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San Diego Wild Animal Park

Nose-Up Display in the Goral, *Nemorhaedus goral*

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With 3 Figures

Abstract

The behavior of 3 individuals of *Nemorhaedus goral* (one adult ♂, one adult ♀, and their immature ♂ offspring) were systematically observed for a one year period at the San Diego Wild Animal Park. Data were collected, using continuous focal animal sampling, throughout the daytime hours in their open-air 0.5-ha enclosure. This brief report focuses on an expressive behavior called the "nose-up" posture which is performed by this species. During an aggregated 80 h of 1 min focal samples for each animal, the adult ♂ goral performed 1319 "nose-up" displays, the adult ♀ performed none, and the immature ♂ performed 4. This display was performed by the adult ♂ during all months of the year and in specific locations, primarily at the outer perimeter of their exhibit. The results suggest that this display was a form of optical marking and lend support to a hypothesis of territoriality in this species.

Introduction

Goat-antelopes of the genus *Nemorhaedus* inhabit some of Asia's precipitous mountain slopes at elevations of 1,000 to 4,000 m (NOWAK & PARADISO 1983). Due to the inaccessibility of these animals, very little is known about their ecology or behavior (ALLEN 1940, DOBRORUKA 1968, LEKAGUL & MCNEELY 1977, SCHALLER 1977, YIN 1967, and ZHANG 1987).

This paper describes the occurrence of an expressive behavior called the "nose-up" display in the Central Chinese goral (*Nemorhaedus goral arnouxianus*). This display has been found in other species of ungulates, and is described by WALTHER 1984, p. 217 as a posture in which ... "the neck and head are stretched upward, the nose pointing skyward."

The following definitions of terms used in this paper will apply:

Territory: "An area occupied, more or less, exclusively by an animal or group of animals by means of repulsion through overt defense or advertisement" (WILSON 1975, p. 597).

Communication: "Communication is a form of social interaction in which a sender addresses a recipient and delivers a message to him by signs, signals, or symbols, aiming for an adequate response" (WALTHER 1984, p. 15). WALTHER continues by questioning the issue of "addressing", i.e. aiming the message at a definite recipient. He argues that a signal can be made for a potential recipient, even though there is no recipient actually present. This is characterized as "to-whom-it-may-concern communication" (WALTHER 1984, p. 25).

Display: A form of communication which advertises the presence, position, status, and state of the communicator (WALTHER 1984, p. 69—72).

Visual Display: A display which is performed such that the recipient is addressed with his visual senses. A static visual display is one where "the result is achieved merely through the presence or appearance of the animal's body in an area" (HEDIGER 1950, p. 8). A dynamic visual display is one where "a specifically adapted signalling apparatus functions with a typical movement" (HEDIGER 1950, p. 8).

Visual, or Optical, Marking: The demarcation of territory by an animal using Visual Displays.

Methods

This report is part of an ongoing study of the behavior of the Central Chinese goral at the San Diego Wild Animal Park in San Pasqual, California. The subjects were a mature ♂ (2 years of age at the beginning of the study), a mature ♀ (3 years of age), and an immature ♂ (1 month of age) born to these adults. The 3 animals resided in a 0.5-ha enclosure surrounded by a chain-link fence through which the gorals could easily

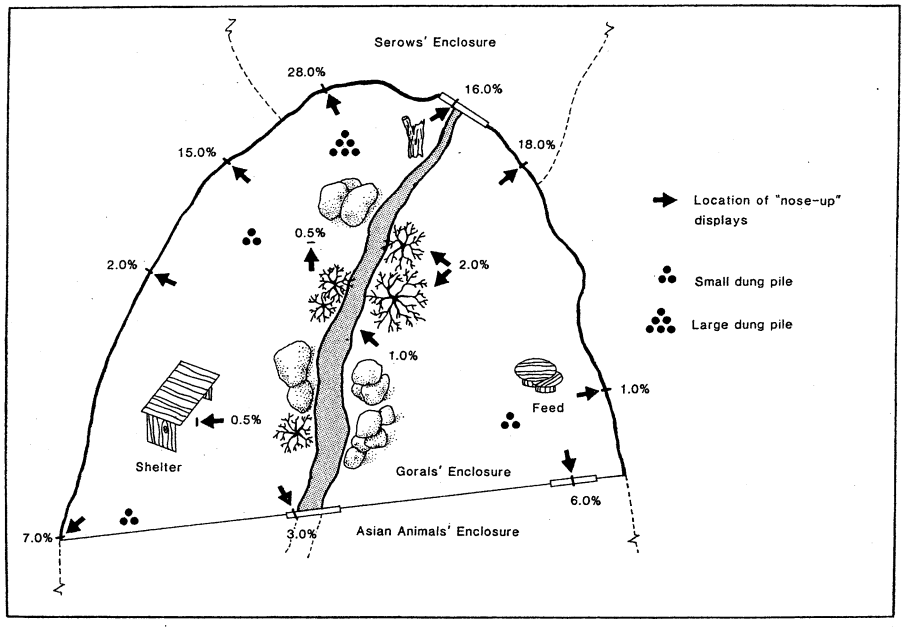

Fig. 1. Enclosure of the Central Chinese goral, showing the locations where the mature male performed his nose-up displays. Each percentage is of the total number of displays over the one year period.

face out to the animals on the other side and be seen by the animals on the other side (Fig. 1). On one side of their exhibit was a 14-ha enclosure which housed 10 species of Asian ungulates, none of which was closely related to the goral. On the other side was a 1-ha enclosure which housed 2 species of Asian ungulates, the Formosan muntjac (*Muntiacus reevesi micrurus*) and a mature ♀ Japanese serow (*Capricornis c. crispus*).

The terrain of the gorals' exhibit was semi-rocky, with sloped banks leading to a stream bed through the center, vegetated with indigenous species of grasses, shrubs, and trees.

Behavioral observations were recorded at weekly intervals from VII. 1986 through V. 1987. The gorals' behavior was documented throughout a 7 h period each day of observation, beginning at 7.00 and extending until 14.00. In addition, some late afternoon observations were made during each month beginning at 14.00 and extending until 16.30 or 18.00, depending on the time of year. The method employed was continuous focal animal sampling (ALTMANN 1974). Behaviors were recorded during 15 1-min-periods for each animal during each hour of observation. For the purpose of this paper, all occurrences of the "nose-up" posture were documented during the performing animal's focal periods. Recorded data included the time and location where the behavior was performed, the location and behaviors of the other 2 gorals, and social interactions before and following the behavior.

Results

The mature ♂ goral engaged in 1319 "nose-up" postures during approximately 80 h of his focal samples. He performed this behavior during each month of the year. The mature ♀ was never observed performing the behavior; the immature ♂ was observed performing the behavior 4 times. However, the immature ♂ periodically performed uncoordinated portions of the display in what appeared to be a behavior without purpose in regards to both location and context.

During most of the displays of this behavior, the ♂ faced the fence and positioned his forefeet at a level higher than his rear feet, either up against the fence, on a rock, or on a raised mound of earth. His nose was pointed upward and his head was turned and rotated at a 90 degree angle, thus stretching the neck muscles and exposing (flashing) the lighter colored throat patch through to the other side of the fence (Figs. 2 and 3). His mouth was either closed or slightly opened during the display. The duration of the timed displays lasted from 3 to 20 s. The ♂ often engaged in more than one display while standing in the same location. Many times he repeated the display a few meters away in the same immediate location. Other times he moved to a new area. When facing the fence, he appeared to look outward to the other side before initially performing the display. During a sequence of displays he usually trotted from one location to another and sometimes back again, especially when performed at the serow's fenceline.

Of the total number of adult ♂ displays, 96% occurred at specific locations along the exhibit's perimeter fence line (Fig. 1). 62 % occurred at or within 3 m of the fence which separated the goral enclosure from that of the Japanese serow; 15% occurred at one of the gorals' favored resting areas, which was 11 to 13 m from the serow's enclosure; 16% occurred at the fence which separated their exhibit from the larger Asian animal enclosure; 3% occurred at 2 other favored resting areas; and 4% occurred at other areas of their exhibit. At the serow's fence line, 44% occurred at areas within 3 to 6 m of the gorals' most frequently used dung pile.

It was also noted that 24% of the displays (single or sequences) occurred following an interaction with the ♀ or immature ♂. These interactions included butting, mutual butting, and lunging. The ♂ either performed the display at the location of the interaction or ran to, and performed the display at, the specific location along the fence line

nearest the point of the interaction. The remainder of the displays were disjoint from any behavior performed by or with the other gorals. In all cases there was no observed response by the ♀ or immature ♂ to the ♂'s displays.

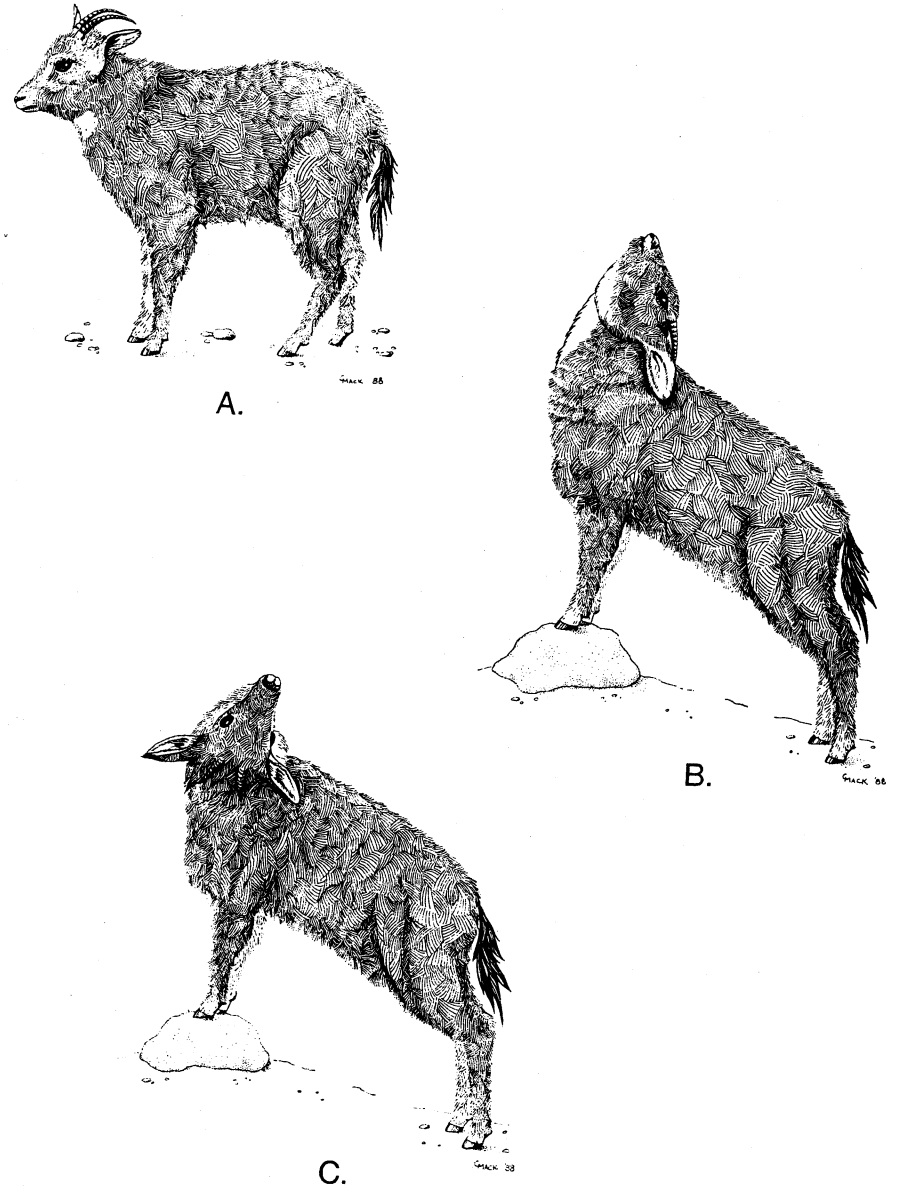

Fig. 2. Postures of the ♂ Central Chinese goral. A — Normal posture. B and C — "Nose-Up" display.

Fig. 3. "Nose-Up" display in the male Central Chinese goral.

Discussion

WALTHER (1984) described a "nose-up" posture as one of the expressive components of the threat, dominance, and courtship behaviors in certain species of ungulates. He did not, however, find evidence that this posture occurs during these communicative behaviors in members of the tribe *Rupicaprini*. This tribe includes 4 genera of animals: *Rupicapra*, *Oreamnos*, *Capricornis*, and *Nemorhaedus* (SIMPSON 1945). The absence of this posture in 3 genera of this tribe, *Rupicapra*, *Oreamnos*, and *Capricornis* is further substantiated by a comparison of communicative behaviors in LOVARI (1985) and by recent correspondence with current researchers of *Capricornis* and *Rupicapra* (KISHIMOTO in letter, LOVARI in letter). LOVARI (1985) did, however, describe a "head-up" posture ("uplifting of muzzle") in courtship behavior of the chamois, and, although some authors have equated "head-up" with "nose-up" (WALTHER 1984), the "nose-up" posture in *Nemorhaedus* is much more exaggerated than the described "head-up" display.

Although the exact significance of the "nose-up" posture in the goral cannot be determined from such a small captive sample, the results suggest that the behavior is a form of dynamic optical marking. This assumption is substantiated by the facts that the behavior occurred during each month of the year, and that 96% of the postures were performed at specific locations along the fence surrounding the enclosure, the majority being displayed while the ♂ faced outward. Additionally, the ♂ most often displayed his postures near the gorals' urine and dung piles. One hypothesis is that the visual

display worked in combination with the chemical factor to advertise the presence of the individuals to which the area belonged. The absence of an overt response to the displays by the other gorals would be expected if the dominant animal was marking the territory of his family group. In the Japanese serow, the ♀ will mark frequently when she has set up her own territory, but when sharing the same territory with a male appears to "charge" the ♂ with the responsibility of marking (MASUI 1987). This was also observed in a pair of captive Japanese serow (BERG 1987), where, additionally, there was no observable behavior by the ♀ in response to the ♂'s scent-marking. Other considerations which should not be overlooked are that the majority of the displays were performed along the fence which separated the gorals from the serow, and that the largest dung pile was that closest to the serow's enclosure. Dung piles being most prevalent in areas closest to interspecific neighboring territories has been shown in other species (GOSLING 1985). The serow and goral are closely related, and, in fact, some taxonomists think they should be classified into the same genus, *Nemorhaedus* (GROVES & GRUBB 1985). (I do not necessarily share this opinion.)

Although this display as performed by the goral has not yet been recorded in the literature, it has been observed in another captive *Nemorhaedus goral* residing at Tierpark Berlin and in wild *Nemorhaedus goral* in Northwest Thailand. In Berlin, the behavior was performed by a resident ♀ following the introduction of a new ♂. The behavior occurred at frequent intervals on the day of introduction and the succeeding day (POHLE in letter). This display was not, however, observed since that time; this pair has no related species as neighbors. It may have been an initial display of dominance and/or related to stress. In Thailand, this display was observed in 2 mature ♂ gorals (LOVARI in letter) which lends support to the fact that it does not appear to be a captive specific behavior. LOVARI, POHLE, and I agree that a significant factor of this display may be the exposure of the distinctly lighter colored throat patch when the neck is stretched and the nose raised upward. By turning his neck and head while in this posture the animal "flashes" his display signal. This sudden flashing, when taken together with raising the frontal portion of his body (thus increasing his appearance), may enhance the display's signaling function. According to WALTHER (1984), many species which perform this display expose a white throat patch. Both LOVARI (1985) and SCHALLER (1977) refer to a "head-up" display in the chamois which also has a white throat patch; LOVARI (1985) emphasizes that the throat patch is prominent during this type of display. SCHALLER (1977) further states that he would expect this display in the goral and serow since they also have these throat patches. However, not all subspecies of *Capricornis sumatrensis* have throat patches (ALLEN 1940), and in *Capricornis crispus*, only the Formosan serow has such a patch (LYDEKKER 1913).

Because the free-living goral resides in mountainous terrain which includes steep and rocky slopes (SCHALLER 1977), and gorals are said to have very good eye sight (LEKAGUL & MCNEELY 1977, YIN 1967), an animal standing on a rocky outcropping and flashing his signal could be seen from a long distance by other gorals in the area. The function of the visual display over a distance could work in combination with the chemical scent (dung piles) at closer range in announcing ownership of an area. According to SCHALLER 1977, p. 291 "On the basis of food habits, body size, habitat choice, and group structure, one would expect territorial behavior in goral and serow." Both species have localized dung piles which is a known form of marking in other species of similar size and group structure (SCHALLER 1977). The Japanese serow also marks with the pre-

orbital gland and is known to be territorial (KISHIMOTO 1981); the goral of Thailand have been observed performing behaviors which indicate possible defense of an area (LOVARI in letter). Whether the "nose-up" display be termed a form of optical marking or not, it does appear to serve an expressive function, and would be a contributing factor in support of a territoriality hypothesis, in *Nemorhaedus goral*.

Future Research

Because my population sample is so small, there is, open to discussion, the validity of my hypothesis. The question of whether this display, or its meaning, is captive-specific has also been raised. One curious observer asked how this display is integrated with other agonistic behavior patterns. There is much to be learned about gorals in general, and each aspect of their behavior specifically. Opportunities for future research abound.

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