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Distribution and Conservation Status of the Arunachal Macaque, *Macaca munzala*, in Western Arunachal Pradesh, Northeastern India

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Abstract: The recently described Arunachal macaque, *Macaca munzala*, has to date been reported only from western Arunachal Pradesh, Eastern Himalaya. Our surveys have recorded a total of 35 troops and 569 individuals, probably a conservative estimate, for the macaque population in the Tawang and West Kameng districts of the state. The species appears to be tolerant to anthropogenic habitat change, but is vulnerable to hunting and retaliatory killing in response to crop damage. Data from one part of the area surveyed, however, indicate that the species can attain remarkably high population densities in the absence of hunting. *Macaca munzala* will need to be protected in human-modified landscapes, and the issues of crop damage and retaliatory persecution must be addressed urgently.

Key Words: Arunachal macaque, *Macaca munzala*, Arunachal Pradesh, India, population density, human-wildlife conflict, hunting, conservation

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The northeastern part of India (*c*.255,000 km²), comprising seven states, supports the highest diversity (11 species) of primates in the country (Choudhury 2001; Srivastava and Mohnot 2001; Kumar *et al*. 2005; Sinha *et al*. 2005). Of these states, Arunachal Pradesh (26º28′–29º30′ N, 91º30′–97º30′ E; 83,743 km²) is arguably the country's richest region in terms of terrestrial biodiversity. A wide altitudinal range (100 to >6,000 m), an associated diversity of habitats (tropical rainforests, subtropical and temperate forests, alpine meadows), and a unique location at the junction of the Eastern Himalaya and Indo-Burma biogeographical zones contribute to the rich diversity of mammalian fauna in this state (Mishra *et al*. 2004). Large tracts of forest still remain in Arunachal Pradesh, in part due to its low human population density (13 per km²).

Recent surveys in the mid- to high elevations of western Arunachal Pradesh led to the discovery of a rich assemblage of mammals (Mishra *et al*. 2006), including the Arunachal macaque, *Macaca munzala*, first described by Sinha *et al*. (2005). Belonging to the *sinica* species-group of the genus *Macaca*, this relatively short-tailed, dark, and heavy-set primate was found to occur mainly at altitudes between 2,000 and 3,000 m in the westernmost districts of Tawang (2,172 km²; Fig. 1) and West Kameng (7,422 km²). Given the contiguity of habitat, the Arunachal macaque is also likely to occur in the bordering areas of central Arunachal Pradesh, as well as in parts of Tibet and Bhutan, though these areas remain to be surveyed for the species.

We sighted a total of 35 troops and at least 569 individuals of the Arunachal macaque during surveys conducted between April 2004 and August 2005 (Kumar *et al*. in prep). Of these, 32 troops (*c*.540 individuals) were sighted in Tawang and three (*c*.29 individuals) in West Kameng (Fig. 1). Information from local people indicated the possible occurrence of at least 25 more troops in the region. Most of the macaques were sighted within the 2,000–2,250 m altitudinal zone, though we recorded them up to 3,000 m in fir, *Abies densa* (Pinaceae), forests. Local people reported the seasonal occurrence of macaques up to 3,500 m, and we accordingly estimated the total potential macaque habitat (all areas below 3,500 m) within Tawang district to be *c*.800 km² (approximately one-third of the district's total area). In the Zemithang area of this district, which has a relatively high abundance of macaques and where we found most of the existing troops, we recorded 10 troops (234 individuals), and estimated a density of 0.94 troops and 22.01 individuals per km².

More than three-quarters of the Arunachal macaques sighted during our surveys were in human-modified landscapes and forests. More than half of the individuals sighted were in degraded broadleaved forests and degraded open scrub in the vicinity of human habitation. These degraded forests

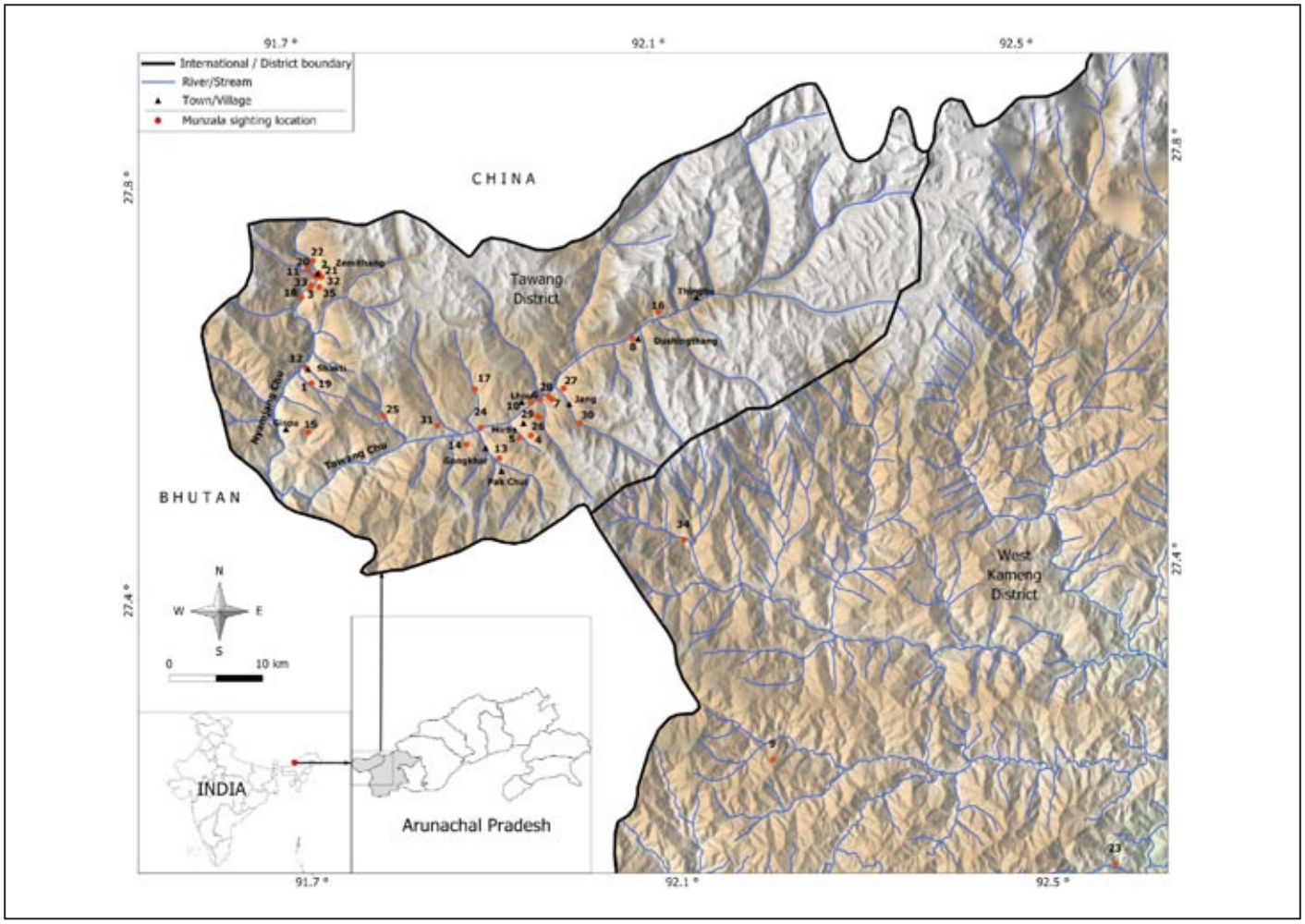

Figure 1. The sighting locations of the Arunachal macaque, *Macaca munzala*, in western Arunachal Pradesh, northeastern India. The cluster of sightings in northwest Tawang district are those from the high-density Zemithang area where the village councils prohibit hunting.

have moderate to high levels of anthropogenic disturbance in the form of felling, livestock grazing, lopping, and leaf litter collection.

We conducted detailed surveys in a number of villages to evaluate the extent of human-macaque conflict in Tawang and West Kameng districts (Kumar *et al*. in prep). In 35 of the 64 villages where we conducted perception surveys, people reported the Arunachal macaque to be the most common cause of crop loss. The extent of crop damage by macaques was found to be greatest at altitudes between 2,000–2,500 m owing to the greater abundance of villages and fields in this zone. We found the intensity of conflict with macaques to be high in five of the six villages where we carried out detailed, door-to-door surveys. The only exception was the high-altitude Thingbu village where conflict with macaques was reported to be very low, and where, due to their religious beliefs, the village council imposes a fine of INR 1000 (*c*.US$20) on anyone hunting macaques. Thingbu is largely pastoral, with very little cultivation. In the other five villages, a high level of conflict was reported by 87% to 100% of the 244 respondents, with the crops most affected being maize and millet (Kumar *et al*. in prep). Crop damage was reported to occur throughout the year but peaked between July to September. In a preliminary analysis, we estimated the financial losses to be between INR3,250 to INR4,600 (*c*.US$70 to 100) per family per year.

In two villages, about 92% of the people acknowledged the occurrence of retaliatory killing of the macaques, while only some respondents reported this in the other three villages where high levels of conflict were also reported. In the four villages where persecution was confirmed, people reported that an average of 35 macaques had been killed over the last five years. Snaring, shooting, and the use of bows and arrows being the most commonly reported means employed to kill them.

In Arunachal Pradesh, we believe that the Tawang district, given its particular ethnic composition and practices, should support the highest density of the Arunachal macaque and provide for its best conservation prospects. In most other areas of the state, hunting, an important tradition for most of Arunachal Pradesh's 26 tribes, seriously threatens most wildlife populations (Datta 2006). Primates are commonly hunted throughout the state, with most of the tribes killing them for their meat and for medicines (Borang and Thapliyal 1993; Singh 2001; Solanki and Chutia 2004). People of the *Monpa*

agro-pastoral tribe living in the Tawang district, however, generally do not hunt primates for meat (Solanki and Chutia 2004; Mishra *et al*. 2006). Due to their Buddhist beliefs, hunting, although prevalent, is not as widespread or culturally ingrained in the *Monpa* community as it is in most other tribes of Arunachal Pradesh. In fact, some of the villages in Tawang have voluntarily prohibited the hunting of wildlife in their village forests (Mishra *et al*. 2006). Hunting, however, has deep cultural roots in this state as in much of northeastern India, and its reduction or regulation may not be feasible merely through law-enforcement, but will require a close and culturally sensitive engagement with the local communities.

An important legislative means to facilitate wildlife conservation is the scheduling of species under the Indian Wildlife Protection Act, 1972 (Anonymous 2002). Schedules I and II of this act provide the highest level of legal protection to a species, the basis of the listings being population status in the wild and threats. Currently, our knowledge of the Arunachal macaque's distribution and population sizes are not adequate to permit an informed choice of an appropriate schedule of the act. Furthermore, given that our knowledge of the morphology, genetics, and taxonomic variation among the macaques of northeastern India is still incipient (Kumar *et al*. 2005; Sinha *et al*. 2005; Chakraborty *et al*. in prep), it is perhaps more essential to support the conservation of all species in this macaque evolutionary hotspot, rather than designate individual species into schedules on the basis of incomplete biological and ecological information. In addition, the effectiveness of legislative instruments to effect conservation is completely dependent on the ability to implement them across differing sociocultural contexts. At the present time, it remains a serious challenge to ensure effective on-the-ground conservation of many of the Schedule I species in this part of the country. In culturally complex regions such as northeastern India, it is perhaps more important to design conservation strategies that, in the end, can be implemented, rather than merely slotting species into legal categories.

Our preliminary work thus brings to light both the challenges as well as the opportunities for the conservation of the Arunachal macaque. It appears that conservation efforts for the Arunachal macaque will need to focus on a landscape that has already seen considerable anthropogenic impacts. Among the most important current research needs is a better understanding of the patterns and intensity of crop-raiding, with a view to designing appropriate conflict-mitigation strategies. Although it is unlikely that conflicts can be eliminated, interventions are needed to minimize crop damage as well as offset losses. The potential of a variety of interventions needs to be assessed; these could include the adoption of alternate buffer crops, use of deterrents, better crop protection measures, habitat management in the vicinity of villages, and the introduction of crop compensation or insurance programs.

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