Impacts of Environment on Degree of Despotism in Semi-Free Ranging Japanese Macaques (*Macaca fuscata*)

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1. Background

Primate societies have evolved social hierarchies where higher-ranking individuals can gain differential access to resources such as food and mating opportunities (Thierry, 2004). In order to maintain high rank, individuals must defend their position against lower-ranking primates. Different primate groups have varying degrees of hierarchical flexibility on a spectrum from tolerant to despotic.

Tolerant-leaning hierarchies are typically seen in environments where group cohesion and cooperation are important for individual success (Adams et al., 2015). They are characterized by moderately high rates of low-intensity aggression, low rates of severe wounding, and a less linear dominance hierarchy. Tolerant societies may also have higher rates of positive interactions such as huddling and grooming (Fig. 1). In contrast, despotic-leaning hierarchies are found where individuals gain benefits by competing against each other for access to resources (Adams et al., 2015). They are distinguished by high rates of wounding between individuals and a highly linear dominance hierarchy with infrequent interactions between individuals of different ranks. Japanese macaque (*Macaca fuscata*) hierarchies are primarily characterized as despotic-leaning. However, there are some provisioned groups that demonstrate more tolerant-leaning behavior (Zhang and Watanabe, 2013). Socioecological or environmental factors such as provisioning, sex ratio, and genetic isolation may influence the degree of tolerance groups demonstrate.

2. Objectives of the Study

The goal of this study is to compare our study population against the provisioned groups from Zhang and Watanabe (2013) to assess their degree of social tolerance.

3. Subjects

Subjects of this study were 17 adult male Japanese Macaques (*Macaca fuscata)* in a semi-free ranging group at the Oregon National Primate Research Center (ONPRC). These males varied in age from 7 to 25 years. Individuals were independently identifiable by dye markings on their backs

Figure 1: Grooming in adult Japanese macaques.

4. Data Collection and Analysis

We collected a total of 512.5 hours of behavioral data using 15-minute focal follows with one-minute instantaneous scans. Data collection spanned two distinct study periods: 1) June – September 2018 and 2) July – December 2019. In order to begin investigating the social system at the ONPRC, we used a paper by Zhang and Watanabe (2013) as an example of comparable macaque populations. Following their methodology, we calculated the mean rate of aggression per hour per individual, along with the standard deviation. This allowed us to conduct a preliminary comparison of our study population against the three populations studied by Zhang.

Figure 2: Aggression in Japanese macaques.

Table 1. Aggression per hour across the Shodoshima Island, Takasakiyama Park, Shiga Heights, and ONPRC groups.

Group	N	Mean	SD
Shodoshima Island	16	0.3	0.2
Takasakiyama Park	16	0.4	0.1
Shiga Heights	16	0.2	0.1
ONPRC	17	0.3	0.3

5. Results

- Out of 32,800 data points, 115 were instances aggression
- The ONPRC group demonstrated a mean rate 0.3 ±0.2 aggressive interactions per individual per hour (Table 1)
- These results are most directly comparable with the Shodoshima Island population (N=16, 0.3 ±0.2) (Table 1)

Figure 3: Adult Japanese macaques huddling.

6. Discussion & Implications

Our preliminary results show a promising comparison between the tolerant-leaning Shodoshima Island group and the ONPRC group (Table 1). The Shodoshima island group demonstrates a moderately high level of adult aggression frequency, mirroring the mean frequency of aggression in the ONPRC group. Zhang and Watanabe included adult females in their study, whereas our data only includes adult males which necessitates adjustments to analytical comparisons. To further compare these populations, we plan to measure the intensity and frequency of wounding, percentage of active time grooming, and frequency of positive interactions (such as huddling and play).

Some theorize that intraspecies differences in dominance style can be attributed to the varying degrees of nepotism (Thierry, 2004). More despotic-leaning groups promote high nepotism and kin-support whereas more tolerant-leaning groups promote higher non-kin support. Both the ONPRC and Shodoshima Island groups have been genetically isolated for multiple generations resulting in higher degrees of interrelatedness which could explain their tolerant-leaning behaviors. The Takasakiyama Park and Shiga Heights groups were never isolated and therefore have lower degrees of interrelatedness. High levels of nepotism likely contribute to their despotic-leaning behaviors. The high variation in dominance styles seen in these Japanese macaque groups indicates that dominance styles may be more environmental than species-specific which supports previous evolutionary research into the conditions which favor the evolution of social bonds.

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References

Adams, M. J., Ostner, J., Schülke, O., Marco, A. De, Ethoikos, F., Faunistico, P., … Weiss, A. (2015). Personality Structure and Social Style in Macaques. *Journal of Personality and Social Psychology*, *109*(2), 338–353.

Thierry B (2004) Social epigenesis. In: Thierry B. Singh M, Kaumanns W (eds) *Macaque societies: a model for the study of social organization*. Cambridge University Press, Cambridge, pp 267- 290

Zhang, P., & Watanabe, K. (2013). Intraspecies variation in dominance style of Macaca Fuscata. *Primates,* 55: 69-79.