

## Brief Communication:

# Barbary Macaque Group Size and Composition in Bouhachem Forest, North Morocco

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## INTRODUCTION

The Barbary macaque (*Macaca sylvanus*) is an endangered primate species with fragmented populations in Morocco and Algeria. In Morocco, Barbary macaque populations are reported to be decreasing in both the Middle and High Atlas Mountains (El Alami *et al.* 2013; Menard *et al.* 2013). In the north of Morocco, reported reasons for the species decline include overgrazing by livestock communally pastured on the mountains, along with habitat fragmentation and destruction for agriculture (Fa 1982; Fa *et al.* 1984). The topography of the north of Morocco is steep, rocky and, occasionally, inaccessible. The macaques in the region are very wary of people, making them a difficult species to observe (Mehlman 1989).

Two previous surveys of the Barbary macaque populations in the north of Morocco concluded that group sizes were small and the species was in danger of extinction in the region (Fa 1982; Waters *et al.* 2007). One area included in both these surveys is the mixed oak forest of Bouhachem (Figure 1).

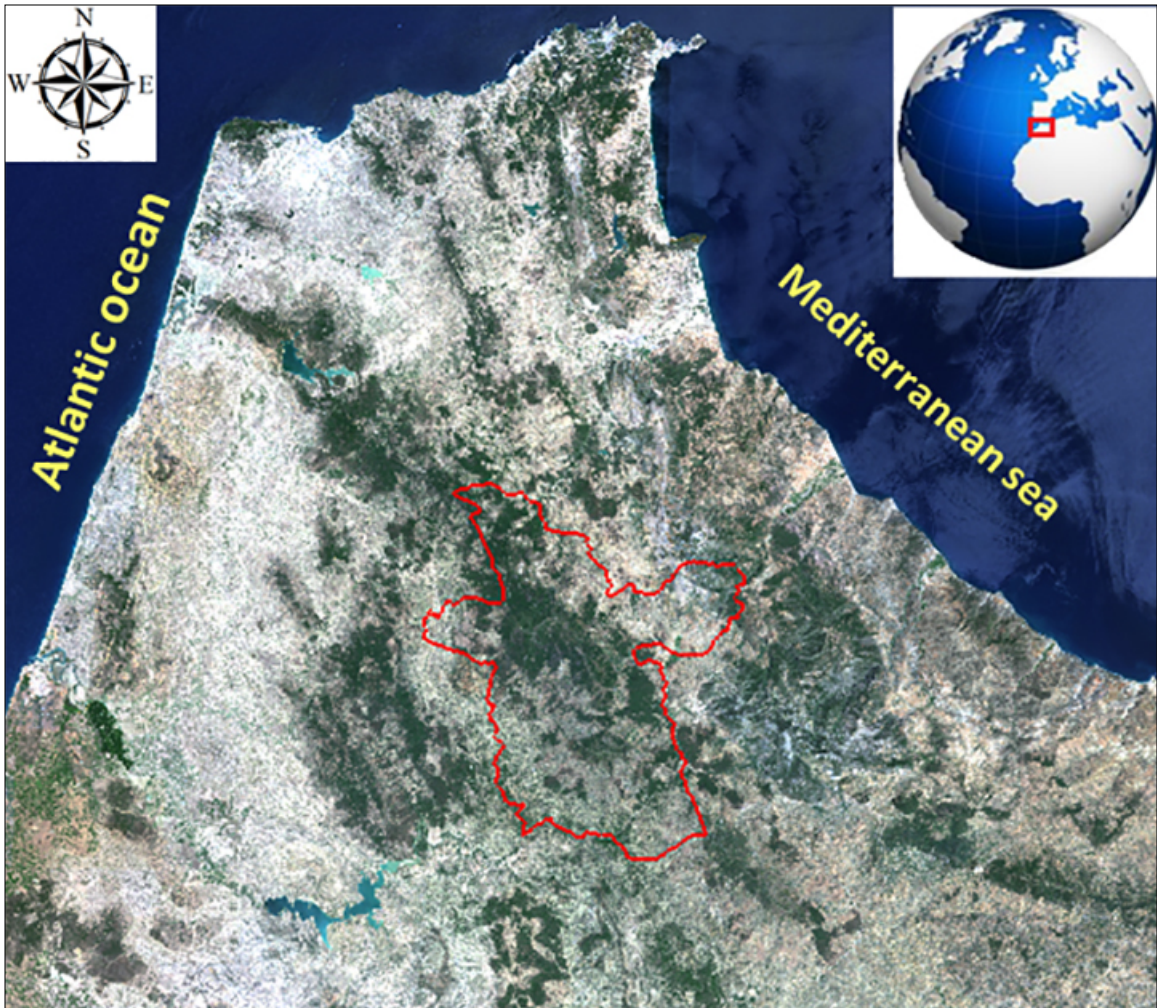
Previously documented group sizes for Bouhachem ranged 8 – 27 individuals in five groups with a mean group size of 13.6 (Fa 1982) and two groups of 7 – 16 individuals, with a mean group size of 11.5 (Waters *et al.* 2007). As part of a larger investigation into whether the inclusion of local people in a larger survey effort can effectively co-produce information on the status of Barbary macaques in Bouhachem (Waters 2014), we collected group size and composition for four Barbary macaque groups adjacent to one another in Bouhachem forest.



**Figure 1.** A Barbary macaque in the mixed oak forest of Bouhachem. Photograph by A. El Harrad.

## STUDY SITE AND METHODS

The study area, Bouhachem, is in the Tangier-Tétouan region of northern Morocco (Figure 2). Bouhachem is a mountainous forested area of approximately 142km<sup>2</sup> comprising three species of oak - the evergreen cork oak (*Quercus suber*), the deciduous zeen oak (*Q. canariensis*) and Pyrenean oak (*Q. pyrenaica*). An area encompassing 8,000 ha, constituting about 75% of the total area of forest has protected status as a Site of Biological and Ecological



**Figure 2.**-- Location of Bouhachem protected area in the north of Morocco. Landsat map LC82010352014217LGN00 courtesy of the US Geological survey. Prepared by M. Ikssi.

Interest. At the time of the study there was one paved road through the forest and one track accessible to 4WD vehicles.

Barbary macaques occur throughout the forest but are hard to observe because they flee on encountering people on foot. During the first three months of our study (October – December 2009), we noted that the macaques tolerated a stationary vehicle from a distance of about 30 m. However, if we were on foot, the macaques moved out of sight quickly unless situated on escarpments or rocky outcrops inaccessible to people. We therefore located macaque groups by patrolling the paved road in a vehicle at an average speed of 15 km/h in the morning (7 – 11 am) and late afternoon/evening (3 – 5pm), two days per week.

On encountering a group, we stopped and began to count individuals. Adult males were always the

last to flee, so we paid close attention to males during observations of groups whilst in the vehicle and used those with easily observed physical features to identify individual groups. By January 2010, we could confidently identify four macaque groups that contained at least two males that exhibited distinct physical characteristics such as scars or limps that we were able to observe with binoculars from a distance of ~30 m. If no such individual was observed, we recorded the group as unidentified. We recorded one observation per day of each group for two days per week during February and March 2010 (eight weeks).

We recorded macaque group counts and composition when groups crossed an open area such as the paved road, or open clearings. We distinguished four age-sex categories (Table 1). To avoid errors due to the often rapid movement of

**Table 1. Age-sex class of Barbary macaques used to determine group composition.**

Age-Sex Class	Definition
Adult male $\geq$ 5 years	Full body size; fully developed testicles
Adult female $\geq$ 5 years	Full body size; differentiated from males at distance by appearance of genitals and/or presence of elongated nipples
Unknown adults $\geq$ 5 years	Adults of unidentified sex; full body size
Sub-adults $\geq$ 3 - 5 years old and juveniles $\geq$ 1 - 3 years old	Blonde in colour; slender body; smaller than full body size

individual macaques across open spaces both sub-adult and juvenile age classes are counted together. We do not include newborn infants in this study due to the lack of information regarding infant mortality in this area.

## RESULTS

We were able to clearly identify each Barbary macaque group at least eight times during the study and recorded its size and composition. We labelled the groups after the location where we observed them most often.

In Table 2, we present the most comprehensive counts and composition of each group taken during

the survey period. Barbary macaque group sizes in this study ranged 52 – 72 individuals with a mean group size of 62. Due to the rapid movement of group members we could not always identify the sex of some adults. The mean overall adult sex ratio was 1:1.1.

## DISCUSSION

Preliminary results from this study suggest that current Barbary macaque group size in Bouhachem is larger than those reported in previous surveys by Fa (1982) and Waters *et al.* (2007) of 7 – 27 individuals. A group in deciduous oak forest in Algeria numbered 53 individuals (Menard & Vallet

**Table 2. Group numbers and composition of four Barbary macaque groups in Bouhachem, February and March 2010.**

Date	Study Group Name	Adult Males	Adult Females	Sub-Adults & Juveniles	Unknown Adults	Total
27.3.10	Handak Kherba (HK)	24	16	11	1	52
28.2.10	Dar de Monte (DM)	17	28	20	7	72
10.3.10	Marja Ghatwil (MG)	22	25	18	1	66
13.2.10	Lota Teshta (LT)	18	21	18	2	59
<b>Total</b>						<b>249</b>

1993) suggesting the group sizes we report here may be the norm for this species in such habitat. The previous surveys in Bouhachem took place before the construction of the paved road through the forest and so those group sizes may be lower due to the difficulty in encountering and observing macaques on foot. Low group counts were noted during a study in another area of Barbary macaque habitat in the region and were updated when further opportunities for observation allowed more accurate counts (Mehlman 1984). The ratio of adult males to females concurs with studies of the species in other areas of its distribution (Menard & Vallet 1996).

October has been suggested as the best period for Barbary macaque surveys because macaque activity patterns remain relatively stable allowing easier detection of groups (Menard & Vallet 1997). However, in our experience in Bouhachem, the winter months (December -- February) are more conducive to counting non-habituated Barbary macaques in deciduous forest due to less foliage and vegetation which can obscure our view of macaque groups feeding in grassy clearings. These data provide a baseline for a wider survey of the conservation status of Barbary macaques in Bouhachem and provide evidence that Bouhachem may be an important area for the species' long-term conservation.

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