

# WOLF PACK TERRITORY MARKING IN THE BIAŁOWIEŻA PRIMEVAL FOREST (POLAND)

by

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## Summary

We analysed data on territory marking with urine, scats, and ground scratching by wolves (*Canis lupus*) belonging to four packs in the Białowieża Primeval Forest, Poland. The aims were to determine: (1) seasonal variation in the marking rates, (2) significance of various kinds of marking in territory demarcation, and (3) relationship between spatial distribution of wolves' marking and their use of territory. Continuous radio-tracking and subsequent snow tracking of the collared wolves were the main methods. Deposition rates of scats showed little variation in time and space, whereas rates of urine marking and ground scratching showed large seasonal and spatial variation. Wolf marking rates with urine and ground scratching were highest during the cold season (October-March) and peaked during the mating season, in January and February. Marking intensity did not grow with the number of wolves in a pack, and *per capita* rates of marking were highest in wolves travelling singly or in pairs. Mean marking rates per km of wolf trail were low in the core areas of territories, and increased

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when wolves approached the boundaries. However, densities of marks (number of marks per square km) increased in territory centre (due to intense use of core area by the pack), and in peripheral areas, which bounded other territories (due to increased marking activity by wolves when moving along the territory edge). Our findings did not support the 'olfactory bowl' model of wolf territory marking, as marks were not distributed equally along territory boundaries. Instead, marks were concentrated in 'hot spots' more vulnerable to penetration by intruders (territory edge) or more valuable to owners (vicinities of breeding dens).

*Keywords:* *Canis lupus*, territory, urine marking, ground scratching, Białowieża Forest, economic constraints, 'hot-spots' model.

## Introduction

Scent marking is an important aspect of olfactory communication in mammals. This behaviour probably originated from a response to unfamiliar surroundings or situations, but has gained numerous social functions throughout evolution (Kleiman, 1966). Wolves *Canis lupus* mark to assert dominance, in pair-bonding, to achieve reproductive synchrony, for spatial orientation and territory maintenance, and to mark empty food caches (Peters & Mech, 1975; Rothman & Mech, 1979; Harrington, 1981; Asa *et al.*, 1984; Paquet & Fuller, 1990; Paquet, 1991; Vila *et al.*, 1994). Scent marking in wolves and other canids involves urination, defecation, and anal gland secretions aimed at specific, usually conspicuous objects. Ground scratching is a form of marking, which in addition to olfactory information involves a visible sign. Animals that are marking often adopt special postures that convey visual messages to other individuals. Without information on the stance taken by the animal, it is difficult to determine whether urination and defecation have behavioural or eliminative characters (Bekoff, 1979; Paquet & Fuller, 1990). Moreover, urine-marking rates are controlled by hormones and therefore vary seasonally (Asa *et al.*, 1990). Marking rates are also influenced by the presence of various stimuli such as previous marks, marks of other conspecifics, conspicuous landmarks and novel objects or smells, as well as by suitable ground for scratching (Kleiman, 1966; Peters & Mech, 1975).

In many species of mammals marking is linked to territory defence (Macdonald, 1980; Gosling, 1982; Hutchings *et al.*, 2001). Because the establishment and maintenance of marks involves a cost, animals are not able to mark the whole territory. Instead, a limited number of marks must be placed in a way to maximise the chance of being detected by conspecifics (Gosling &