

Short communication

PRELIMINARY OBSERVATION OF A NEWLY DISCOVERED  
BABOON HYBRID ZONE IN NORTH SHOA, ETHIOPIA

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**ABSTRACT:** Hybridization between two related but distinct species and populations has attracted the attention of biologists for several decades, but the significance of hybridization in evolution has been and is still being debated. In the last few decades the elaboration of genetic and mathematical models and the development of molecular techniques have enabled refined studies of hybridization and the dynamics of hybrid zones to be undertaken. As a result, there is resurgence in the study of hybridization and a better understanding of the role of natural hybridization in the processes of evolution. In Ethiopia, hybridization between anubis (*Papio hamadryas anubis*) and hamadryas (*P. h. hamadryas*) baboons has been known to occur in Arsi and in the Awash National Park; the latter has been intensively studied since the early 1960s. Although these detailed long-term, multidisciplinary studies that have contributed to our understanding of hybrid zones, research to date has been restricted to areas in and around the Awash National Park. Here, I describe the first recorded observation of interbreeding between anubis and hamadryas baboons in northern Shoa. This new hybrid zone provides an opportunity for future comparative study of the dynamics of anubis-hamadryas hybridization.

**Key words/phrases:** Baboons, hybrid zone, interbreeding, Northern Shoa

INTRODUCTION

Hybrid zones are areas where individuals derived from genetically distinct populations interbreed and produce "offspring of mixed ancestry" (Harrison, 1993:4). Although scientific interest in hybridization dates back at least one century, intensive interest and research on the process of natural hybridization began during the development of the "Modern Synthesis" between 1930 and 1950 (Arnold, 1997; Howard *et al.*, 2003). Earlier zoological studies of hybridization emphasized the incomplete development of reproductive isolation between closely related taxa (Dobzhansky, 1940) assuming intrinsic inferiority of hybrids and considering hybridization maladaptive (*e.g.*, Mayr, 1942). However, recent developments in molecular techniques and theoretical models have resulted in resurgence of empirical and theoretical investigation of hybridization (Barton and Hewitt, 1985; Harrison, 1990; 1993; Arnold, 1997). Hybrid zones are now considered as "natural laboratories" or "windows on evolution" where the actual processes of

evolution can be investigated (Barton and Hewitt, 1989; Harrison, 1990), including the hypothesis that natural hybridization represents a significant evolutionary event - one that sometimes produces novel genotypes, new lineages, or leads to evolutionary reticulation (Arnold, 1997).

To date, the most investigated natural hybridization in primates is the one that occurs between anubis (*Papio hamadryas anubis*) and hamadryas (*P. h. hamadryas*) baboons in the Awash National Park (ANP) in Ethiopia (Nagel, 1973; Brett *et al.*, 1977; Phillips-Conroy and Jolly, 1986; Sugawara, 1988; Nystrom, 1992; Shimelis Beyene, 1993; 1998; Bergman, 2000; Beehner, 2003). The Awash baboon hybrid zone (AHZ) has been the subject of ecological, behavioral, demographical and genetic studies since the early 1960's. As a result, a good understanding of the ecological, behavioral, social, genetic and demographic factors that affect the dynamic of this hybrid zone is emerging (Phillips-Conroy *et al.*, 1991; Shimelis Beyene 1993; Newman, 1997; Woolley-Barker, 1999; Bergman and Beehener, 2003). Despite the

important findings from the AHZ that have significance for evolutionary primatology in general, these studies have focused on baboons groups within and in close proximity to the ANP. Even within this geographically limited area however, the nature of the hybrid zone, including the causes of hybridization are known to vary in different parts of the zone itself (Nagel, 1973; Phillips-Conroy and Jolly, 1991; Shimelis Beyene, 1993). This variation may suggest that the study of baboon hybridization needs to be expanded beyond the areas that have so far been intensively investigated in order to get a more comprehensive understanding of the dynamics of interbreeding between anubis and hamadryas baboons. My main objective here is to report the sighting of another anubis-hamadryas hybrid zone in central Ethiopia, near Debrebirhan, that has not been previously described. Future follow-up study of this hybrid zone can potentially provide comparative information critical for a more comprehensive understanding of anubis-hamadryas hybridization.

## METHODS

### Study area

Two surveys were made in several areas along the road from Addis Ababa to Dessie in 1995 and 1999. Here, I describe one of these sites, near Gosh Bado, with baboon groups that clearly had hybrids. Anubis, hamadryas, their hybrids and geladas were observed in several villages within the valleys of both Chacha and Beresa Rivers about 20 to 35 km southwest of Debrebirhan (Fig. 1). The area is characterized by a highland plateau with deep valleys and rugged topography dissected by several small and seasonal streams that form the complex valleys of both the Beresa and Chacha river basins. Most areas, even on the steep slopes within the valleys, are cultivated. Natural vegetation is found only in inaccessible areas and around churches and monasteries. Nevertheless, owing to varied topographic features, there is a diverse vegetation community that supports several groups of baboons although baboons<sup>1</sup> and geladas also frequently raid cultivated fields.

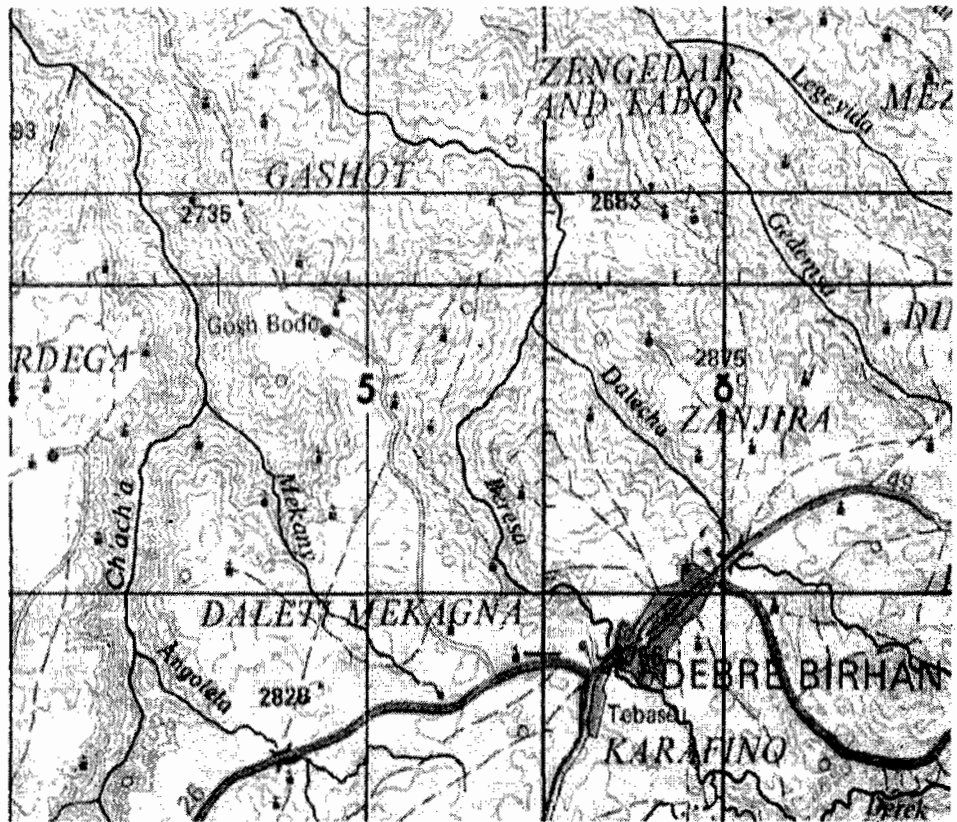


Fig. 1. Map of the study area. Most of the survey trips were initiated from the town of Gosh Bado.

<sup>1</sup>Other wildlife seen in these sites include klipspringers, duikers, and a leopard.

### Baboon survey

In 1995 and 1999 surveys were made on baboon populations near Debrebirhan. Before any survey was started, local communities were asked about the presence of baboons around their neighborhoods. Because geladas as well as anubis and hamadryas baboons are all identified as Zingero in most areas, informants were shown several baboon and gelada pictures to identify the kinds of baboons they knew and where they might be found. Almost all people interviewed knew places with Zingero. But, few informants were able to distinguish among the different baboon forms and the gelada. Informants from several villages reported that they saw geladas at different altitudes, often in sympatry with anubis and hamadryas baboons, or both. However, it was only near the small town, Gosh Bado, that hybrids were observed on multiple occasions.

Once the area was selected for surveying, people living near the specific site were asked about potential sleeping sites and areas where baboons might range during the day. Very early on the following day, travel would be made to the sleeping sites. If baboons were sighted, observations would be made about their morphology, estimated age and sex categories using binoculars. Attempts were also made to estimate group size using an individual count. Baboons were usually counted as they passed through an open area during foraging or when chased by farmers. Although this technique avoids the possibility of double counting, it underestimates group size, especially since conditions for observation were extremely poor in this heavily dissected, rugged terrain. Because estimates of group size are inaccurate, the 1995 and 1999 data for Fatcho and Ayalfush are combined because baboons were observed on both years in these sites.

Morphological features such as face and paracallosal colors, cheek tufts and mane color and

shape (Nagel, 1973) were used to determine the phenotype of baboons. General categories such as anubis, anubis-like hybrid, intermediate hybrid, hamadryas-like hybrid and hamadryas were used to describe the phenotype of individuals. Observations were dictated onto a tape recorder and later transcribed into field notes.

## RESULTS AND DISCUSSION

Baboon groups were observed in several villages within the Beresa and Chacha basins. However, due to the rugged nature of the area and the evasive behavior of baboons toward humans, it was not possible to make detailed observations on baboon groups. Therefore, the data presented here underestimate both the number of groups and size of each group in the study sites. However, what was clear, and critical for this report, was that all baboon groups described here have some hybrid individuals within them. The first group of baboons surveyed was near the village Fatcho, about 20 to 25 km from Debrebirhan. Here a small group was observed both in 1995 and 1999. The Fatcho group, with some hybrid individuals, was a primarily anubis group, perhaps suggesting that if there is a clear hybrid cline in the area, this may be close to the anubis end of the hybrid zone. One adult hybrid female and a hybrid male were seen in 1995 and in 1999 respectively (Table 1). The small group numbers and the fact that the hybrid female seen in 1995 was not observed in 1999, and the hybrid male of 1999 was not observed in 1995, may suggest this group may be a subgroup, *i.e.*, the larger group may regularly split into foraging subgroups similar to other groups observed in Awash (Shimelis Beyene, 1998).

**Table 1. Composition of Baboon Groups.**

Site	Anubis		Hamadryas		Hybrids		Total
	Male	Female	Male	Female	Male	Female	
Fatcho	2	4	0	0	1	1	8
Geter	3	1	2	0	4	6	16
Atse-Wahsa	2	2	0	0	6	4	14
Goshu-Washa	1	1	0	0	4	11	17
Ayalfush	1	0	9	16	2	6	34

Note: Only actual count of adult and subadult baboons are included here, the shyness of the baboons, the thick vegetation and rugged nature of the terrain hindered complete census.

The second group, the Geter Group was found within 10 km of the Fatcho group. The Geter group had 10 (four males and six females) adult hybrids when it was observed in 1995. One characteristic of this group is that it includes hamadryas, anubis, and hybrid males, as if the group was formed by fusion of anubis and hamadryas groups. It is difficult to reach a firm conclusion with this incomplete census, but this is a significant observation to follow up in the future and in which the "Group fusion" hypothesis (Shimelis Beyene, 1993) can be tested. Two more groups, Atse-Washa and Goshu-Washa (Table 1), were located far apart to form Fatcho and Geter groups, and were also distant from each other. The last group, the Ayalfush group (Table 1) was observed in a different valley system altogether, the Beresa valley (Fig. 1). Nevertheless, from what we know about male migration (Nagel, 1973; Packer, 1979; Shimelis Beyene, 1998; Phillips-Conroy and Jolly, 2004) it is possible for males from any one of these groups to immigrate into the other, especially the first four groups. One common feature to all these groups was that each had at least one adult hybrid individual. In contrast to all the other groups observed in these sites however, the Ayalfush group is predominantly hamadryas, with no "pure" anubis adult individuals, although one anubis-like male was observed in 1999. Most of the hamadryas males in this group have relatively darker facial coloration which may indicate some degree of genetic admixture.

It is obvious that both the number of groups and the number of baboons within each group in Chacha and Beresa basins are much higher than reported here. Difficult topographic conditions prevented a complete census of the five groups observed, and the existence of other groups was inferred from the observation of fresh fecal material and consultation with local communities. Further study is necessary to see whether these sites represent a mosaic hybrid zone and what ecological and behavioral factors may influence hybridization here and how this can be compared to the hybrid zone in Awash. More detailed study of these and other potential sites may provide new insight on causes and mechanisms of hybridization, and particularly on the extent of the hybridization and the width of these hybrid zones.

## CONCLUSION

Hybridization between anubis and hamadryas baboons is clearly going on in the Chacha and Beresa valleys. But important considerations for future research include whether these sites represent a single cline from Fatcho to Ayalfush, or just part of a more complex mosaic hybrid zone. We also need to examine what mechanisms are involved in hybridization. It is now becoming clear that even the most intensively investigated hybrid zone, the Awash hybrid zone, may not represent a single cline (Shimelis Beyene, in preparation). Addressing these questions has significant implications for not only improving our understanding of the hybridization between anubis and hamadryas baboons, but also for the study of hybrid zone dynamics in general. The new hybrid zone provides opportunities for comparative study of these questions.

Due to the brief nature of the surveys (14 days in 1995 and nine days in 1999), it was not possible to make reliable observations of baboons along the Addis Ababa-Dessie road. However, the possibility of interbreeding among baboons in these areas remains high, especially in areas such as Shoorobit, and Habro where hamadryas baboons were observed. It is also important to give special attention to the possibility of interbreeding between gelada and either anubis or hamadryas baboons, not only because geladas are found in all highland areas surveyed in 1995 and 1999, but recently interbreeding between gelada and hamadryas was observed in Simien (Gurja Belay, personal communication). So far the only reliable report on interbreeding between gelada and *Papio* baboons is based on the study of captive baboons in Bihere-Tsege park in Addis Ababa (Jolly, *et al.*, 1997) although Dunbar and Dunbar (1974) had reported suspected anubis-gelada interbreeding in Bole valley. It is important to investigate all potential baboon hybrid zones for a more comprehensive understanding of the causes and dynamics of natural hybridization between anubis and hamadryas baboons as well as between baboons and gelada.

ACKNOWLEDGMENTS

I thank Dr. Jane Phillips-Conroy, Dr. Mary Willis and three anonymous reviewers for their comments on earlier drafts of this manuscript. This research was supported by National Geographic Society (Grant # 5505-95 and 5505-97).

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