaque was found to be distributed along Myanmar's coastal regions from its northwestern border (21˚N) near Bangladesh to its southernmost border (9˚58'N) near Thailand. The Rakhine and southern Tanintharyi biogeographical regions are major ranges, and the Ayeyarwady Delta, Bago Yoma, and the northern Tanintharyi regions appear to have suffered extensive population losses. The national population of Myanmar long-tailed macaques in 2009 was estimated to be between 11,130 and 107,900 individuals. Habitat loss from logging, agricultural and aquacultural farming, and hunting for food and trading are current threats to long-tailed macaque populations in Myanmar. As a result, the population may be declining and becoming fragmented and conservation, and management programs will be therefore be necessary to maintain a viable population.

Introduction

Myanmar is situated in the west of the Indochina Peninsula and geographically ranges from 9˚58' N to 28˚29'N and from 92˚10'E to 101˚10'E, with a land area of 676,553 km^2 and a coastline of 2,832 km^2 (Bird Life International, 2005). The wide variation in topography and climate has produced a rich diversity of wildlife in Myanmar, which is a component of the Indo-Myanmar Hotspot for biodiversity (Bird Life International, 2005). New mammal species have been discovered quite recently, such as the leaf deer (*Muntiacus putaoensis*, Amato

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et al., 1999) and the Kachin woolly bat (*Kerivoula kachinensis*, Bates *et al*., 2004). Primate fauna are also rich in Myanmar (Tun Yin, 1967; FAO, 1985; Kyaw Nyunt Lwin, 1995; Parr and Tin Than, 2007), including one species of slow loris (*Nycticebus coucang*), five species of macaques (*Macaca assamensis*, *M. arctoides*, *M. fascicularis*, *M. mulatta*, and *M. nemestrina*), five species of leaf monkeys (*Trachypithecus obscurus*, *T. phayrei*, *T. cristatus*, *T. pileatus*, and *Presbytis femoralis*), and two species of gibbons (*Hylobates hoolock* and *H. lar*).

The long-tailed macaque in Myanmar is classified as a distinctive subspecies (*Macaca fascicularis aurea*), with parts of this subspecies population also occurring in Thailand and Bangladesh. For the most part, the biology and evolution of this subspecies remains unknown. Evolutionary scenarios on the origins of long-tailed macaques (*Macaca fascicularis*) have suggested that proto-*fascicularis* expanded north from Sundaland into continental Southeast Asia (Delson, 1980). After this movement, proto-*fascicularis* diversified into the rhesus macaque (*M. mulatta*) and the ten subspecies of *M. fascicularis* (Fooden, 1995). The Myanmar subspecies (*Macaca fascicularis aurea*) is considered to have arisen from such northern colonizers, perhaps after becoming isolated from the rest of Southeast Asia by the Bilauktaung Mountain Range (i.e., the Dawna Range), which runs from north to south along the national border between Myanmar and Thailand. This hypothesis on the origin of *M. f. aurea* needs to be tested. Consequently, a detailed understanding of their distribution is necessary in order to reconstruct their evolutionary history.

Fooden (1995) stated that the Myanmar subspecies *M. fascicularis aurea* has an infrazygomatic lateral facial crest pattern, a relative tail length (tail length/crown-rump length x 100%) of > 90%, a frequent appearance of crested hair at the crown, a pelage color of grayish brown without patterning in juveniles and adults (cf., bi-partite pattern in rhesus and assamese macaques), a black pelage in infants under three months of age, and whiskers and other hairs around the face. The direction of hair at the cheek is a major subspecific key character, demonstrating an infrazygomatic pattern (*M. f. aurea*; Fooden, 1995) rather than the transzygomatic pattern seen in *M. f. fascicularis*. Possible hybrids have been found in Myanmar that appears to be either inter-specific with rhesus macaques (*Macaca mulatta*) or inter-subspecific with the nominotypical subspecies (*M. f. fascicularis*; Fooden, 1995, 2000).

The status and distribution of long-tailed macaques in Myanmar is still only poorly known. There are rough reports on the distribution of the long-tailed macaque in Myanmar (Tun Yin, 1967; Fooden, 1995), but these may not capture the full extent of their distribution, nor are they necessarily valid today. These reports show that the long-tailed macaques of Myanmar range in lower and southern parts of Myanmar. However, their status and population

levels have not been well reported and significant environmental changes have occurred in Myanmar since these surveys. Consequently, adequate surveys are needed to complete our understanding of their distribution.

Long-tailed macaque populations are reported to be widespread but rapidly declining due to habitat alteration and the animal trade (Eudey, 2008). In Myanmar, there are several threats facing long-tailed macaques and other species. Myanmar is still one of the most forested countries in mainland Southeast Asia, but the forests are declining and have continued to decline by 0.3 percent annually since early 1990 (Peter *et al*., 2008). Forest loss has been due to logging, construction of infrastructure, and conversion to agricultural and aquacultural lands. Consequently, forest habitat and quality have been significantly reduced in Myanmar, and this is especially so in Southern Myanmar (Molur *et al*., 2003). The lowland, coastal, and mangrove forests, which are the primary natural habitats of long-tailed macaques, have been significantly affected by forest conversion. As a result, the habitats available to them are deteriorating and becoming more fragmented. Furthermore, hunting and the wildlife trade also threaten long-tailed macaques in Myanmar. Therefore, a better understanding of their population is needed in order to adequately assess how land use and utilization of macaques as a resource are affecting their population levels.

Long-tailed macaques have been regarded as a "weed species," (Richard *et al*., 1989), meaning that they are resistant to habitat deterioration, live near or inside human settlements, and easily exploit resources from these settlements. Therefore, it is possible that long-tailed macaques will become more weed-like as destruction of natural forest habitat continues, and human development expands. This will place these macaques into a vulnerable position, because although they can exploit human habitat, their continued existence in regions where they live sympatrically with humans will depend on the attitude of humans towards macaques. If the human communities become intolerant of macaques, they could begin to exterminate local populations, and this type of population pressure may have already begun in Myanmar. Consequently, studies are needed to assess how living near human settlements are impacting macaque populations in Myanmar.

In this study, we have surveyed Myanmar to assess the distribution and status of the long-tailed macaque population. Since 2004 we have been conducting interviews and have carried out pet observations as well as direct field observation. In this manuscript, we report the preliminary results of our research. Long-tailed macaques were found in Rakhine, Ayeyarwady Delta, Bago Yoma, and Tanintharyi Biogeographical regions in Myanmar, and we described the present status and estimate population of long-tailed macaques in each of these regions.

Materials and methods

Study region and interviews

Based on factors of physical geography, rainfall, and forest cover (FAO, 1985), Myanmar is divided into ten biogeographic regions, and we travelled through seven of these between July 2004 and March 2009 to assess the presence or absence of long-tailed macaques (Figure 2.1). In these regions, we interviewed 380 local people in 184 of villages along the highways and seven protected areas. In villages, we identified either the head of each village or persons who knew the forests and wildlife and could describe the presence and abundance of nonhuman primates. Photographs illustrating the typical morphology of the species were shown to the participants, so they could identify which species they had observed in the region. We recorded the following information at each location where we conducted interviews: address of the village, the geographical coordinates (latitude, longitude) and altitude with GPS (Global Positioning System), ethnicity of residents, habitat conditions, impacts on wildlife habitats (hunting, consumption, and trading), conflicts between humans and primates, and the local names of primates. In protected areas, we interviewed forest rangers and staff about species diversity, numbers of troops, habitat conditions, and the range of forest protection law. The interview survey form is presented in Appendix 2.1.

Pet observation

During the interview survey, we actively inquired about the location of pet long-tailed macaques in each village. After locating pets, we interviewed the pet owners about the origin of the monkey, the hunting method used to capture the pet, how they obtained the monkey, the price of the monkey, and the route of trade. We observed their morphological characteristics and assessed if there was any evidence of hybrid characteristics (i.e., interspecies or intersubspecies), based on descriptions from Fooden (1995).

Field survey

The region of the field survey ranged from 12˚27’ N to 17˚17’N and from 95˚14’ E to 99˚06’E in southern Myanmar, and covered mangrove forests and isolated limestone mountains which free-ranging and habituated troops of long-tailed macaque were known to inhabit. We observed and classified the

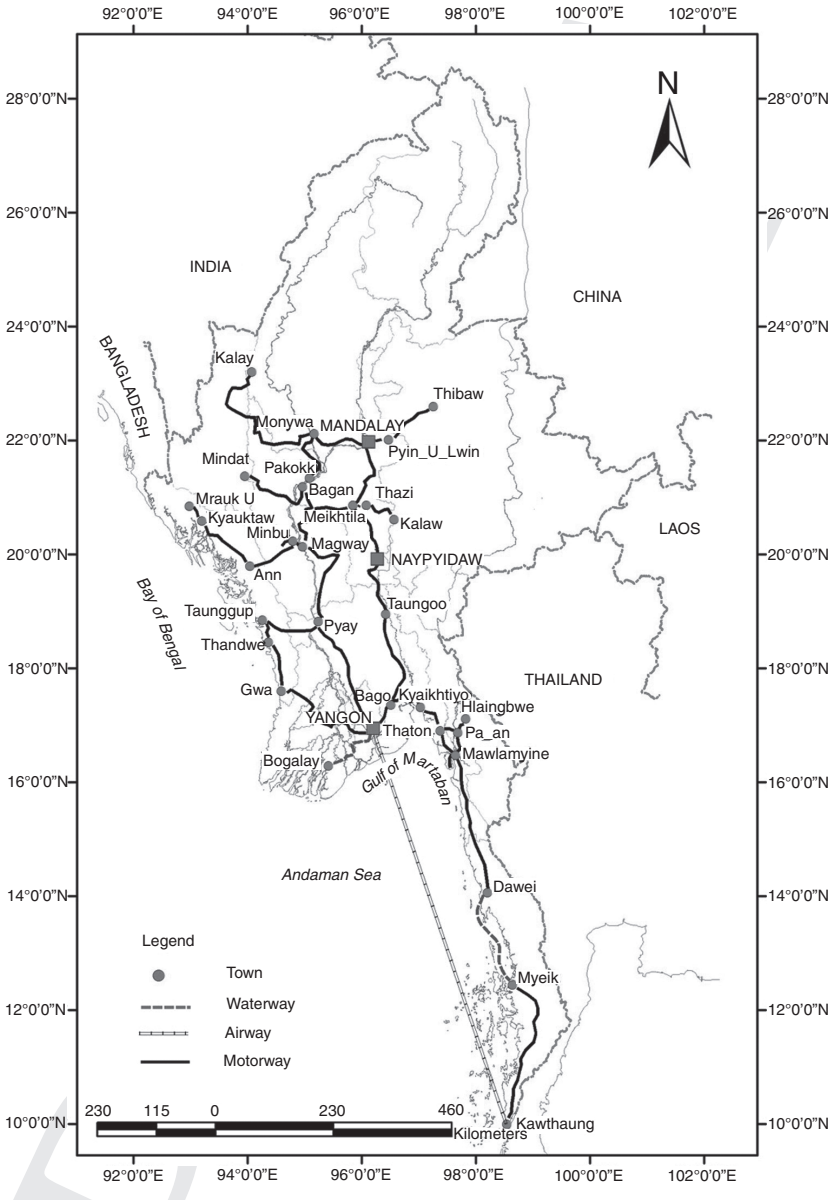

Figure 2.1. Myanmar map showing interview survey routes (2004–2009).

Macaca fascicularis aurea subspecies by their morphological traits, that is, infrazygomatic pattern of cheek hairs and no hair-crest at the vertex of the head (Fooden, 1995). Individuals were classified into sex and age classes based on their morphological characteristics and population sizes were counted by direct observation. The background history of the troop and condition of the habitat were recorded by interviews with local residents, mostly from the monks living at the monasteries.

Population estimation

We estimated the population of long-tailed macaques in Myanmar using several assumptions to assess each habitat region. In the Mon and Kayin States of the northern part of Tanintharyi region, long-tailed macaques troops were found in isolated mountains. The minimum estimation was made by multiplying the number of troops by an average size of 30, which is an average macaque group size that is in accordance with a review of numerous studies in free-ranging conditions (Fooden, 1995). Although we made an exhaustive survey in these regions, we may have missed as many troops as we found. Therefore we generated a maximum estimate that was two times are count to factor in the likelihood that we missed up to 50 percent of the groups occurring in the region.

In the Rakhine and southern Tanintharyi regions, we estimated the total population in lowland forests by using a strip transect method. The parameters obtained from trip surveys were the distance we covered (L) and the number of sites (n) where long-tailed macaques were reported. Forest cover area was obtained from the most recent existing statistics (Leimgruber *et al*., 2005). Our suppositions were as follows: the strip width was 10 km, troop size was 30 individuals, and 50 percent and 33 percent of the forested areas were habitable for long-tailed macaques in the southern Tanintharyi and Rakhine regions, respectively. The proportions of habitable area were determined by assessing the development of forest and influence of human activities. The density was established as 5n/L individuals/km^2. The minimum estimate was then calculated as 3n/L*A for the southern Tanintharyi region and 1.5n/L*A for the Rakhine region. Since the forest cover is decreasing from the year of the report, the estimate was corrected by average decreasing rates; in ten years, equaling 9 percent in southern Tanintharyi and 5 percent in Rakhine. The maximum estimate was established at ten times the minimum to provide a large buffer to avoid an underassessment of the population. However, mangrove forests do not appear as heavily exploited by human activity as the other types of lowland forests, therefore the populations of long-tailed macaques in mangrove forests are

estimated from the area of forest and a density calculated at ten times greater than other lowland forests in each region.

Results

Interview reports on distribution

We found positive records for long-tailed macaque in four of the seven biogeographic regions that we surveyed; Rakhine, Ayeyarwady Delta, Bago and Tanintharyi. (Table 2.1) We obtained reports on the occurrence of long-tailed macaques at 98 villages (53.26 percent) of the 184 villages we visited (Table 2.2 and 2.3). Overall, we found that the range of long-tailed macaques in Myanmar stretches all along the coastal regions from northwestern 20˚32'N, near the Bangladesh border, to the southernmost area, 9˚58'N (Figure 2.2). The ranges of long-tailed macaques between the Rakhine, Ayeyarwady, and Tanintharyi regions were found to be separated by human settlements during our surveys.

The mountains of Rakhine Yoma are covered by patches of primary forest within a landscape dominated by secondary vegetation (largely bamboo) that has resulted from logging and shifting cultivation. Lowland and coastal forests tend to be inhabited by long-tailed macaques. On the other hand, mountainous forests tend to be inhabited by other cercopithecoid species such as pig-tail and rhesus macaques and dusky langurs.

Most of the mangrove forest in the Ayeyarwady Delta region had already been converted to human settlements and agricultural fields, and intensive human population pressures, agriculture, and fishing have destroyed mangroves in most of the surrounding areas. The Meinmahla Kyun Wildlife Sanctuary (MKWS, site No. 59) is the only remaining protected mangrove forest in Ayeyarwady Delta, and affords some protection to the wildlife of this region. We recorded two troops of wild long-tailed macaques inhabiting in MKWS during our surveys.

The Bago Yoma region is believed to be inhabited by a small number of long-tailed macaques. According to interviews, local populations of long-tailed macaques do exist here, but have been almost entirely exterminated from this region, by both human activities and the harsh environment, the dry and deciduous vegetation does not suit the long-tailed macaque. We could only confirm one positive report of pet (Site No. 60, Table 2.3) as evidence of long-tailed macaques in this region.

In the Tanintharyi region, we obtained ten positive records out of 34 (29.4 percent) interview sites in the northern region, and 28 out of 52 (53.8 percent

Table 2.1. *Physical features of the biogeographic regions in the survey areas*

No.	Biogeographic Region	Political Divisions	Mean Rainfall (mm)	Vegetation Types
1	Chin Hill	Chin State	1750–3750	Hill evergreen, pine forest and bamboo forest
2	Shan Plateau	Shan State	1250–3750	Evergreen, mixed deciduous forest and sub-tropical pine forests
3	Rakhine *	Rakhine State	2500–6250	Evergreen and deciduous forest. Bamboo forest and tidal swamps, beach forest, islands
4	Dry Zone	Mandaly, Magway and Sagaing Divisions	625–1000	Dry forest and scrub
5	Bago Yoma*	Bago Division	1250–3500	Mixed deciduous and semi-evergreen forest
6	Ayeyarwady Delta*	Ayeyarwady Division	2500–5000	Tidal swamp forest
7	Tanintharyi*	Mon, Kayin States and Tanintharyi Division	3750–5000	Evergreen tropical rainforest Tidal swamp forest Beach forest Offshore islands and coral reef

* Biogeographic regions where long-tailed macaques were found

Table 2.2. *Information of long-tailed macaque in biogeographic regions*

Biogeographic Region	Date of Survey	Total Interview Sites	Long-tail positive	Frequency (%)
Rakhine	19 to 22 Nov 2004	45	21	46.7
	14 to 22 Jan 2007	6	6	100
	16 to 20 Jan 2009	43	31	72.1
Ayeyarwady Delta	18 to 22 Jul 2004	1	1	100
Bago Yoma	1 Dec 2004	3	1	33.3
Tanintharyi (North)	20 to 24 May 2008	34	10	29.4
Tanintharyi (South)	1 to 8 Mar 2009	52	28	53.8
TOTAL		**184**	**98**	**53.26**

Table 2.3. *Positive records of long-tailed macaque in different regions*

Site	Date	Region	Village	Latitude	Longitude	Altitude(m)
1	19-Nov-04	Rakhine	Hlay-lone-taung	16˚57′44.1″	94˚30′25.6″	+
2	19-Nov-04	Rakhine	Seit Gyi	16˚57′19.7″	94˚3′14.6″	+
3	19-Nov-04	Rakhine	Chaung Tha	16˚58′13.7″	94˚27′02.6″	+
4	19-Nov-04	Rakhine	Chaung Tha	16˚58′14.9″	94˚27′04.7″	+
5	19-Nov-04	Rakhine	U-To Chaung	16˚57′32.4″	94˚28′35.3″	+
6	19-Nov-04	Rakhine	Chaung-khwa	17˚28′18.9″	94˚56′23.0″	+
7	19-Nov-04	Rakhine	16 miles camp	17˚30′54.7″	94˚34′26.2″	+
8	19-Nov-04	Rakhine	Mya-yar-pin	17˚32′50.6″	94˚49′40.0″	+
9	19-Nov-04	Rakhine	Baw-di Camp	17˚34′08.8″	94˚43′48.1″	+
10	20-Nov-04	Rakhine	Gwa Township	17˚35′19.9″	94˚41′42.2″	+
11	20-Nov-04	Rakhine	Dawn Chaung Kwin	17˚35′08.9″	94˚38′23.7″	+
12	21-Nov-04	Rakhine	Old Myay Kwin	17˚39′03.1″	94˚35′43.1″	+
13	21-Nov-04	Rakhine	Ye-thit-kone	17˚40′24.4″	94˚36′05.7″	+
14	21-Nov-04	Rakhine	Tie-kyoe	17˚49′05.0″	94˚29′23.1″	+
15	21-Nov-04	Rakhine	Sar-chet	17˚57′42.3″	94˚30′14.3″	+
16	21-Nov-04	Rakhine	Boga-lay	18˚07′11.2″	94˚29′06.6″	+
17	21-Nov-04	Rakhine	Thit Ngot Toe	18˚11′17.8″	94˚28′52.7″	+
18	21-Nov-04	Rakhine	Kyauk-gyi	18˚14′48.5″	94˚28′36.5″	+
19	21-Nov-04	Rakhine	Nat-taung	18˚33′21.0″	94˚20′15.9″	+
20	21-Nov-04	Rakhine	Ah Bay	18˚41′40.1″	94˚15′47.0″	+
21	21-Nov-04	Rakhine	Tha Phan Shwe	18˚51′20.0″	94˚14′36.0″	+
22	10-Jan-07	Rakhine	Gat Gyi	19˚51′22.1″	94˚26′30.8″	+
23	10-Jan-07	Rakhine	Lay Dan Ku	19˚48′12.3″	93˚58′16.7″	+
24	12-Jan-07	Rakhine	Kyay Taw	20˚32′48.7″	92˚58′44.0″	+
25	12-Jan-07	Rakhine	Tan Pauk Chaung	20˚20′02.3″	93˚20′10.6″	+
26	13-Jan-07	Rakhine	Sa Nyin	19˚58′49.6″	93˚43′11.9″	+
27	13-Jan-07	Rakhine	Kha Maung Taw	19˚51′30.0″	93˚54′23.9″	+
28	16-Jan-09	Rakhine	Sein-taung-kone	16°49.107’	94°34.096’	12
29	16-Jan-09	Rakhine	Maw-tin Junction	16°48.789’	94°33.635’	3
30	16-Jan-09	Rakhine	Elephant Camp	16°48.630’	94°29.560’	42
31	16-Jan-09	Rakhine	Shaut pin chaung	16°49.340’	94°27.709’	30
32	16-Jan-09	Rakhine	Ya-mon-nar-oo Hotel	16°49.874’	94°23.759’	10
33	17-Jan-09	Rakhine	Tha-latt-khwa	16°49.328’	94°36.545’	18
34	17-Jan-09	Rakhine	Nga-thaing-chaung	17°23.396’	95°04.002’	20
35	17-Jan-09	Rakhine	Chaung-kwa	17°28.331’	94°56.407’	20
36	17-Jan-09	Rakhine	Naung-ta-kha	17°30.611’	94°53.499’	209
37	17-Jan-09	Rakhine	Nyaung-ta-kha	17°30.725’	94°53.144’	173
38	17-Jan-09	Rakhine	25 mile camp	17°32.701’	94°49.146’	286
39	17-Jan-09	Rakhine	31 miles 4 farlon	17°34.121’	94°46.526’	459
40	17-Jan-09	Rakhine	33 miles	17°33.458’	94°45.088’	213
41	18-Jan-09	Rakhine	Kan-thar-yar beach	17°43.696’	94°32.526’	10
42	18-Jan-09	Rakhine	Zi-kone	17°45.676’	94°31.351’	15
43	18-Jan-09	Rakhine	Sat-twar-kone	17°46.569’	94°30.360’	10
44	18-Jan-09	Rakhine	Maw-shwe-chaing	17°47.981’	94°29.169’	3
45	18-Jan-09	Rakhine	Tai-kyoe	17°49.947’	94°29.430’	10

Table 2.3. (*cont.*)

Site	Date	Region	Village	Latitude	Longitude	Altitude(m)
46	18-Jan-09	Rakhine	Chaung-tha	17°50.673’	94°29.839’	6
47	18-Jan-09	Rakhine	Tha-pyu-chaung	17°53.223’	94°30.175’	3
48	18-Jan-09	Rakhine	Kyein-ta-li	18°00.298’	94°29.424’	4
49	18-Jan-09	Rakhine	Kyauk-khaung-kwin	18°05.591’	94°28.686’	21
50	18-Jan-09	Rakhine	Kha-ye-tan	18°08.652’	94°28.764’	18
51	18-Jan-09	Rakhine	Thit-gnot-to	18°11.283’	94°28.909’	15
52	18-Jan-09	Rakhine	Me-ne-kwin	18°22.310’	94°25.563’	10
53	19-Jan-09	Rakhine	Kway-chaung	18°35.444’	94°21.052’	11
54	19-Jan-09	Rakhine	Tha-ka-pyin	18°42.418’	94°19.658’	17
55	19-Jan-09	Rakhine	Tha-la-ku	18°48.550’	94°15.618’	10
56	19-Jan-09	Rakhine	Kyauk-ta-gha camp	18°30.131’	94°20.393’	+
57	19-Jan-09	Rakhine	Sa-lu	18°44.603’	94°30.002’	646
58	19-Jan-09	Rakhine	Ye-paw-gyi	18°40.475’	94°34.780’	699
59	19-Jul-04	Ayeyarwady	Meinmahla Kyun	15°51’ to 16°05’	95°14’ to 95°21’	+
60	1-Dec-04	Bago	Day-son-par	17°32’50.7”	96°32’30.2”	+
61	21-May-08	N.Tanintharyi	Bayin Nyi Naung	16°58.2’	97°29.6’	28
62	21-May-08	N.Tanintharyi	Taung-ga-lay	16°53’09.2”	97°32’04.2”	44
63	21-May-08	N.Tanintharyi	Kaw-kun-gu	16°49’21.6”	97°35’9.2”	15
64	21-May-08	N.Tanintharyi	Ya-yhae-pyan-gu	16°50’6.5”	97°34’14.8”	21
65	22-May-08	N.Tanintharyi	Mt. Zwe-ka-pin	16°49’27.7”	97°40’05.4”	726
66	22-May-08	N.Tanintharyi	Kaw-ka-thaung-gu	16°49’42.6”	97°42’21.9”	23
67	22-May-08	N.Tanintharyi	Shwe-pyi-tahung	16°44’21.5”	97°45’30.7”	36
68	22-May-08	N.Tanintharyi	Kha-yon-gu	16°32’0.5”	97°42’53.5”	13
69	23-May-08	N.Tanintharyi	Indian Single Rock	16°19’19.1”	97°42’33.3”	73
70	23-May-08	N.Tanintharyi	Mahar-kottheinnar-yon	17°17’9”	97°13’0.1”	45
71	1-Mar-09	S.Tanintharyi	Aung-thu-kha	09°59’04.2”	98°32’53.7”	36
72	3-Mar-09	S.Tanintharyi	10 miles	10°04’55.4”	98°32’00.8”	58
73	3-Mar-09	S.Tanintharyi	Ban-ka-chun	10°08’59.5”	98°35’35.5”	9
74	3-Mar-09	S.Tanintharyi	Ban-ka-chun	10°08’59.7”	98°35’33.2”	10
75	3-Mar-09	S.Tanintharyi	Ma-li-wun	10°15’11.8”	98°36’06.6”	9
76	3-Mar-09	S.Tanintharyi	San-thida	10°28’0.12”	98°37’45.5”	31
77	3-Mar-09	S.Tanintharyi	Kha-maut-gyi	10°21’05.3”	98°37’24.2”	20
78	3-Mar-09	S.Tanintharyi	Shwe-pyi-thar	10°00’48.8”	98°33’46.3”	42
79	3-Mar-09	S.Tanintharyi	kyay-mar-thiri	10°01’13.6”	98°33’49.8”	42
80	4-Mar-09	S.Tanintharyi	Karathuri	10°55’59.2”	98°45’34.7”	20
81	4-Mar-09	S.Tanintharyi	Bokpyin Town	11°15’39.9”	98°45’27.9”	10
82	4-Mar-09	S.Tanintharyi	Khe-mine	11°13’04.2”	98°47’33.9”	19
83	4-Mar-09	S.Tanintharyi	Shwe-bon-thar	11°15’48.3”	98°45’28.8”	4
84	5-Mar-09	S.Tanintharyi	Lenya	11°26’58.7”	98°59’40.2”	9
85	5-Mar-09	S.Tanintharyi	Pyi-gyi-mine-dine	11°28’24.9”	99°00’35.0”	7
86	5-Mar-09	S.Tanintharyi	Htin-mei-ywa	11°31’17.1”	99°03’17.5”	15
87	5-Mar-09	S.Tanintharyi	Chaung-naut-pyan-ywa	11°43’56.6”	99°06’27.5”	64

Table 2.3. (*cont.*)

Site	Date	Region	Village	Latitude	Longitude	Altitude(m)
88	5-Mar-09	S.Tanintharyi	Tanintharyi, Orgyi	12°06'14.1"	98°59'10.1"	48
89	5-Mar-09	S.Tanintharyi	Kaw-ma-pyin	12°06'27.8"	98°58'28.6"	22
90	5-Mar-09	S.Tanintharyi	Pa-nan-nge	12°09'13.9"	98°57'34.2"	8
91	5-Mar-09	S.Tanintharyi	San-thit	12°13'27.2"	98°53'36.1"	18
92	5-Mar-09	S.Tanintharyi	Ah-thar	12°21'19.6"	98°47'18.6"	minus 1
93	6-Mar-09	S.Tanintharyi	Pa-htaw-taung	12°27'24.7"	98°34'36.9"	127
94	6-Mar-09	S.Tanintharyi	Shin-ma-kan	12°27'33.5"	98°34'54.7"	minus 4
95	8-Mar-09	S.Tanintharyi	Zet-her	14°04'54.2"	98°13'53.5"	minus 1
96	8-Mar-09	S.Tanintharyi	Ta-laing-taung	14°04'54.6"	98°14'16.9"	66
97	8-Mar-09	S.Tanintharyi	Tha-bya-ywa	14°04'21.8"	98°16'20.6"	minus 9
98	8-Mar-09	S.Tanintharyi	Pa-kar-yi	14°06'21.7"	98°18'10.6"	0

+ Elevation data was not recorded
N.Tanintharyi (North Tanintharyi)
S.Tanintharyi (South Tanintharyi)

percent) in the southern region. The northern region consists of the flood plains of the Thanlwin River, which have been extensively converted to agricultural farms, paddy fields, and rubber plantations. The long-tailed macaque populations are now restricted to limestone cliffy mountains surrounded by human settlements, where Buddhist or Hindu temples are established. In the southern region (Tanintharyi Division), primary forests still remain; and this higher quality of habitat condition is reflected by the frequencies of positive reports.

Pets

Based on the interviews and origins of pet macaques (n=23), long-tailed macaques appear to range in lowland and mangrove forests, while other species of macaques tend to range in inland and mountainous forests, showing a possible ecological separation of macaque in Myanmar. Pet long-tailed macaques were found in thirteen of the 98 sites (13.3 percent) where we had obtained positive long-tailed macaque reports. Of these, there were four (30.7 percent) in Rakhine, one (7.7 percent) in Bago and eight (61.5 percent) in Tanintharyi regions (Table 2.4). Among the thirteen pets, two were juveniles (15.4 percent), two adolescent males (15.4 percent), six adult males (46.2 percent), and three adult females (23.1 percent). A marginally significant larger proportion (61.5 percent) of pet long-tailed macaques were found in the southern Tanintharyi region ($X^2 = 5.692$, df = 2, p = 0.058), and most of these (61.5 percent) were in the southernmost area of the region. This higher number of pets may not only

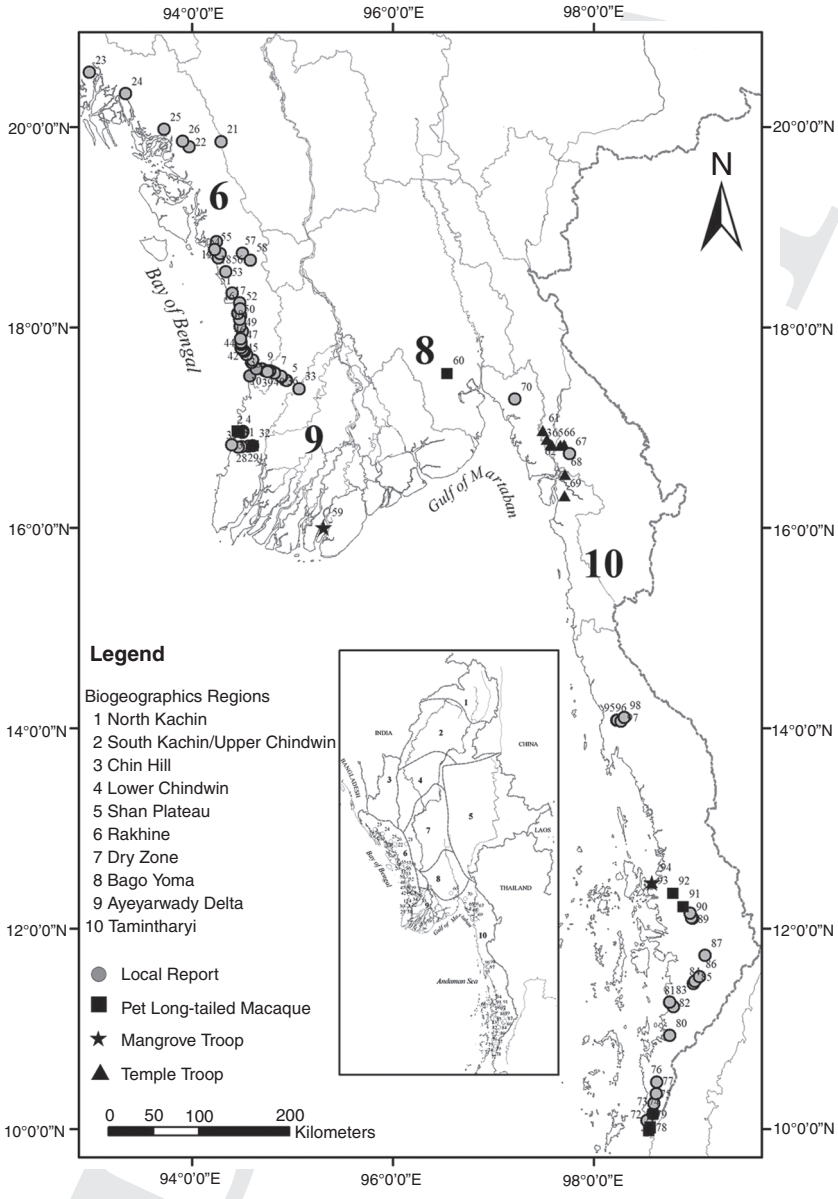

Figure 2.2. Myanmar map showing distribution of long-tailed macaque along coastal area.

Table 2.4. *Pet long-tailed macaques*

No	Date	Sex/Age	G.P.S	Region	Origin (Forest)	Captured Method	Purpose
1	19-Nov-04	Ad F	16°58'13.7" 94°27'02.6"	Rakhine	Mangrove	Bow and Arrow	Street-exhibitor
2	19-Nov-04	Ad F	16°58'13.7" 94°27'02.6"	Rakhine	Mangrove	Bow and Arrow	Street-exhibitor
3	19-Nov-04	Juv M	16°58'13.7" 94°27'02.6"	Rakhine	Mangrove	Snare	Trade
4	16-Jan-09	Ad M	16°49.874' 94°23.759'	Rakhine	Mangrove	Snare	Pet
5	1-Dec-04	Ad M**	17°32'50.7" 96°32'30.2"	Bago Yoma	Unknown	Unknown	Pet
6	1-Mar-09	Sad M	9°59'04.2" 98°32'53.7"	South Tanintharyi	Mangrove	Snare	Trade
7	3-Mar-09	Ad M	10°08'59.7" 98°35'33.2"	South Tanintharyi	Mangrove	Unknown	Trade
8	3-Mar-09	Ad M	10°00'48.8" 98°33'46.3"	South Tanintharyi	Mangrove	Unknown	Pet
9	3-Mar-09	Ad F	10°00'48.8" 98°33'46.3"	South Tanintharyi	Mangrove	Unknown	Pet
10	3-Mar-09	Ju M	10°00'48.8" 98°33'46.3"	South Tanintharyi	Mangrove	Unknown	Pet
11	3-Mar-09	Ad M	10°01'13.6" 98°33'49.8"	South Tanintharyi	Unknown	Unknown	Pet
12	5-Mar-09	Sad M	12°13'27.2" 98°53'36.1"	South Tanintharyi	Mangrove	Snare	Trade
13	5-Mar-09	Ad M*	12°21'19.6" 98°47'18.6"	South Tanintharyi	Mangrove	Snare	Trade

* Crest at the vertex

** Mixed characters between long-tail and pig-tail

occur because there is a larger wild population in this region, but also because pet long-tailed macaques are exploited in this region for domestic and international trade.

Field survey results

Populations of wild long-tailed macaques were difficult to observe because they are hunted in most areas and thus avoid contact with humans trying to track them. In the mainland Tanintharyi region, we found free-ranging, habituated long-tailed macaque troops: eight in the northern region (Mon and Kayin States) and two in the southern region (Table 2.5). The habitats they were found in varied, and included vegetation that was disturbed (secondary) forests, riverine or coastal mangrove forests, and steep limestone mountains or coastal hills. Nine of the groups we found live in the vicinity of Buddhist or Hindu temples on steep limestone mountains. Although natural resources appear poor in these limestone mountain habitats, these troops are provisioned to varying degrees from their interactions with monks and pilgrims. The groups we observed averaged about 50 individuals in size, but had a wide range of distribution (range: 10–100; Table 2.5).

Population estimate

We estimated the population of long-tailed macaques throughout the regions that we interviewed and surveyed. In the Bago Yoma and Ayeyarwady Delta regions, the population of long-tailed macaques is estimated to be between 90 and 300 individuals, based on the records from Meinmahla Kyun Wildlife Sanctuary. In Mon and Kayin States, we estimated a population between 350 and 700, and these figures are based on our sighting of eight groups. In the Rakhine region, we traveled 300 km, and found 31 sites with macaques. We estimated the density of macaque in this region to be 0.155 individuals/ km^2, and estimated the population to be between 1,300 and 13,000 individuals. The population of long-tailed macaques in mangrove forests (decreasing by 8 percent from 1996) was estimated to be between 2,250 and 22,500 individuals. Therefore, the total population estimated for the Rakhine region was between 3,550 and 35,500. From Kawthaung to Myeik, we traveled about 390 km, and on this route found 28 sites with positive reports for long-tailed macaques. We estimated a density of 0.215 individuals/km^2, and estimated the population to be between 2,760 and 27,600. We separately calculated the population in mangrove forests, which has an area of 2,600 km^2 (Leimgruber

Table 2.5. *Long-tailed macaque troops encountered in Myanmar*

Biogeographic Region	Locality	Habitat	G.P.S (N, E)	Group Size
North Tanintharyi	Bayin Nyi Naung	Isolated mountain	16˚58.2', 97˚29.6'	ca 40–50
	Taung-ga-lay	Isolated mountain	16˚53.15',97˚32.1'	ca 40–50
	Kaw-kun	Isolated mountain	16˚49.4', 97˚35.2'	ca 51–60
	Ya-thae-pyan	Isolated mountain	16˚50.1', 97˚34.2'	ca < 10
	Mt.Zwe-ka-pin	Isolated mountain	16˚49,7', 97˚40.5'	ca 51–60
	Kaw-ka-thaung	Isolated mountain	16˚49.7', 97˚42.4'	ca < 10
	Indian Single Rock	Isolated mountain	16˚19.3', 97˚42.6'	ca 70–80
	Kha-yone-cave	Isolated mountain	16˚32.0', 97˚42.9'	Not recorded
South Tanintharyi	Pa-htaw-taung	Isolated mountain	12˚27.4', 98˚34.6'	ca 40–50
	Shin-ma-kan	Mangrove forest	12˚27.6', 98˚34.9'	ca 40–50
Ayeyarwady Delta	Meinmahla Kyun Wildlife Sanctuary	Mangrove forest	15˚52'–16˚05' 95˚14' – 95˚21'	ca 40 – 50* ca 40–50*

* Meinmahla Kyun Wildlife Sanctuary Office reported on 19 July 2004

et al., 2005). We estimated the population of long-tailed macaques in mangrove forests to be between 4,380 and 43,800 individuals. In the southern Tanintharyi region, where villages are sparse and the forests are more intact, the density of long-tailed macaques may be higher. We therefore estimated the total population for the southern Tanintharyi region to be between 7,140 and 71,400 individual.

Based on these figures in the various regions, we calculated the total population of long-tailed macaques in Myanmar to be somewhere between 11,130 and 107,900 individuals. This is a wide range, but we prefer to be conservative in our estimation, and further census work will be needed to better refine these numbers. The southern Tanintharyi region holds the greatest population (64.1–66.4 percent), and the Rakhine region the second greatest (31.9–33.0 percent). The northern Tanintharyi region has the second-smallest population (3.14–0.65 percent), and Ayeyarwady Delta and Bago Yoma have the smallest (0.81–0.28 percent).

Table 2.6. *Local name and conflicts of long-tailed macaque*

Region	Ethnicity	Local Name	Conflicts and threats			
			Damage crop	Hunting	Eating	Trade
Rakhine	Rakhine, Chin, Bamar	de-kyin-myauk	Yes	Yes	Yes	Yes
Bago Yoma	Bamar, Kayin	myauk-ta-nga	No	Yes	Yes	No
Ayeyarwady Delta	Bamar, Kayin	myauk-ta-nga	No	No	No	No
North Tanintharyi	Mon, Kayin, Bamar	myauk-mie-shay	Yes	No	No	Yes
South Tanintharyi	Dawei, Myeik	za-yet-taw-myauk	Yes	Yes	Yes	Yes

Human-macaque relationships

Conflict between humans and macaques was found to occur in Rakhine State, Bago Yoma and Tanintharyi Division (Table 2.6), and the most common conflict reported was by farmers having macaques raid their crops. In the Rakhine region (site No. 48, Table 2.3), long-tailed macaques were reported to have damaged nipa-palm fruits by drinking nipa-palm juice. In the Ayeyarwady Delta regions, conflict between humans and long-tailed macaques was not reported, perhaps because long-tailed macaques have been extensively exterminated, excepting two troops in the Meinmahla Kyun Wildlife Sanctuary.

Hunting long-tailed macaques for food and trade was observed in the Rakhine and southern Tanintharyi regions (Table 2.6), hunters use snare, bow with poisoned arrows or gun (fusil). Two wildlife meat restaurants in the Rakhine region and four in southern Tanintharyi region were found. In these restaurants, myauk-chay-kha (cooked monkey's meat and digestive tract) is a popular meal for local people. Monkeys (macaques and langurs) were sold at the price of 15,000 kyats (equivalent to $15 USD) by restaurants in Tanintharyi. In the southern part of Tanintharyi, hunting pressure on long-tailed macaques appears heavy for international trade, smuggling through Kawthaung to Ranong, although neither the quantity of macaques traded nor the sources of the trading were assessed.

In Tanintharyi, in 2004–2005, Chinese entrepreneurs ran monkey farms to collect *M. fascicularis aurea* and 3,000 monkeys went through this facility in 2005 for export to China or to developed countries via China (Shwe Pyi Thar Report, 2006). They constructed cages, which they falsely called "breeding

sites" at the base of Pa-htaw-taung hill (Site No.93). They purchased long-tailed macaques at 5,000 kyats to 20 ,00 kyats (about $5 to $20 USD) per individual from villagers around the Myeik Archipelago. According to interview, at least 1,000 long-tailed macaques were exported during 2005 and 2006. However, the Forest Ministry of Myanmar banned this trade in 2006 (Myanmar Wildlife Protection Law, 1994). The Chinese company abandoned its business and released macaques at Shin-ma-kan mangrove forest (Site No. 94) and Thandar Island in 2006. In the present study, a troop of semi-wild long-tailed macaques (40–50 individuals) was found in site No. 94.

Discussion

Current distribution of the long-tailed macaque in Myanmar

The distribution of the Myanmar subspecies of long-tailed macaques (*Macaca fascicularis aurea*) extends from the southernmost (Kawthaung, 9˚58'N, Tanintharyi) to the northwestern most parts of Myanmar (Kyay Taw, 20˚32'N, Rakhine) near Bangladesh along the coastal regions (Figure 2.6). The mangrove forests and riverine lowland forests that they inhabit are continuous along the coasts of the Bay of Bengal and the Andaman Sea. Although we conducted field surveys only in the mainland of Tanintharyi, the Myeik Archipelago, which includes more than 800 islands, also harbors for long-tailed macaques (Tun Yin, 1967; Fooden, 1995), and this will need to be studied further in order to fully assess the population of long-tailed macaques in Myanmar. The population of *M. f. aurea* also extends into southeastern Bangladesh (Khan and Ahsan, 1986) and southwestern Thailand (Malaivijitnond *et al*., 2005).

The Myanmar long-tailed macaques' distribution appears restricted to the coastal regions and was mainly found in the Rakhine, Ayeyarwady, and Tanintharyi biogeographic regions, with a small population in the Bago Yoma region near the coast. Long-tailed macaques were not found in other biogeographic regions, such as Dry zone, Shan Plateau and Chin Hill. This is likely because long-tailed macaques have not adapted to these regions of higher latitude with drier, seasonal climates and dry forests with mixed deciduous forest vegetation, or that they are outcompeted by other macaque species that live in those regions.

The total mainland population of long-tailed macaque in Myanmar is broadly estimated to be between 11,130 and 107,540. However, these estimates depend on just a preliminary survey and several assumptions and therefore are only a rough estimate of the mainland population. Future work will need to confirm and refine the population census. About 64.0–66.0 percent of the population

occurs in the southern Tanintharyi region, 32.0–33.0 percent in the Rakhine region, 0.28–0.81 percent in the Ayeyarwady Delta and Bago Yoma regions, and 0.65–3.20 percent in the northern Tanintharyi region. Thus, Rakhine and southern Tanintharyi are the major ranges of long-tailed macaques in Myanmar. In addition to these two ranges, a small number of troops were found scattered in the Ayeyarwady Delta, Bago Yoma, and northern Tanintharyi regions.

Habitat degradation and fragmentation

It is possible that the distribution of long-tailed macaques in Myanmar has been reduced by human activities. At present, the two major ranges of long-tailed macaques in Myanmar, the Tanintharyi and Rakhine regions, are separated by the Ayeyarwady Delta and northern Tanintharyi regions. These areas, which were previously mangrove and lowland forests around the estuaries of the Ayeyarwady, Sittaung and Thanlwin Rivers have been converted to human settlements and this has likely impacted long-tailed macaque populations. In the northern Tanintharyi and eastern Ayeyarwady Delta regions, long-tailed macaque habitats have been becoming degraded for the last 30 years. Wide areas of land were converted to agricultural fields (rice paddy fields) and human settlements, and forests were cut for timber, fuel and constructed of the country's infrastructure. Thus, in these areas, the troops we found were restricted to steep limestone mountains with temples. These populations appear to be isolated from each other by human settlements, and this may be causing there to be a higher ratio of males in some groups than is typical, such as in the Bayin Nyi Naung Mountain troop, (1:1.2 of male and female ratio) (Aye Mi San, 2007). Male dispersal may now be restricted and therefore, the gene flow between troops will be an important area for future research in Myanmar.

In the Ayeyarwady Delta, vast areas of mangrove forest have been destroyed in the last 30 years by deforestation for the production of fuel wood and the expansion of agriculture and aquaculture (Nay Win Oo, 2002). The annual deforestation rate has been as high as 5.6 percent, and the total forest cover declined from 24 percent of the total area in 1989 to 12 percent in 1998 (Oo, 1998). The total decrease has been from 3,860 km^2 in the early 1900s, to 1,770 km^2 in the 1990s (Oo, 1998). In our survey, two troops of wild long-tailed macaques were identified in the Meinmahla Kyun Wildlife Sanctuary (area of 136 km^2), which is protected by the Myanmar Wildlife Protection Law (1994), and therefore long-tailed macaques appear restricted to protected areas in this region of Myanmar.

There are misconceptions by the human inhabitants of macaque territory that long-tailed macaques are quite resilient to the impact of human activities.

Since long-tailed macaques are easily noticed in temples and small, private zoos, and since many forested areas are inhabited by some macaques, the wild local long-tailed macaque population is thought to be large by the local people. However, evidence we found suggests that the population has been reduced over the last few decades by habitat degradation and hunting. Therefore, we suggest that the risk of localized extinctions of populations may be rather high.

The two major ranges of long-tailed macaques, the Rakhine and southern Tanintharyi regions, have undergone significant environmental degradation. In the Rakhine region, the forest cover was 62 percent in 1989, and the annual deforestation rate was rather low at 2.6 percent (NCEA, 2006), because there were few big cities, road conditions were poor, and the coastal area of the Rakhine region was less densely populated. However, the lowland forest that long-tailed macaques inhabit had been deforested much more than other types of forest, because it is along forest edges, close to human settlements and is good for exploitation. Moreover, the coastal mangrove forests have been encroached upon for paddy cultivation and shrimp farming. In the southern Rakhine area, the habitat conditions have rapidly degraded. Bamboo forests have expanded, and erosion and gullies have been observed (Geissmann *et al*., 2008). A number of villages have been established by immigrants of Bamar, Rakhine, and Chin ethnicities, and lowland forests have been cultivated. A considerable portion of immigrants subsists on timbers and non-timber forest products such as bamboo, bamboo shoot, mushrooms, and wildlife, including long-tailed macaques, which are hunted by snares, poisonous arrows and guns.

In the southern Tanintharyi region, 9 percent of the tropical rainforest was lost between 1990 and 2000, and 6,350 km^2 were degraded from closed forest to degraded forest (NCEA, 2006). Both illegal and legal logging has had a heavy impact on nonhuman primate populations (Htin Hla *et al*., 2003). Habitat loss has also resulted from the conversion of forests to agricultural uses (i.e., wide areas of plantation development for commodity crops), aquacultural farms (i.e., prawn, shrimp, and soft-shell crabs) and construction of roads and other infrastructure. Increased employment opportunities are likely to encourage human immigration, which will put additional pressure on natural resources and habitat. Recently, a government project of an oil palm plantation was realized and rubber and betel nut plantations are increasing in scale. These plantations were established in lowland forests, destroying the habitats of long-tailed macaques and much other wildlife.

Hunting pressure is also high in the southern Tanintharyi region. In the majority of areas in Tanintharyi, primates appear to be hunted for village-scale consumption. They are also hunted for trading. We encountered wildlife meat

restaurants between Kawthaung (9˚58'N) and Tanintharyi town (12˚06'N) that purchase monkeys at a considerably high price (equivalent to $15 USD/individual). Living animals and wildlife products are also internationally smuggled through the border towns, Kawthaung (Myanmar) to Ranong (Thailand). Wildlife products fetch a higher price across the border in Thailand via Kawthaung, and thus there is strong incentive to trade. A living monkey was reported to bring 50,000 kyats ($50 USD) in the area between Bokpyin and Kawthaung, but it was reported to be priced three times higher in Thailand. Between Kawthaung and Bokpyin, 247 km apart, there are few villages along the graveled road ("Tanintharyi highway"). One or two public buses a day connect Kawthaung, Bokpyin, and Myeik. If transport were easier, the wildlife trade would be worse.

Human-macaque conflict

Crop raiding by macaques has not become a serious problem across Myanmar, although in some regions it presents a significant challenge for farmers. Conflict has been reported with long-tailed macaque populations living close to or inside human settlements in other Southeast Asian countries (Aggimarangsee, 1992; Wheatley, 1999; Cortes and Shaw, 2006; Zhao, 2005; Fuentes *et al*., 2008; Sha *et al*., 2009), and macaques are commonly found inhabiting temples or city parks where they are provisioned and protected from hunting and predators (Aggimarangsee and Brockelman, 2005; Malaivijitnond *et al*., 2005). Because of human land development, long-tailed macaques have been forced to live in increasing proximity to human settlements in Java (Iskandar *et al*., 2008). In Thailand, Indonesia, Gibraltar, China, and Singapore macaque populations can easily increase in size (see Box 6.1), and in Thailand have been reported to reach group sizes of over 200 animals (Malaivijitnond and Hamada, 2008). In contrast, long-tailed macaque troops inhabiting temples in Myanmar tend to be smaller than they are in Thailand, and maybe this is because long-tailed macaques inhabiting temples in Myanmar suffer more from human activity (see Gumert, Chapter 1).

Conclusions

M. fascicularis aurea is distributed from the southern to northwestern borders in Myanmar along the coastal regions. Habitat loss and degradation, hunting, and the wildlife trade may be having negative impacts on the long-tailed macaque, and future work will need to monitor the effect of human activities

on long-tailed macaques in this region. Human land-use is causing forest habitats to shrink, and there are, therefore, fewer habitats for long-tailed macaques and their populations appear to be becoming isolated from each other. We will need more extensive surveys of Myanmar long-tailed macaques in the future to fully assess their population and the effects of human activity on them. In particular, surveys will need to be conducted throughout the Myiek Archipelago to determine the extent of Myanmar's island populations of long-tailed macaques. This chapter presents the first census showing the population of long-tailed macaques on mainland Myanmar and thus we provide the first set of data on the conservation status of a data deficient sub-species (*M. fascicularis aurea*) (Ong and Richardson, 2008). We provide evidence that this subspecies may be facing several threats from habitat conversion, habitat fragmentation, hunting pressure, and international trade. The future effects of human activity on their population remain uncertain and needs to be closely monitored.

Box 2.1 Preliminary survey of the long-tailed Macaques (*Macaca fascicularis*) on Java, Indonesia: Distribution and human–primate conflict.

Randall C. Kyes, Entang Iskandar and Joko Pamungkas

Despite presumed abundance and widespread distribution, little recent data exists on the status of the long-tailed macaque (*Macaca fascicularis*) population in Indonesia. Currently, the long-tailed macaque is categorized as Least Concern (ver 3.1) in the IUCN Red List, a designation based in part on "…its wide distribution…" and "…presumed large population…" (Ong, P. and Richardson, M. 2008). In an effort to provide current information on the distribution of the long-tailed macaque and assess increasing media reports of growing human–primate conflict on Java, Indonesia, we conducted a preliminary survey of the island from 6–12 January 2009.

The survey originated in Bogor, West Java and involved a west-to-east loop of the island covering a total of 2,160 km. Time and funding constraints limited our ability for a more extensive survey of the island. We visited several target sites based on reported macaque sightings by media and forestry officials, and searched for additional sites based on leads from local people along the way. Travel and observation occurred from 7 am until 8 pm daily and involved the use of secondary roads to allow for frequent stops to query local people. We stopped on average, every 15–20 km (i.e., approximately 100 stops along our route), and surveyed more than 250 people to inquire

about monkey sightings/conflict in the area. When we received a report of monkeys in the area, we traveled to the location (often into remote village and forest areas) to investigate the report. At each site where monkeys were reported, we walked around the immediate area to permit observation and confirmation of monkey presence and possible human-primate conflict. In cases where we were not able to confirm the presence of monkeys via our personal observation (i.e., "confirmed sighting"), we coded the location as "reported sighting," defined as independent reports of monkeys by at least three individuals who were not associated with one another.

Over the seven-day period, we identified and visited a total of 22 sites along our route where wild, free-ranging long-tailed macaques were reported. The sites included nature reserves (*cagar alam*), agricultural areas, villages, local tourist areas (e.g., parks, picnic areas, recreation sites), religious sites, and cemeteries (Figure 2.3). We confirmed the presence of long-tailed macaques at 10 of the locations, and recorded "reported sightings" at the other twelve sites (Figure 2.4). Due to time constraints, we were not able to generate estimates of abundance at each location. The "reported" population sizes at the 22 sites ranged from "many monkeys" to an approximate number. Among ten sites where a reported estimate was given (Figure 2.4), the average "reported" population size was 102 monkeys (range: 7–300).

Reports of human-primate conflict were noted at 20 of the 22 sites and typically involved various forms of crop raiding (e.g., corn, papaya, sweet potatoes, coconuts) from private gardens and agricultural areas or stealing food (e.g., produce, snacks, drinks) from vendor stands and small restaurants. The typical response from the farmers and merchants included, hollering at/chasing the monkeys, throwing rocks, waving/banging a stick, and use of sling shots. At most of the local tourist areas/religious sites/cemeteries, we observed people feeding the monkeys. However, we never observed, nor did we hear reports of, monkeys displaying aggressive behavior (i.e., grabbing, biting, scratching, etc.) toward people.

Throughout the survey, a striking observation was the vast area where there were no reports of monkey sightings by the local people, suggesting a possible patchy distribution of long-tailed macaques in Java. We covered long stretches that included agricultural areas as well as areas with adequate forest habitat, where the local people were consistent in their responses of "no monkeys in the area." The fact that long-tailed macaque populations are often located in areas of human habitation, where sightings and conflict occur daily, may lead to assumptions of over-abundance in regions where actual population size may be much smaller then perceived. As such, we

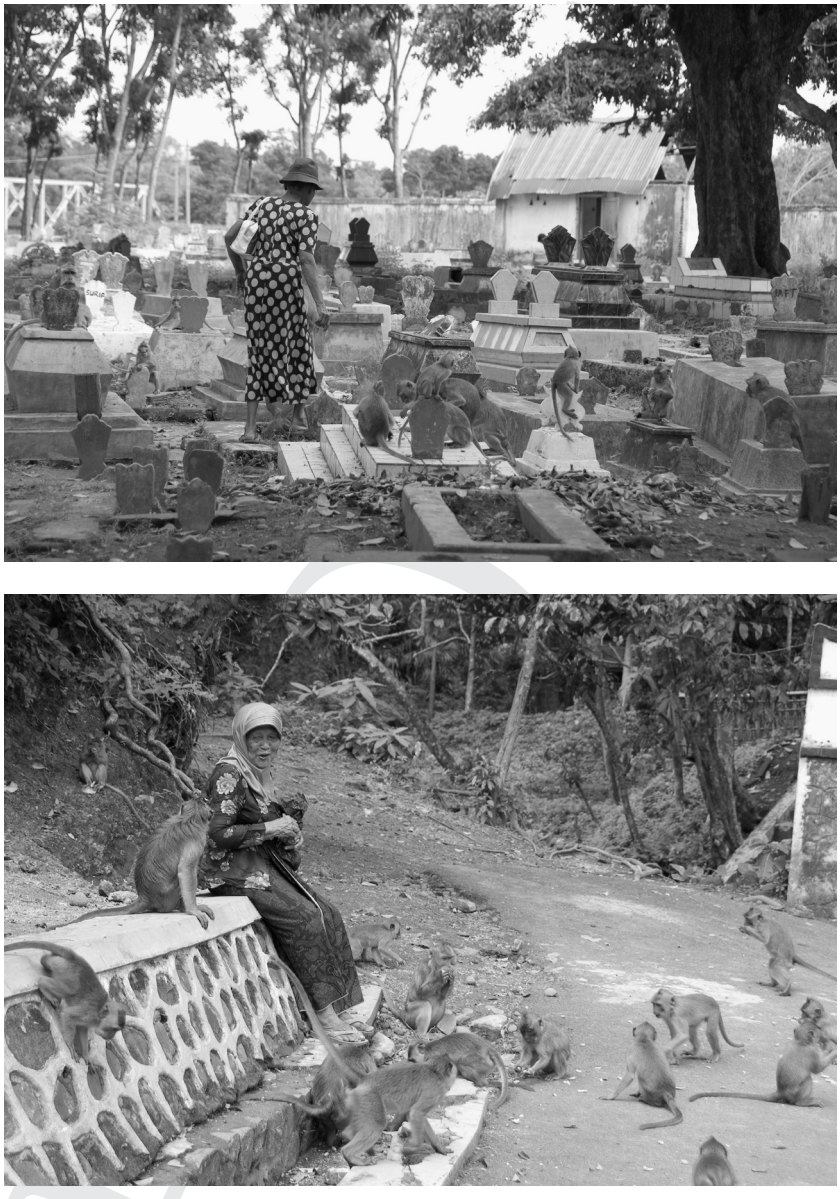

Figure 2.3. (a) A Javanese woman feeding a resident group of long-tailed macaques in the village of Cikakak, in Wangon, Central Java. Macaques were observed in the village and around its cemetery, and they frequently raided crops and homes. (b) Long-tailed macaques at a cemetery in Tulung Agung, East Java. The macaques were fed rice daily by cemetery caretakers and some conflict was reported.

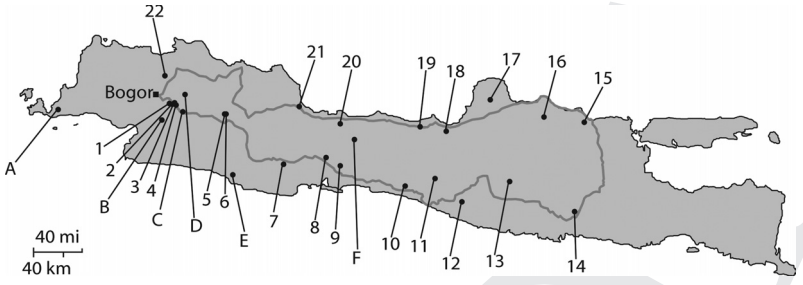

Figure 2.4. The distribution of long-tailed macaques on Java, Indonesia. The line indicates the survey route during the January 2009 survey. Dots with numbers represent the 22 sites where wild populations of macaques were reported/confirmed. Dots with letters represent additional locations where wild populations of long-tailed macaques have been confirmed by the authors within the past two years (since 2008). Key: 1, Taman Safari *(C)*; 2, Gunung Mas *(R)*; 3, Cagar Alam Telaga Warna *(C)*; 4, Puncak Pass *(R)*; 5, Maribaya *(R)* [30], 6, Curug Omas *(C)* [20]; 7, Cisarua, Garut *(R)* [50]; 8, Cimanggu *(R)*; 9, Cikakak *(C)* [150]; 10, Kaligondang *(R)*; 11, Maja Singi *(R)*; 12, Wanagama *(R)*; 13, Tawangmangu *(C)* [150]; 14, Tulung Agung *(C)* [110]; 15, Bektiharjo *(C)* [7]; 16, Sumber Semen *(R)*; 17, Colo *(R)* [100]; 18, Goa Kreo *(C)* [300]; 19, Kutosari *(R)*; 20, Jati Barang *(R)*; 21, Cirebon *(C)* [100]; 22, Cibubur *(C)*; A, Taman Nasional Ujung Kulon;B, Taman Nasional Gunung Halimun; C. Cagar Alam Gunung Simpang; D, Taman Nasional Gunung Gede Pangrango; E, Cagar Alam Leuweung Sancang; F, Gunung Slamet. In the key, *(R)* represents "reported sighting" and *(C)* represents "confirmed sighting." The numbers in brackets indicate the "reported" population size at site where a number was provided by the people surveryed. Map adapted from Google maps.

believe efforts should be made to conduct thorough population surveys of the long-tailed macaques throughout their range in Indonesia. Our preliminary survey, reported here, is just the first step in an ongoing effort to confirm the locations of long-tailed macaque presence thereby helping to "fill-in-the-blanks" regarding their distribution as we move ahead with plans to conduct an island-wide population survey of the long-tailed macaque on Java.

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APPENDIX IINTERVIEW SURVEY FORM (own format)

1. **Interview No. (**) **Date** ..……
2. **Interviewee Name**…….……..…..
3. **State / Division**……..……..
3. **Name of village** …… **Ethnicity**……..…
4. G.P.S. **(Latitude, Longitude, Altitude)**…..……..
5. **Species confirmation with the help of macaque's photograph**…….
   (1) Long-tailed (2) Rhesus (3) Pig-tailed (4) Stump-tailed (5) Assamese macaque
6. **If, we found pet long-tailed macaque**
   (a) *Where did they catch?* ……..
   (b) *How far forest from here?* ……
   (c) *When/ How did they catch?*……
   (d) *What's purpose for keeping?*……..
7. **Observation on Morphology**
   (a) *Pelage color and infant's color* ……..…
   (b) *Tail Length (TL)* ……..…….
   (c) *Crown-rump Length (CRL)* ……..……
8. **Conflicts between human and long-tailed**
   (a) Damage field? (b) Hunting ? (c) Eating ? (d) Trading?
9. **Hunting Method** *(a) Snare (b) Gun (c) Arrow (d) Poisonous leaf*
10. **Livelihood of villagers** *(a) Forest (b) Agriculture (c) Aquaculture*