Do the costs and benefits of group living in a proportional manner with group size

Identifying the ecological and social factors that underlie vertebrate group size and social organization has been a question that has intrigued biologists for decades. This interest stems from the enormous variability in group size found both within and between species (Fig 1). For example, in primates group size varies from two to over 300 individuals. In addition group size affects many aspects of the lives of social species, such individual stress levels, disease susceptibility, reproductive and developmental rates, and animal behavior. For almost two decades researchers have thought that this large variation in group size is driven by competition over food resources with individual energy intake increasing in a lineal fashion with group size. Namely, in comparison to small groups, the increased energy requirements of larger groups necessitates travelling farther to visit more food patches that are depleted more rapidly until the point where the costs of living in a group outweigh the benefits. The increased energetic costs of living in a large group may be a sensible investment, if larger groups experience decreased predation or increased success in competition among groups.

Gelada baboons (Theropithecus gelada) one-male units engaged in late afternoon grooming along the edge of a sleeping cliff at Guassa, Ethiopia. Geladas illustrate the complexity of evaluating group size since they have a multi-level social organization (i.e., social units within a larger social group). Photo by Peter Fashing, Fullerton University with permission.

Recent research has run counter to this traditional thinking and Markham and colleagues used a remarkable dataset involving the study of five social groups of baboon over 11 years to examine the predicted linear relationship between group size and measures of feeding competition. They found a U-shaped relationship between group size and average daily travel distance, home range size, and stress levels. This suggests that large and small groups were energetically more stressed, while intermediate sized groups were closer to the optimal strategy.

These results have important conservation implications. Many forms of human disturbance to baboon habitats will decrease resource availability, which should theoretically favor smaller groups. This is because larger groups deplete patches faster and if habitat disturbance decreases patch availability, it increases the distance between patches and groups must to travel further. At some threshold of habitat disturbance, large groups will no longer be viable. This is an important consideration for animals like baboons because of the extent of deforestation; between 2000 and 2012, 2.3 million km^2 of forest was lost globally and in the tropics forest loss increased by 2101 km^2 per year. In savanna or woodland habitat baboons will be similarly impacted because of the cutting of trees for charcoal or conversion to agricultural land. Agriculture has replaced 70% of the world's grassland and 50% of the savannahs and today cropland and permanent pasture land covered 12% and 26% of the ice-free land, respectively. One estimate suggests that 1 billion ha of new agricultural land, primarily in developing countries, will need to be converted to agriculture by 2050 to meet the demands of the growing human population - an area larger than Canada.

The cascading impacts of anthropogenic habitat changes are often hard to identify, but are important to understand in the construction of informed management and conservation plans. These studies of the costs and benefits of group size not only adds an exciting twist to theory, they suggest that changing group size may be one of the cascading impacts of human disturbance.

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Publication

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