

The Vocal Communication of Tibetan Macaques in Mt. Huangshan, China: their Vocal Repertoire, Call Functions, and Congeneric Comparisons in the Genus *Macaca*

中国の黄山におけるチベットモンキーの音声コミュニケーション：
音声レパートリーおよび音声機能，マカク属内種間比較

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Vocal repertoires are the essential foundation for studies on vocal communication. From this foundation researchers establish and promote the conformity of terminology, allow researchers to investigate certain calls in more detail, and aid comparative studies by serving as the infrastructure. This thesis is the first systematic study on the vocalizations of Tibetan macaques (*Macaca thibetana*). I first used quantitative analyses to assess the vocal repertoire by extracting 30 acoustic parameters from 534 call recordings. Post hoc validation of the a priori repertoire classified eleven call types: *coo*, *squawk*, *squeal*, *noisy scream*, *growl*, *bark*, *compound squeak*, *leap coo*, *weeping*, *modulated tonal scream*, and *pant*. Tibetan macaque females make acoustically distinct copulation calls that are uncharacteristic of the genus. These calls are shrill undulating calls of a longer duration than the “inhale-exhale” grunts typically observed in macaques. The copulation style of Tibetan macaques is specialized in comparison to the rest of the genus, and so I investigated this unique auditory characteristic further.

Many hypotheses have been put forward to explain copulation call function, but none appear able to explain function in a single species, let alone a group. Recent studies have explored the audience effect, how bystanders affect call production. I investigated copulation calling behavior and what factors potentially influence call production (e.g., ejaculation, rank, promiscuity, harassment, parity, and audience). Call rate was low overall, unrelated to ejaculation, promiscuity, and parity. Females showed a tendency to call with lower-ranking males. Calling elicited harassment, and there was a female audience effect on harassment of copulatory dyads. My results suggest that there may

be a complex cost-benefit tradeoff where females call to potentially attract mates at the risk of intrasexual competition in the form of female harassment.

I then made congeneric comparisons of the vocal repertoire to identify the selective factors that potentially influence which calls are homologous and derived in the genus. Overall, the repertoires of macaques share a similar set of calls. The main differences were found in the calls emitted in the copulation context.

In conclusion, the vocal repertoire of Tibetan macaques is similar in acoustic structure to the rest of the genus. The key distinct feature lies in the calls associated with copulations. This may be a result of the fact that females show unique behaviors that are rare in primates, females harass copulatory dyads and show no proceptive behaviors indicative of estrus. Indeed, most of the derived vocalizations in the genus were the copulation calls of species with distinct copulation styles. It is likely that an interplay of phylogenetic, ecological, and social factors have shaped the flexibility of vocalizations across the genus.