

**Observations of predation by pumas and Geoffroy's cats
on the plains vizcacha in semi-arid scrub of central Argentina**

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Introduction. – Foraging behavior of nocturnal felids has been studied with radio tracking of movement patterns, analysis of diet, and examination of kills (Hornocker 1970; Schaller and Vasconcelos 1978; Emmons 1988; Sunquist and Sunquist 1989). However, direct observations of pursuit and capture of prey are rare, and data on capture success of felids in the wild are particularly scarce. I report observations of predation by puma (*Puma concolor*) and attempted predation by Geoffroy's cat (*Oncifelis geoffroyi*) on the plains vizcacha (*Lagostomus maximus*, family Chinchillidae), a large nocturnal rodent of the grasslands and semi-arid scrub of central Argentina.

Studies of felids have shown that prey size and prey behavior are key variables influencing predatory behavior (Sunquist and Sunquist 1989). Most ecological and behavioral studies of pumas have been conducted in North America where puma primarily prey on large mammals, particularly ungulates (Hornocker 1970; Seidensticker *et al.* 1973; Ackerman *et al.* 1984). Vizcachas are the most abundant prey in puma feces in our study area (Pessino, Branch and Villarreal, pers. obs.). Vizcachas live in social groups (*ca.* 10-30 animals) in fixed communal burrow systems, and thus provide a spatially predictable resource for predators. Vizcachas are small (females, 2.5-4.5 kg; males, 4.5-8.0 kg) relative to many other potential prey in the area (e.g., guanacos, *Lama guanicoe*; European boar, *Sus scrofa*; rheas, *Rhea americana*). In other parts of Central and South America, pumas also often forage on small- to medium-sized prey (Iriarte *et al.* 1990).

The biology of the Geoffroy's cat, like most other small South American cats, is poorly known (Emmons 1988). Only two field studies have been conducted on this species (Berrie 1978; Johnson and Franklin 1991). Johnson and Franklin (1991) report that the diet of the Geoffroy's cat is primarily rodents and introduced European hare (*Lepus capensis*). Hunting behavior of this species has not been described.

Methods. – Observations were recorded in Lihue Calel National Park (38°00'S, 65°35'W), La Pampa Province, Argentina during a behavioral study of the vizcacha from January 1985 to August 1987. The park (8000 ha) is comprised of bare rock hills surrounded by flat semi-arid scrub. On 260 nights (1,011 hours), systematic behavioral observations were made with binoculars and a spotlight from platforms (height 1.5-2.5 m) in a 14-ha study area containing 8 social groups of vizcachas. The landscape was scanned continuously with the spotlight. Systematic data were collected on the behavior and location of all vizcachas at 0.5 h intervals throughout the night, and all

sightings of pumas ($N = 41$) and Geoffroy's cats ($N = 8$) were recorded (Branch 1993). Pampas cats (*Oncifelis colocolo*) also were sighted three times, but this species was not observed preying on vizcachas. Additional data on predation were obtained from telemetry of 12 vizcachas fitted with radio collars and monitored 3-6 nights per week (Branch *et al.* 1994).

Results and discussion. – Geoffroy's cats were observed moving through the study area on eight nights, and one chase was recorded, as follows. An adult female vizcacha was feeding alone in the open about 3 m from the burrow system when a Geoffroy's cat appeared 14 m to the east. Upon seeing the vizcacha, the cat changed its course and quickly moved behind a shrub. The cat crouched and sneaked from one shrub to another until it was behind the shrub nearest the vizcacha (*ca.* 3 m away). It remained behind this shrub for 12 minutes until the vizcacha hopped 6 m north of the burrows and resumed foraging with its back to the cat. The cat then immediately left the shrub cover and began to inch forward in a low, jerky posture. It moved 10-20 cm at a time for about 4 jerks, and then quickly moved a body length, followed by 4-5 more jerks, a body length, etc., always keeping low. About 4 m from the vizcacha, the cat rapidly sprang forward to make the attack. The vizcacha began to run when the cat was within a meter, and escaped to an isolated burrow 10 m north of the main burrow system. The cat dashed beyond the burrow about 0.5 m, returned and inspected the burrow, and then quickly left the study area.

During systematic nocturnal observations with the spotlight, pumas were sighted about once per 25 hours of observation. Detection of pumas was facilitated by the alarm calls of vizcachas. Most observations were of single adults ($N = 30$). At least two adult females used the area, one with two dark kittens (3 observations, December 1985 - October 1986) and one with a single light-colored kitten (6 observations, November 1986 - February 1987). Twice a single kitten, about three-quarters adult size, was observed alone in the study area. As reported for other areas protected from hunting (Johnson, pers. com.), pumas did not run or show other signs of changing their behavior in response to the observer.

Pumas were observed pursuing vizcachas 10 times, resulting in one kill. This kill occurred only 35 m from the observation platform, and provided the best observations of a puma stalking vizcachas. When I first observed the puma, it was about 40 m downwind from a group of 4 vizcachas that were foraging in the open. The puma watched the vizcachas from the cover of a creosotebush (*Larrea divaricata*) until a sub-adult male vizcacha separated from the group and moved about 10 m toward the puma. The puma immediately crouched, sneaked toward the vizcacha, and then from about 10 m sprang for the prey. The vizcacha bolted, but was overtaken by the puma. The puma did not immediately kill the vizcacha and used its forepaws to keep its prey from escaping until a killing bite was inflicted at the back of the skull. The puma then retreated into the scrub carrying the vizcacha in its mouth.

The techniques that cats use to kill prey vary with prey size. Sunquist (1981) found that tigers used a throat bite on prey more than half their weight. Tigers, and most other cats, kill small prey with a nape bite (Leyhausen 1979; Sunquist 1981). Similarly, the method of killing by pumas varies with prey. Robinette *et al.* (1959) reported that pumas use a nape bite or a throat bite on deer. In central Chile, pumas kill guanacos with a throat bite that crushes the trachea (Wilson 1984). Examination of vizcacha kills ($N = 3$) corroborated direct observations and indicated that pumas dispatched vizcachas with a bite at the posterior of the cranium, in a manner similar to jaguar (*Panthera onca*) kills of capybara (*Hydrochoerus hydrochaeris*) (Schaller and Vascon-

celos 1978). Because vizcachas have a short neck, canines of a puma can puncture the skull and the shoulder region in a single bite.

Pumas removed vizcachas from the kill site. Nine of the 12 animals with radio collars were killed by pumas (Branch *et al.* 1994), and the collars were recovered from a valley with dense tussock grass about 350 m north of the study area. These radio collars, ear tags from two vizcachas, and bone fragments from numerous other vizcachas were found within a 10 m \times 10 m area, indicating that the same site was used repeatedly for consuming prey. Pumas consumed all parts of the vizcacha except the viscera and, occasionally, part of the mandible.

Prey capture involves investment of energy in four phases: search, stalk, attack, and subduing prey (Elliot *et al.* 1977). Because of the difficulty of monitoring and quantifying the search phase, my data, and most other studies, report hunting success based on the attack success after initiation of the stalk. The attack success of pumas on vizcachas (10 percent) was lower than prey capture rates reported for other felids. Using tracks in the snow in Idaho, Hornocker (1970) estimated that pumas were successful in 82 percent of their attacks. Primary prey were elk (*Cervus canadensis*) and mule deer (*Odocoileus hemionus*). Successful kills by lynx (*Lynx canadensis*) have been reported in 17 - 38 percent of the chases of snowshoe hare (*Lepus americanus*) (Parker 1981; Murray and Boutin 1991), and 50 - 70 percent of the attacks on ungulates such as reindeer (*Rangifer tarandus*) and roe deer (*Capreolus capreolus*) (Haglund 1966). A capture success of 48 percent was recorded for servals (*Leptailurus serval*) pouncing on small prey (e.g., rodents, birds, and insects; Geertsema 1985). Although the attack success of pumas on vizcachas is low, hunting of this species may be profitable because the predictable location of vizcachas at burrow sites reduces the time and energy pumas expend searching for prey. Also, there is little risk of physical harm or energy expended in subduing a vizcacha compared to larger prey.

Vizcachas exhibit several behaviors that may directly influence hunting success of felids. Through grazing, vizcachas convert the understory vegetation around burrow sites from tall, dense grass to low-growing forbs (Branch *et al.*, submitted). They also clip grasses and shrubs that are not eaten. Similar behavior has been documented in prairie dogs (*Cynomys ludovicianus*) and is presumed to be an anti-predator strategy (King 1955). Because cats typically ambush prey, or capture prey by stalking followed by a short rush (Sunquist and Sunquist 1989), cover is a critical variable in prey capture. Pumas and the Geoffroy's cat moved behind cover to get as close as possible to vizcachas before attacking. Field data on lions and simulation modelling show that capture success is strongly related to the distance covered in the final attack (Elliot *et al.* 1977). By removing cover, vizcachas may increase the minimum attack distance and reduce capture success of felids.

The loud warning vocalizations of vizcachas also are clearly an important antipredator behavior (Branch 1993). In response to cats, vizcachas gave a warning call, and if the cat was within 15-20 m, vizcachas ran to a burrow. The primary function of alarm vocalizations in social species generally is considered to be warning of conspecifics, often kin (Sherman 1977). However, observations of puma-vizcacha interactions suggest that these vocalizations also may deter attacks by predators. Pumas and Geoffroy's cats never pursued vizcachas that vocalized or gave other indication of having sighted the cat before the attack. A similar pursuit deterrent function has been proposed for alarm vocalizations in antelope and tail-signaling in deer (Woodland *et al.* 1980; Tilson and Norton 1981).

Vizcacha populations fluctuate dramatically in the semi-arid scrub of central Argentina (Branch *et al.* 1994). When vizcacha populations are low, pumas incorporate

more large prey (e.g., guanacos and feral hogs) and small prey (e.g., guinea pigs, *Galea musteloides*) in the diet (Pessino, Branch, and Villarreal, pers. obs.). Nothing is known about diet shifts in the smaller cats. This highly dynamic system provides an excellent opportunity for studying the inherent flexibility and ecological constraints (Sunquist and Sunquist 1989) on predatory behavior of a little-known group of South American felids.

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**Somatometry and reproductive data on the Northern water shrew,
Neomys fodiens (Pennant, 1771) from the Aran Valley
(Spanish Pyrenees)**

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The Northern water shrew, *Neomys fodiens* (Pennant, 1771), is a Palaearctic species with a wide European distribution. In the Iberian Peninsula it occupies only the northernmost fringe, from the Catalan Pyrenees and pre-Pyrenees to eastern Galicia (Sánchez Canals 1977; Nores *et al.* 1982; López-Fuster *et al.* 1990). Most of the studies concerning the Iberian populations have dealt with craneometrical traits, based on owl pellet material, and usually approach taxonomic aspects (Bühler 1963; Nores 1979; Nores *et al.* 1982; Pemán 1983; López-Fuster *et al.* 1990). Although the morphological and biological characteristics of *N. fodiens* are well known in most of its European distribution (see Spitzenberger 1990), there is little information about these features for Iberian populations, especially owing to the scarce capture of the species. Only Sánchez Canals (1977) and Sans-Coma and Margalef (1981) report the body measurements for six specimens from Ancares (Galicia) and two from Catalonia, respectively. In this paper we give data on the somatometry and reproduction of *N. fodiens* from the Aran Valley, in order to extend the faunistic knowledge of the species in the Pyrenees.