Jaguar predation on capybara

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Abstract

Studied the techniques used by jaguar to kill capybara and noted the effects of predation on a small capybara population in Mato Grosso. Jaguar often used a specific killing bite, puncturing the temporal bones of their victims with the canines. An analysis of 59 kills and other remains revealed that predation was not selective on a particular age class. Jaguar killed 20—30 % of a small population in two months. However, disease — probably trypanosomiasis — first reduced the population to a point where predation could become important. Results indicate that predation had a significant effect by increasing the prey's rate of decline.

Introduction

The predatory behavior of several species of large cats has been studied in recent years (e.g. Schaller 1967, 1972; Hornocker 1970; Eaton 1970; Rudnai 1974), but that of jaguar *(Panthera onca)* remains little known, the available information consisting mainly of anecdotes by such naturalists as Rengger (1830), Krieg (1948), and von Humboldt (1958), and by such hunters as Siemel (1952) and Almeida (1976). While conducting a mammal survey of the Acurizal ranch in the Mato Grosso state of Brazil from June to August 1977, we also collected some data on predation by jaguar on capybara *(Hydrochoerus hydrochaeris)*, a large semi-aquatic rodent. The ranch, 136 sq km in size, lies along the western edge of the Pantanal (17°45'S, 57°37'W), a vast plain part of which is flooded seasonally by the Rio Paraguai and its tributaries. Dominating the ranch is a high ridge covered on its upper slopes by an open woodland and on its lower slopes and base by a mosaic of cattle pastures, thickets, and stands of semideciduous forest with trees up to 20 m tall. Between the high ground and the nearby Rio Paraguai is a flood plain of bays and lakes along whose margins are meadows and gallery forests. However, this area has remained almost wholly inundated since a severe flood in 1974, and now only a narrow grassy beach separates the waterline from the forest on high ground. Capybara often foraged and rested on this beach. Judging by the size and shape of tracks, three jaguar — a male, a female, and an independent subadult — were resident in the northern half of the ranch during our stay. The animals hunted over about 50 sq km of terrain, including the shore line. Although we never saw the nocturnal and shy cats, spoor provided us with information on their activity. Daily during July and almost daily during August we checked the same 8 km of beach for evidence of jaguar predation.

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Predatory behavior

Jaguar subsist on a wide variety of animals (see Guggisberg 1975). Our list of prey items from the Pantanal includes cattle, dog, capybara, tapir *(Tapirus terrestris)*, marsh deer *(Blastocerus dichotomus)*, whitelipped peccary *(Dicotyles pecari)*, collared peccary *(Tayassu tajacu)*, La Plata otter *(Lutra platensis)*, night monkey *(Aotus trivirgatus)*, and tortoise (*Geochelone* sp). Miller (1930) also noted predation on caiman *(Caiman yacare)*, Almeida (1976) on coati *(Nasua nasua)* and Roosevelt (1914) on horses. The capybara is one of the most important prey species of jaguar in the Pantanal, as well as in some other parts of South America (Krieg 1948; von Humboldt 1958). We examined 11 fresh capybara kills and a number of old ones. One example, based on a reconstruction from spoor at the kill site, conveys how jaguar capture, kill, and dispose of capybara:

A capybara sat about two meters from the water's edge while a female jaguar approached at a walk, screened by a bush. When 15 m from her prey, she broke into a trot. Suddenly aware of its danger the capybara bolted for deep water. However, the jaguar grabbed it within 4 m, in 15 cm of water, and killed it with deep bites in the throat and the back of the head. After moving the carcass ashore, she apparently left her kill to walk back and forth along the beach. She then straddled the capybara's body with her forelegs, and, picking it up in her jaws, dragged it in typical cat fashion across the beach and into the forest for a total distance of 110 m. In a dense stand of saplings she disemboweled the animal, moved it another 3 m, and began to eat, chewing first a hole through the brisket. She consumed part of the chest, the heart, and the liver for a total of about 2 kg. That same night she abandoned the carcass. The remains, those of a subadult male, weighed 15.5 kg.

The jaguar's approach and attack resemble those used by other large cats, but its killing techniques show some distinctive features. Small felids usually kill rats and similar prey with a bite through the nape, wedging their canines between and disconnecting the vertebrae (Leyhausen 1965); large felids such as tiger *(Panthera tigris)* and lion *(Panthera leo)* tend to kill small prey with a bite in the nape or back

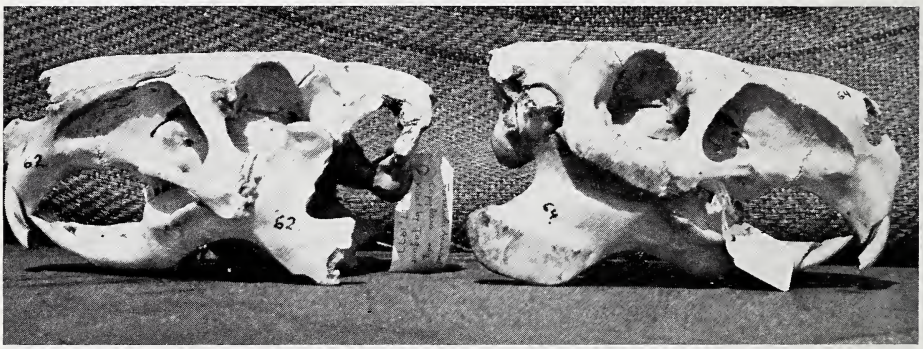
Table 1

Measurements (in kg and cm) of adult jaguar from the Pantanal[1]

Sex	Weight[2]	Total length	Tail length	Cranium		Comments
				Length (prosthion to basion)	Greatest zygomatic width	
Male	105	208.3	62.2	24.7	18.9	—
Male	119	212.1	54.6	24.2	20.0	stomach empty
Male	79.5	196.9	61.0	23.0	18.2	stomach full
Male	93	210.8	63.5	23.8	18.7	calf remains in stomach
Male	92.5	208.0	58.4	23.4	18.7	cattle remains in stomach
Male	80	194.3	66.0	22.0	18.1	stomach empty
Female	75	186.1	59.1	20.9	17.8	stomach full
Female	73	191.8	59.7	21.8	17.6	stomach empty
Female	85	203.2	61.0	22.3	18.1	calf remains in stomach

[1] We are indebted to Richard Mason for providing us with these data and for permitting us to measure the skulls. — [2] Weights include stomach contents.

of head, breaking the bones, and large prey by grasping the throat until the victim suffocates (Schaller 1967, 1972). A jaguar attacking a capybara probably resembles a housecat pouncing on a large rat, except that a jaguar may weigh over 90 kg (see Table 1) and the capybara over 25 kg. However, we found no evidence that jaguar attempt to sever the vertebrae of capybara. Instead they orient their bites to the throat and importantly to the posterior part of the cranium. Nine out of 11 fresh kills had been bitten in the braincase. The jaguar seems to take the head into its mouth and with an opposing set of canines bite one or more times until the teeth penetrate the brain. Both sets of canines may be used, and, with bicaninal width being 7–8 cm, tooth punctures may then be found on the neck too. This killing technique is noteworthy in two ways. One is the precision with which the canines are placed. Bites are confined to a small area, usually less than 3×3 cm in size, centered on each temporal bone and the adjoining margins of the occipital and parietal bones (Fig.).



Two capybara killed by jaguar. The skull on the left has a hole in each side of the cranium and a broken zygomatic arch and mandible; the one on the right shows deep tooth marks which fail to penetrate to the brain

On several occasions a jaguar inserted one canine neatly into each ear and penetrated the skull, leaving no visible injuries. The other noteworthy feature is the force of the bite. Not only must the jaguar grasp a skull nearly as large as its own (compare Table 1 with data in the next section), but also penetrate the temporal bone which may be up to 2 cm thick. Of 20 crania with tooth marks in the braincase, canines had penetrated through the bone one or more times on each side in 10 cases, leaving holes of up to 4 cm in diameter, on only one side in 7 cases, and on neither side in 3 cases, there being only chipped bone to attest to the effort. The precise cranial bite was used only on capybara, not on other species, judging by the scattered tooth marks on the skulls and vertrebrae of some peccary and cattle kills we examined.

Nine out of 11 fresh kills had been so deeply and forcefully bitten into the throat that either one or both of the zygomatic arches and the posterior margins of the mandible were chipped or broken. Either the throat or head bite could have killed most capybara. A subadult jaguar was apparently unable to penetrate the skull of its victim and, after leaving superficial wounds there, seemed to have strangled it.

After killing a capybara, the jaguar drags it to a thicket or other secluded spot. For 11 fresh kills the dragging distance averaged 87 (18–150) m. We examined a kill 7 times before vultures reached it. Twice the jaguar had disposed of the digestive tract by pulling it 2 to 3 m from the carcass. Almeida (1976) stated that jaguar usually begin to eat at the forequarters of their victims, and this we also noted, the ventral surface of the neck, the chest including the liver and heart, and the shoulders

of capybara being consumed first. In contrast, lions tend to begin with the viscera and tigers with the hindquarters. The cats readily abandoned their partially eaten kills even if we had not disturbed them. Of 11 fresh capybara kills found, a jaguar had abandoned the carcass without eating in 2 instances, it ate fewer than 5 kg and left the remains the same night in 3 instances, and it remained with the kill for 2 to 3 days in 4 instances. One jaguar failed to stay a second night after we disturbed it, and at two sites the evidence was not clear. Perhaps jaguar often fail to guard their kills because prey is fairly common in the Pantanal. For instance, the female jaguar killed a capybara one night, she took the lungs of a cow which we had hung as bait in a tree two nights later, and she killed a second capybara the following night. Jaguar made no attempt to hide kills by covering them with branches or grass even though vultures rapidly strip unguarded carcasses, in contrast to tiger (SCHALLER 1967) and puma *(Felis concolor)* (HORNOCKER 1970) which show such behavior.

Age, sex, and condition of kills

Based mainly on the sequence with which cranial sutures ossify, OJASTI (1973) divided Venezuelan capybara into several age classes. We follow his method with minor modifications. In classes I and II, both consisting of young fewer than 10 months old, the condilo-basioccipital, presphenoid-basisphenoid, exoccipital-supra-occipital, and basioccipital-basisphenoid sutures are open. By class III, when animals are roughly 14 months old, the condilo-basioccipital suture has ossified. Thereafter one more suture closes with each age class in the order listed above until all are ossified in class VI. According to OJASTI (1973), capybara attain sexual maturity at the age of about 1½–2 years. Thus classes IV, V, and VI consist of adults. Skull measurements show that class IV animals have almost reached their full size. The average length (prosthion – basion) of class IV capybara is 18.4 (18.1–18.7) cm, of class V 18.9 (17.2–20.3) cm, and of class VI 19.6 (17.6–20.3) cm; and the greatest zygomatic width of class IV is 12.8 (12.4–13.0) cm, of class V 13.2 (12.5–14.0) cm, and of class VI 13.5 (12.2–14.4) cm.

Table 2 shows the ages of jaguar kills. To ascertain whether jaguar prey selectively on certain age classes we compare the kill figures with two other samples. One consists of skulls found in a poachers' camp in the Caracará Biological Reserve adjoining Acurizal on the other side of the Rio Paraguai. Poachers presumably kill at random. The other sample contains animals dead of disease and unknown causes including probably a few kills which we failed to recognize as such. All 3 samples are similar in that deaths occurred mainly among adults: only 5 out of 77 animals were subadult. To explain this, one could hypothesize that young avoid predation and disease, that the fragile skulls of young are eaten or disintegrate easily, or that subadults comprise only a small percentage of the living population. We have evidence to support the last-named point. Although litters average 4 young and a female may have 1.5 litters per year (OJASTI 1973), there were few young in the

Table 2

Ages of capybara killed by jaguar, disease, and poachers, expressed in percent

Age class	Jaguar kills	Mainly disease deaths	Poached animals
I	—	2.7	—
II	—	—	11.1
III	4.5	2.7	—
IV	9.1	10.8	11.1
V	31.8	27.0	16.1
VI	54.5	56.8	61.1
Sample size	22	37	18

Acurizal region. Of the 30–35 capybara using our census area only one female had offspring at heel, a single young which we saw just once. Thus our predation figures reflect the age groups of capybara available to jaguar rather than selection for adults.

There were 4 males, 6 females, and one unidentified individual among the fresh kills. One out of the 11 kills was in poor condition.

Effects of predation

We attempted to assess the impact of jaguar on capybara at Acurizal. Capybara concentrated on the beaches in early July with the retreat of the flood waters and the appearance of a new growth of grass. At that time we repeatedly encountered certain individuals and small groups along our 8 km census route, and we identified 26. A few others also used the beach, raising our estimate to 30–35, about a third of the population on the whole ranch. Jaguar killed 7 (20–23 %) capybara in our sample population during July but none during August when capybara spent less time on the beaches and jaguar hunted there less often. Jaguar obviously had a significant impact on this small population.

These results must be viewed in a historical perspective. Many hundred capybara existed at Acurizal until 1974 according to the local inhabitants. In that year a severe flood submerged most of the preferred capybara habitat, the grassy margins of lakes and rivers, and the animals crowded onto the remaining beach until "it was black with capybara", in the words of one resident. We were told that disease then decimated the animals. Judging by the fact that many horses died at the same time, the disease was equine trypanosomiasis (*Trypanosoma* sp.). Capybara are well known natural hosts of these trypanosomes and when experimentally infected they died within 15–20 days (Ojasti 1973). Disease still had an effect in 1977, well after the population had been drastically reduced. Of the 30–35 capybara in our sample, 4 (11–13 %) were near death, being emaciated and covered with sores, and 2–3 others were also in poor condition. Two were subsequently found dead. Thus disease was probably as important a mortality factor as predation, and the combination of the two reduced our sample population by about a third in two months.

The relative impact of predation and disease on the whole Acurizal population can be assessed in another way. We collected 72 capybara skulls on the ranch, the majority of animals that had died in 1976 and 1977. Of these 13 were too dilapidated for analysis. Since jaguar characteristically bite capybara in the head – 9 out of 11, or 82 %, of fresh kills had broken or cracked skulls – death due to jaguar predation can be separated in most instances from that attributable to other causes. Twenty-two skulls represented kills and 37 disease and other deaths. Assuming that about a fifth of the skulls in the latter category consisted of undetected kills, then our sample actually contained 29 kills and 30 disease deaths. The results confirm our direct observations that predation and disease affected the population about equally in 1976 and 1977. The impact of these two factors was accentuated by the capybara's poor reproductive success. Most of the population consisted of adults in the oldest age class (see Table 2), indicating that few young had survived in recent years to offset other forms of mortality. In conclusion, habitat loss and disease in 1974 caused not only a major decline in the population but somehow also had an adverse effect on reproduction. These factors still influenced the population in 1977. Jaguar predation had a significant effect on the remnants by increasing the rate of their decline. But whether predation merely affected animals soon doomed to die of disease anyway, or whether it actually depressed the population to a level lower than it would have maintained in the absence of jaguar remains unknown.

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Zusammenfassung

Wasserschweine als Beute des Jaguars

Wasserschweine gehören zu den wichtigsten Beutetieren der Jaguare im Mato Grosso. Aus Spuren und von Tötungsplätzen konnten wir entnehmen, wie Jaguare Wasserschweine anpirschen, fangen, töten und fressen. Auffallend war ein besonderer Tötungsbiß, bei dem der Jaguar mit den Eckzähnen die Knochen in der Ohrregion des Opfers durchsticht. Untersuchungen an Beutetieren zeigten, daß Jaguare nicht Wasserschweine eines besonderen Alters bevorzugen. Binnen 2 Monaten töteten Jaguare 20—30% der Tiere einer kleinen Wasserschweinpopulation. Diese war jedoch zuvor durch Krankheit, wahrscheinlich Trypanosomiasis, erheblich reduziert worden. Außerdem konnte unzureichende Vermehrung festgestellt werden. In dieser Situation hatte der Beutefang durch Jaguare einen bedeutenden Einfluß auf die Überreste der Population, da er deren Niedergang beschleunigte.

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