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PRIMATES IN PROTECTED AREAS OF NORTHERN VIETNAM

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ABSTRACT

Biodiversity surveys carried out between July 1994 and March 1997 in seven protected areas in northern and central Vietnam produced evidence for the presence of 10 primate species. All were observed in the wild in at least one study area. In addition, data were collected in interviews with local farmers and hunters living within reserves, and forestry protection officials. Captive specimens and animal parts in trade were also observed. Nine of the taxa recorded are regarded as under threat within Vietnam, and six of these are globally threatened.

INTRODUCTION

Tropical forests, historically the dominant natural vegetation in Vietnam, have declined in extent drastically during the twentieth century as a result of war and the pressure of a large and expanding rural population. In 1943, approximately 44% of the country's land area was forest; by 1983, this had been reduced to 24% (MACKINNON, 1990). Good quality (primary or old-growth secondary) forest probably makes up less than 10% of the total land area (GOVERNMENT OF SRV, 1994). Forests support the greater part of Vietnam's biodiversity, including most of its extant primate species (NISBETT & CIOCHON, 1993); few of the primates thrive in substantially human-influenced habitats, except rhesus macaque *Macaca mulatta* (RICHARD *ET AL.*, 1989) and lorises *Nycticebus* spp.

The taxonomic position of some of Vietnam's primates (notably the gibbons *Hylobates* spp., and leaf monkeys *Trachypithecus* spp.) is unclear (FOODEN, 1996), and the number of species recognised in the country varies from 15 to around 22, depending on the taxonomic treatment adopted. This paper follows GROVES (1993), with 16 non-human primates in Vietnam.

This paper discusses recent sightings of primates in northern Vietnam (south to 16°N) made during general biodiversity surveys carried out from October 1994 to March 1997. These surveys were conducted in seven protected areas in Northern and Central Vietnam by the Society for Environmental Exploration (SEE) and its Vietnamese partner organisations (Xuan Mai Forestry College and the Institute of Ecology and Biological Resources, Hanoi). In each of the 10-week survey periods, vegetation, insect, bird and mammal biodiversity was assessed, and these data were used in conjunction with the results of socio-economic surveys to determine the status of, and threats to, biodiversity in the

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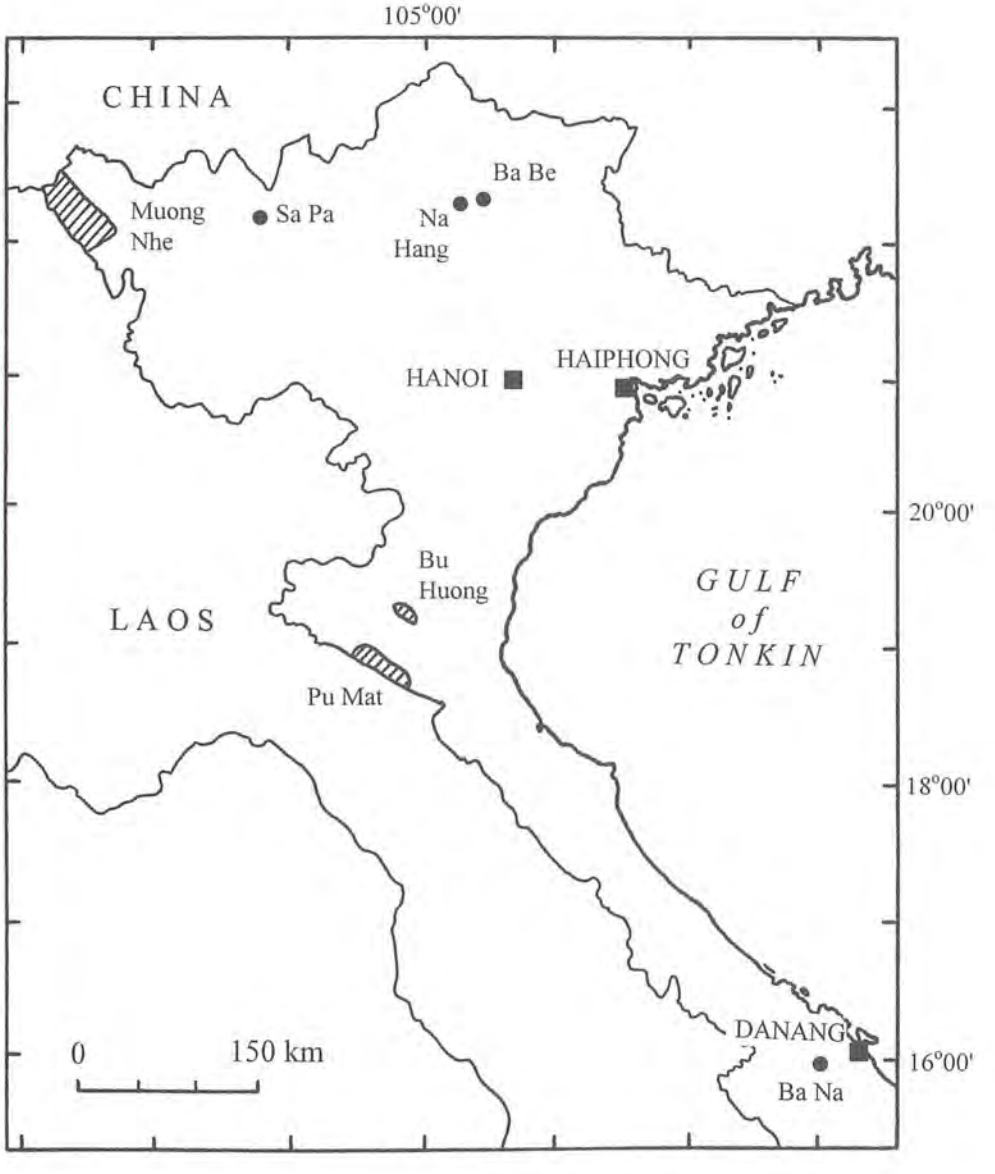

Figure 1. Map of northern Vietnam, showing study sites and major cities.

reserves studied.

METHODS

Surveys were conducted by SEE field staff and volunteer research assistants, assisted by Vietnamese mammalogists and ornithologists. Surveys were largely carried out by day, with observers using binoculars and recording the activity of birds and diurnal mammals. In two of the study sites (Ba Be and Na Hang), continual observation was conducted from hides constructed in primary forest, for periods of 7–10 days. Due to the steep topography of most of the sites visited, and the difficulty of observing most primate species (many species are shy, and may occur at low population densities; eg. EAMES & ROBSON, 1993), it was not possible to obtain quantitative estimates of primate populations in the sites studied. Remains of animals (the prey of carnivores or human hunters) were occasionally found in the forest, and these were identified where possible.

In addition, interviews were carried out with local people, and Forestry Protection (Kiem Lam) officials, to determine the level of threat to primates through hunting, and to identify species which had not been observed in the field survey (see BARNETT, 1995, for a discussion of interview techniques in primate surveys). In two of the sites surveyed (Pu Huong and Ba Be), extensive interviews were conducted among local villages. In the other sites, interviews were opportunistic in nature.

Live primates were often observed in captivity, either as pets or in trade, and these were noted, with details of their place of origin where known. Monkey bones and skins are commonly traded in Vietnam (RATAJSZCZAK, 1988), and trade was observed at some of the study sites. However, information provided on the origin of wildlife products is not always reliable. Within Vietnam, certain wildlife species and their derivatives may be traded legally, although hunting of all species is prohibited within protected areas. Some (perhaps many) of the animals traded undoubtedly originate in reserves and these can be confiscated by forest protection officials. Traders, even if they are aware of the site of origin of their animals, may choose to conceal it.

STUDY SITES

Biodiversity surveys were carried out in seven locations, all protected areas, two of which (Ba Be and Na Hang) were subject to two 10–week survey periods. The location of sites is shown in Figure 1. A summary description of each of the reserves is given in Table 1. All sites are nature reserves (including 'natural reserves' and 'species and habitat reserves') except for Ba Be, a national park. While nature reserves have in general been selected for their importance to biodiversity conservation (with 'species and habitat reserves' specifically targetted to protect habitats of endemic species), national parks include some areas which are of greater value for tourism or education (GOVERNMENT OF SRV, 1994).

Table 1. Some characteristics of the sites studied, with dates of survey

Site	Province	Date established	Area (ha)	Altitude (m)	Co-ordinates	Dates of survey (mo/yr)
Pu Mat	Nghe An	1996	93,400	400–1,841	18°50'N–19°10'N, 104°20'E–104°55'E	10–12/94
Sa Pa (Hoang Lien Son)	Lao Cai	1986	29,831	1,000–3,142	22°09'N–23°30'N, 103°00'E–103°59'E	1–3/95
Pu Huong	Nghe An	1986	49,000	400–1,580	19°15'N–19°30'N, 104°45'E–105°00'E	4–6/95
Ba Na	Da Nang	1986	5,217	300–1,440	15°57'N–16°03'N, 107°57'E–108°03'E	7–9/95
Na Hang	Tuyen Quang	1995	21,725	100–1,082	22°16'N–22°31'N, 105°22'E–105°29'E	1–3/96 7–9/96
Ba Be	Bac Can	1977 (NR) 1986 (NP)	7,696	145–1,098	22°24'N, 105°37'E	7–9/94 10–12/96
Muong Nhe	Lai Chau	1986	182,000	500–1,948	22°00'N–22°26'N, 102°10'E–102°45'E	1–3/97

STUDY SITES: VEGETATION

Forests were an important component of the vegetation of the study sites, although the dominant vegetation of one (Muong Nhe) was tallgrass savannah (COX *ET AL.*, 1992).

The forests fall into four main categories, based on mean annual and seasonal distribution of rainfall, altitude and underlying geology (WWF & IUCN, 1995).

(1) Tropical wet evergreen and semievergreen forests; in lowlands (under 1200 m a.s.l.) with mean annual rainfall of over 1500 mm. Restricted to the wetter parts of central and southern Vietnam; only important at Ba Na.

(2) Tropical moist semideciduous and deciduous forests (monsoon forests); in lowlands with mean annual rainfall less than 1500 mm. The predominant natural vegetation type at Pu Mat and Pu Huong, and important at Na Hang (COX, 1994) and Ba Be. The natural vegetation type of the lowlands of Muong Nhe, although forests in this area are now fragmented (COX *ET AL.*, 1992).

(3) Montane forests. Forests at higher altitudes are characterised by features including decreased height and leaf-size of trees, lack of emergent trees, and a change in the species structure and characteristics of the flora (WHITMORE, 1984). Lower Montane forests are found above around 700 m a.s.l., and Upper Montane forests above 1800 m a.s.l. These form important vegetation types at Hoang Lien Son nature reserve, Sa Pa (KEMP *ET AL.*, 1995).

(4) Limestone tropical forests. Found on karst areas, these forests have a restricted range of tree species (WHITMORE, 1984), and are rich in endemic herbs (WWF & IUCN, 1995). Both Na Hang and Ba Be are on limestone, and this forest type is important at both these sites.

RESULTS

Ten primate species were positively identified, and one tentatively identified, in the study period. Six of these are internationally threatened, with their status recorded in the *1996 IUCN Red List of Threatened Species* as Vulnerable (VU), Endangered (EN) or Critically Endangered (CR) One species comes close to inclusion in a threatened category (it is 'Near Threatened'; NT). For two species, there are insufficient data to judge their status at an international level; they are recorded 'Data Deficient' (IUCN, 1996). Species recorded and their conservation status are listed in Tables 2 and 3.

Table 2. Species recorded over the survey period

Species name[a]	English name[b]	Vietnamese name[c]	Status (IUCN)	Status (VN RDB)
Nycticebus coucang	Slow loris	Cu li lón	-	VU
Nycticebus pygmaeus	Lesser slow loris	Cu lỵnhoỉ	VU	VU
Macaca nemestrina	Pig-tailed macaque	Khi đuôi lợn	VU	VU
Macaca assamensis	Assamese macaque	Khi mốc	VU	VU
Macaca mulatta	Rhesus macaque	Khi vàng	NT	-
Macaca arctoides	Bear macaque	Khi mãt do	VU	VU
Trachypithecus francoisi francoisi	Francois' leaf monkey	Voọc đen má trăng	VU	VU
Trachypithecus phayrei	Phayre's leaf monkey	Voọc xám	DD	VU
Pygathrix avunculus	Tonkin snub-nosed monkey	Voọc mũi hếch	CR	EN
Hylobates leucogenys leucogenys	White-cheeked gibbon	Vuọn đen bac ma	DD	EN
Hylobates spp.	Gibbon	Vuọn	?	?

a from GROVES (1993)
b from CORBET AND HILL (1992)
c from DANG HUY HUYNH *ET AL.* (1994)

Table 3. Records of primate species in the reserves studied

Species name	Ba Be	Ba Na	Pu Huong	Muong Nhe	Na Hang	Pu Mat	Sa Pa
Nycticebus coucang	B I	-	I	-	-	I	-
Nycticebus pygmaeus	-	-	-	-	C	-	-
Macaca nemestrina	-	-	I	-	•	-	-
Macaca assamensis	-	-	•	C	-	•	-
Macaca mulatta	• C	•	• C	•	-	-	-
Macaca arctoides	•	-	•	-	•	•	-
Trachypithecus f. francoisi	• I	-	-	-	-	-	-
Trachypithecus phayrei	-	-	I	•	-	I	-
Pygathrix avunculus	I	-	-	-	• B	-	-
Hylobates l. leucogenys	-	-	•	-	-	•	-
Hylobates spp.	•	-	-	I	-	-	-

• Observation in wild
C Captive animal seen
B Bones/remains
I Interview data

In some locations, species were identified by interview data alone. Interviews with local people are not always reliable; they can be biased by the informant's desire to give positive responses (RATAJSZCZAK *ET AL.*, 1989) and other factors, and are of limited value in discriminating between similar species (for example, the lorises) without confirmatory evidence in the form of remains or sightings.

NOTES ON THE RECORDS

Nycticebus spp., lorises

At least two loris species, *Nycticebus coucang* and *N. pygmaeus,* are found in Vietnam, although it is possible that there are three or even more species in northern Indochina (L. Alterman, *in litt.* to J. W. Duckworth 1998). Of the two known species, the slow loris *N. coucang* is found from India to Borneo, while *N. pygmaeus* appears to have a more restricted distribution, centred on Vietnam although extending into Laos (OSGOOD, 1932; DUCKWORTH *ET AL.*, 1994), Cambodia and Southern China (CORBET & HILL, 1992). Neither species was observed in the wild (surveys were not conducted at night when these animals are active). A slow loris skull was found at Ba Be, a locality not reported in NISBETT & CIOCHON'S (1993) review of primate distribution in northern Vietnam. A captive lesser slow loris, confiscated by forestry protection officers, was seen at Na Hang, where this

species has been previously recorded (NISBETT & CIOCHON, 1993). This animal was probably destined for markets in Hanoi or Southern China; RATAJSZCZAK (1988) observed that *N. pygmaeus* was "nearly always available in the Hanoi market", and this is still the case.

Macaca spp., macaques

Table 3 shows that the macaques are the most commonly observed primates in the protected areas studied. *Macaca mulatta* and *M. arctoides* were positively identified at four sites, and *M. assamensis* at three. *Macaca mulatta,* the most widespread nonhuman primate (SOUTHWICK & SIDDIQI, 1988), is distributed throughout northern Vietnam; in the far South (below approximately 12°N) it is replaced by the closely related crab-eating (long-tailed) macaque *Macaca fascicularis* (FOODEN, 1996). *M. mulatta* shows broad ecological tolerance, surviving in disturbed sites where other primate species may be lost (WOLFHEIM, 1983). Groups are frequently found close to human habitation, and commonly raid crops. NISBETT & CIOCHON (1993) record that this species inhabits all forest types except karst forest in Vietnam; however, at Ba Be NP in 1996, one troop (of at least seven animals) was observed in forest on steep limestone cliffs (at around 200m above sea level). In addition, at least two further groups were observed in other areas of forest on limestone, with a total of four observations made. One group (of at least 5 animals) was observed in lowland disturbed forest (160 m a.s.l.), and one (of 10–11 individuals) in primary forest at 750 m a.s.l. In 1994, one captive individual was seen at Ba Be, although no groups were seen in the wild. At Muong Nhe, *M. mulatta* was observed on three occasions in secondary monsoon forest, with groups of around 25 individuals seen at altitudes of 330 m and 500 m a.s.l. At Pu Huong, *M. mulatta* were observed in the wild, and four live individuals were found for sale on the local market.

M. arctoides is also widely distributed outside Indochina, ranging from North Malaya to India and South China (CORBET & HILL, 1992). It is found throughout Vietnam except the far South, but is particularly abundant in the northern (Tonkin) region (NISBETT & CIOCHON, 1993). In Thailand, this species has been adversely affected by deforestation, hunting, and the demand for laboratory animals, and survives only as isolated relict populations in mountainous areas (TREESUCON, 1988). At Na Hang, one troop of about 7 individuals was observed in lowland primary forest (about 350 m a.s.l.). At Ba Be (1994), one group of five individuals was observed at the lakeside (around 150 m a.s.l.), but the species was not seen during the 1996 survey at Ba Be. At Pu Mat, two large groups of *M. arctoides* were observed, one (consisting of at least 15 individuals) in secondary forest at 500 m, the other (observed several times) in primary lower montane forest (>750 m). At Pu Huong, only one *M. arctoides* was observed, although local people suggested in interviews that the species was extremely common there.

M. assamensis is found in the Himalayan region from North-East India (where it is considered abundant; WOLFHEIM, 1983) to China. Populations extend to western Thailand in the South (CORBET & HILL, 1992). In Vietnam, it is restricted to northern provinces, the most southerly records being from Ha Tinh province (DANG HUY HUYNH *ET AL.*, 1994). The record for Pu Huong (Nghe An Province) is a new location for this species near the southern limit of its range in Vietnam. At Pu Huong, four individuals were observed at 750 m a.s.l. At Pu Mat, a single individual was observed. This is primarily

a forest species (WOLFHEIM, 1983), although farmers in Muong Nhe (Lai Chau Province) reported that it was a regular crop-raider (along with *M. mulatta*).

M. nemestrina has a more southerly range than the above three species, and is found from Myanmar to Malaya, Sumatra and Borneo (CORBET & HILL, 1992). In North Vietnam it is approaching the northernmost extent of its range. *M. nemestrina* was positively identified only once, at Na Hang, where it had been previously recorded by COX (1994), although the group identified probably represents a new population, as it was observed in the northern sector of that reserve, while Cox reports it only from the South. A group of 7 individuals was observed once in primary montane forest at around 900 m a.s.l.

Pygathrix avunculus, Tonkin snub-nosed monkey

The Tonkin snub-nosed monkey is endemic to North Vietnam, where it was formerly widespread in Tuyen Quang, Yen Bai, Bac Thai, and adjoining provinces (COX, 1994). In 1987, MACKINNON & MACKINNON estimated that the total population could not exceed 18,120 (of which a maximum of 880 could survive in Ba Be National Park) but, in view of more recent estimates, these figures were probably wildly inaccurate. The species was accorded the highest conservation priority in the IUCN's review of primate conservation in Asia (EUDEY, 1987). In 1994, Le Xuan Canh (*in* COX, 1994) estimated that the world population was less than 200 animals. The Na Hang reserve was gazetted in 1995 specifically to protect this primate. The Na Hang population may number between 130 (Le Xuan Canh *in* COX, 1994) and 80 individuals (Le Hong Binh, FPD Na Hang, *pers. comm.*). Ba Be is within the historical range of *P. avunculus* (RATAJSZCZAK *ET AL.,* 1990), and during the 1994 survey interview data suggested that a population of the species survives there, but the animal was not observed during either survey period, and it is possible that it is extinct at Ba Be. It is possible that other small, scattered populations of *P. avunculus* survive within the historical range of the species; at least two further sites were identified in Tuyen Quang province by RATAJSZCZAK *ET AL.* in 1992, but in each the population numbered less than 40 individuals and hunting pressure was high.

During the survey of the Na Hang reserve in early 1996, the species was observed twice, although one observation was fleeting and no estimate could be made of group size. On the other occasion, a group of four individuals was observed feeding in the canopy of primary forest (at between 500 and 600 m a.s.l) for an hour. Tonkin snub-nosed monkey remains (a severed tail) were also observed in a hunter's house.

Trachypithecus spp., leaf monkeys

Trachypithecus francoisi exists in up to 6 separate forms in Vietnam, Laos and Southern China (DAO VAN TIEN, 1989). *T. f. francoisi* is the most widespread (EUDEY, 1987), and this was the subspecies observed at Ba Be National Park, where it was also recorded by RATAJSZCZAK *ET AL.* (1990). The species was observed twice (probably the same group), in one area of primary forest at 750 m a.s.l.

Trachypithecus phayrei is a widespread species, extending from northwest India to Vietnam (CORBET & HILL, 1992). In Vietnam, it is found in the central and northwest provinces (RATAJSZCZAK *ET AL.,* 1990), including Lai Chau, where it was observed in the

current survey (Muong Nhe NR). At Muong Nhe, a single injured individual was observed beside a stream in secondary forest dominated by bamboo, at 300 m a.s.l. The cause of its injury was unknown, but may well have been gunshots; the widespread ownership of firearms and uncontrolled hunting in the Muong Nhe reserve are likely to have seriously reduced primate populations in this area (COX *ET AL.*, 1992). Although *T. phayrei* is not regarded as endangered, RATAJSZCZAK *ET AL.* (1990) consider that the form *Trachypithecus phayrei crepusculus* in Vietnam is vulnerable to extinction.

Hylobates leucogenys, white-cheeked gibbon

The gibbons of Indochina (*Hylobates* subgenus *Nomascus*) have been classified as one to four species by various authors, but the classification used here is that of GEISSMANN (1995), who recognised three species; *Hylobates concolor* (three subspecies in Vietnam), *Hylobates leucogenys* (two subspecies in Vietnam, *H. l. leucogenys* and *H. l. siki*), and *H. gabriellae*. *H. leucogenys* is the most widespread gibbon in Vietnam (GEISSMANN, 1995), occurring throughout central Vietnam, and *H. gabriellae* is found in southern Vietnam, where RATAJSZCZAK (1988) described gibbons as common in several national parks, including Nam Bai Cat Tien (Dong Nai Province).

EAMES & ROBSON (1993) estimated that the world population of *Nomascus* gibbons may be 10,000–14,000, of which 450–600 could survive in Vietnam. In reality, the status of the gibbons in Vietnam is poorly known, although, since they are vulnerable to hunting and habitat loss (BLEISCH & CHEN NAN, 1990), they are certainly endangered within Vietnam. Gibbons can sometimes survive in highly disturbed habitats, as at Ben En National Park, Thanh Hoa Province, where *H. leucogenys* was recorded in 1997 in forest that has been extensively logged (TORDOFF *ET AL.*, 1997), but habitat fragmentation and hunting have led to the extinction of gibbons at several sites.

H. concolor is restricted to the North of Vietnam, southern China and Laos (BLEISCH & CHEN NAN, 1990). Delacour and Lowe collected the species at Sa Pa in 1929 (OSGOOD, 1932), but severe hunting pressure in this area could have driven it to extinction there; if it remains, it is certainly extremely rare (KEMP *ET AL.*, 1995). *H. concolor* possibly occurred at both Na Hang, but is no longer present there (COX, 1994). A single black gibbon observed in lakeside forest (c. 200 m a.s.l.) at Ba Be in 1994 was probably of this species, although gibbons have previously been recorded as extinct at this site (RATAJSZCZAK *ET AL.*, 1990). During the 1996 survey of Ba Be, no gibbons were observed or heard.

H. leucogenys is found in central and northwest Vietnam (GEISSMANN, 1995). RATAJSZCZAK *ET AL.* (1990) recorded the species from Que Phong district, Nghe An Province; this district includes part of Pu Huong nature reserve, where the species was seen in the present survey. One individual was shot by hunters during the survey, and gibbons were heard calling in at least two locations in lower montane forest (750 m a.s.l.). At Pu Mat, one lone black gibbon was observed on one occasion.

H. leucogenys was recorded in Muong Nhe in 1991 (COX *ET AL.*, 1992), although it was reported to be restricted to the remotest parts of the reserve. It was not recorded in Muong Nhe during the present survey, which was limited to the South of the reserve; local people in the area studied knew of no populations, although immigrant Hmong hunters reported gibbons in some of the reserve's forests. Since most of the reserve is grassland,

and forest is fragmented, gibbons can only be absent from much of the protected area.

DISCUSSION

Two of the primates known from North Vietnam (North of 16°N) were not recorded in any of the sites visited: the crab-eating macaque *(Macaca fascicularis),* and douc langur *(Pygathrix nemaeus).* The crab-eating macaque tends to replace the rhesus macaque in the South of Vietnam, and there is a area of intergradation south of around 17°N. Only in southernmost Vietnam (south of about 12°N) does the true *M. fascicularis fascicularis* occur (FOODEN, 1993). According to NISBETT & CIOCHON (1993), a population of crab-eating macaques exists on the Son Tra Peninsula, near Da Nang; these are probably intergrades between the two species, or released animals (the species is fairly common in the wild animal trade, and individuals confiscated by forestry protection authorities have been released, and survive, at Pu Mat). The douc langur occurs as three forms: *P. nemaeus nemeus* (red-shanked douc langur), *P. nemeus nigripes* (black-shanked douc langur) and *P. nemaeus cinereus* (grey-shanked douc langur). *P. nemaeus nemeus* occurs in north-central Vietnam, including Nghe An, Ha Tinh, and Da Nang provinces (RATAJSZCZAK *ET AL.,* 1990). *P. nemeus cinereus* appears to occur further to the South, in the Central Highlands of Vietnam, although few specimens are known, most of which were live animals taken from the trade (NADLER, 1997). The distribution of *P. n. nigripes* is centred on the Central Highlands and the Da Lat plateau in southern Vietnam (NADLER, 1997). Two primate species have been recorded from southern Vietnam, but not the northern part of the country; the silvered leaf monkey *Presbytis cristata,* and pileated gibbon *Hylobates pileatus. Presbytis cristata* is widespread in southern Indochina, but the only record of *Hylobates pileatus,* from Phu Quoc Island in the extreme South of Vietnam is probably spurious (FOODEN, 1993).

SUITABILITY OF RESERVES FOR PRIMATES

All but one of the reserves visited supported primates, and most had several species. The reserves showing the greatest range of primate species were Ba Be, Pu Huong and Na Hang, although two of these reserves (Ba Be and Na Hang) received greater survey effort. The Ba Be National Park is relatively small and largely consists of degraded forests on limestone. Although there is a resident human population which can access the forest on paths leading from its central lake, the limestone topography (including features such as lakeside cliffs) may provide some less-disturbed refuges for primates. However, *Trachypithecus francoisi* was observed at Ba Be within a few kilometers of a Hmong minority village, in easily accessible forest. Na Hang reserve, established primarily to protect the Tonkin snub-nosed monkey (COX, 1994), contains areas of primary forest and supports primate populations of international importance. At present, it is made up of two blocks of forest (9,975 ha and 11,750 ha respectively), separated by cleared land which acts as a barrier to primate movement. It is not clear whether these areas have the potential to support viable populations of endangered primates in the long-term. It is probable that

two additional species (*Trachypithecus phayrei* and *Hylobates* sp.) once occurred at Na Hang, but are now extinct (COX, 1994), and *Trachypithecus francoisi francoisi,* which has been recorded once in the reserve, was not recorded by COX (1994) or in the present survey, and may also be extinct. Pu Huong is a larger area of forest, also containing areas of lowland primary forest and Lower Montane forests (KEMP & DILGER, 1996). Like Na Hang, however, it forms an isolated block of protected forest surrounded by human encroachment.

The Hoang Lien Son nature reserve, Sa Pa, was the only site visited where no primates were observed. In 1929, Delacour and Lowe collected *Hylobates concolor* and *Macaca arctoides* in the vicinity of Sa Pa (OSGOOD, 1932). Since this time, logging, forest clearance for agriculture, and hunting have placed mammal populations under intense pressure in this area (KEMP *ET AL.*, 1995). Some primates probably survive in the Sa Pa area; in 1994, a slow loris skin was seen in the Sa Pa market (KEMP *ET AL.*, 1995), and a live lesser slow loris was purchased by a tourist on Sa Pa market in 1998, although the exact place of capture is unknown (A. TORDOFF, *pers. comm.*). Three species of macaques (Assamese, rhesus and bear macaque) are reported to occur by local Hmong villagers, and one gibbon (*Hylobates concolor*) is also reported. A single black gibbon skin was observed in a hunter's house during recent (1997–98) interviews (TORDOFF *ET AL.*, in prep.). The larger primates are undoubtedly highly threatened in the Sa Pa area, and (if still present) are restricted to the most inaccessible forests on steep mountain slopes.

THREATS TO PRIMATES IN NORTHERN VIETNAM

The main threats to primate populations in Vietnam are habitat destruction (primarily, forest clearance for agriculture and small-scale commercial logging), and hunting. All of the protected areas studied had resident human populations and clearance was going on both within the reserves and at the margins. In some areas, plans exist for the resettlement of at least some of the local inhabitants outside the reserve (for example, Hmong villagers at Na Hang; Le Hong Binh, *pers. comm.*). Resettlement appears to have been successful in one protected area in Vietnam, Cuc Phuong National Park, where villagers were moved out of the core area, resulting in some reduction in human pressure on the forests and fauna (MACKINNON, 1990), but such programmes are expensive and require careful planning if they are to succeed.

Although Vietnamese law forbids the carrying of guns by civilians, hunting with guns and trapping of live animals is widespread. Gun ownership was common in all the protected areas studied, and there were abundant signs that hunting continues in most areas (including gunshots, observation of hunters with dead prey animals, and thriving wildlife trade within or around protected areas). Hunting may be for food (as is the case with gibbons in Pu Huong and Pu Mat), to protect crops (macaques, particularly in Muong Nhe), or for trade; the latter affects all groups of primates in all the areas studied. Live animals are commonly exported to China to supply the restaurant trade (LI WENJUN *ET AL.*, 1996), while species such as the lorises are kept as pets.

Monkey bones (of most species) are valued as traditional medicines in Vietnam and China (RATAJSZCZAK *ET AL.*, 1990). Large-scale preparation of monkey bones was observed

in Muong Nhe, an area with a thriving trade in wildlife products. Monkey bones were sold here for around 20,000 Vietnamese Dong per kilogramme (US$1.80 per kg). At a market in Dien Bien Phu town, Lai Chau Province, wildlife products for sale included the skins of two gibbons (*Hylobates* sp.).

Hunting is probably the most important threat to the existing populations of primates in protected areas of northern Vietnam. The continued survival of several endangered species now appears to depend upon effective control of hunting and the trade in wildlife products.

CONCLUSIONS

In India, SOUTHWICK & SIDDIQI (1988) have predicted a "pessimistic future for nonhuman primates that cannot accept commensal niches," a statement that certainly holds true for Vietnam. Primarily because of the country's large and rapidly expanding human population, these primates (*Trachypithecus, Pygathrix, Hylobates*) can only be safeguarded in protected areas (if at all, in the wild). This study has shown that populations of primate species survive at almost all of the protected areas visited. Habitat destruction and hunting pressures tend to be less intense within these areas than in unprotected forests, although both occur within all the nature reserves and national parks studied.

Vietnam holds internationally important populations of certain species (including the entire world population of Tonkin snub-nosed monkey) and it is vital that populations of such species are monitored to assess the effectiveness of current conservation measures.

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