JAGUARS, LIVESTOCK, AND PEOPLE: AN EXAMPLE OF PEACEFUL COEXISTENCE IN NW BELIZE

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ABSTRACT

Frequently, human/predator interaction is negative. An example of “peaceful coexistence” between jaguars (Panthera onca) and people can be found in northwestern Belize. Good livestock husbandry and strict wildlife protection at Gallon Jug have evidently been positive for jaguars. There have been no resultant losses to livestock although approximately 150 head of cattle have been resident for about 10 years. Gallon Jug, which lies at the center of a vast forested area, bans hunting and controls access via security gates. Jaguars appear conspicuous and it is likely that their numbers are relatively high. Because they are frequently seen, jaguars have benefitted local tourism. Log book sightings of wildlife maintained by a local ecotourism lodge were compiled and augmented with additional data including camera-trapping. Types of sightings and jaguar/human interactions are discussed. No aggressive interactions have been reported. Corn grown on the farm may be an important food resource augmenting already healthy populations of jaguar prey species such as white-tailed deer (Odocoileus virginianus), peccary (Tayassu pecari, Pecari tajacu) and turkey (Meleagris ocellata). A healthy prey base, sound livestock husbandry, and fenced livestock separated from the forest are factors that appear to discourage jaguar depredation on cattle. The Gallon Jug area appears important for source populations that likely disperse throughout the greater tri-national Selva Maya area.
INTRODUCTION

Predators are frequently considered pest animals where they coexist with humans. Large charismatic carnivores such as bears, wolves and cats are among those that incite strong reactions, both positive and negative, from humans. In Central and South America, Mexico, and recently, the U.S. state of Arizona, the jaguar (Panthera onca) carries this same cachet (McNamee, 1997; Rabinowitz, 1997).

Often predators conflict with human interests when they attack domestic animals, notably livestock. Hunting of both jaguars and their prey are examples of further negative interaction. People often perceive that predators compete for the same foods/prey that humans use, particularly subsistence hunters. Predators are frequently shot as trophies for display and often for being in the wrong place at the wrong time.

Not all human/predator interaction is negative however. The presence of predators can lend heightened interest to ecotourism destinations where the hope of seeing wildlife, and specifically the jaguar, offers a great attraction to tourists. In 1981 the country of Belize enacted laws prohibiting the hunting of jaguar. Thanks largely to the Belize Zoo and Tropical Education Center’s education campaign, today jaguars are a symbol of national pride. Hotels and resorts feature its name (e.g., Jaguar Paw, Jaguar Creek, Jaguar Reef Hotel) and logos depicting the jaguar as a cultural icon abound. A recent mapping exercise (Anon. 1999) showed that healthy populations of jaguars exist throughout most of Belize.

A prime example of “peaceful coexistence” between jaguars and humans can be found in northwestern Belize where benign management of wildlife has evidently been positive for jaguars with no resultant livestock losses. Densities for jaguar have yet to be quantified; however, they appear conspicuous and it seems likely that their numbers are relatively high. Because they are frequently seen, jaguars have benefitted local tourism. Here I discuss observational information I compiled on jaguars and other felids as reported by guests and residents on the Gallon Jug property. This information was augmented with camera trapping data and provides an unusual insight into how jaguars behave when they are not persecuted and adequate prey exists.

METHODS

Study Area-
The privately owned Gallon Jug property in northwestern Belize encompasses 52,000 ha at approximately 120 m elevation. The Gallon Jug property is buffered to the north and east by the privately-owned Rio Bravo Conservation Management Area, to the south by the Yalbac Cattle and Ranch company, and to the west by the Maya Biosphere Reserve in Guatemala (Figure 1). Total forested areas consist of approximately 400,000 ha. Neighboring protected areas in Mexico, such as Calakmul Biosphere Reserve, further expand these forested areas.
Figure 1. Gallon Jug study site location within La Selva Maya.
The Gallon Jug area is categorized as Subtropical Moist using the Holdridge Life Zone classification system (Hartshorn, 1984), receiving approximately 162.5 cm of rainfall during an average year. Generally, the forests are classified as “deciduous seasonal forest 50-70 ft. high on limestone” with areas of low and high marsh forest (Wright et al., 1959). Gallon Jug has recently been broadly classified as “lowland broadleaf moist evergreen seasonal forests over limestone, northwestern variant” with wetland communities and marsh forests (Iremonger and Brokaw, 1995).

Approximately 1214 ha, mostly at the center of the property, are in agriculture with some cattle ranching. Corn is the primary crop, although some shade coffee and cacao are grown. Approximately 150 Hereford, criollo, and Hereford-criollo cattle are pastured within the 1214 cleared hectares. Intensively farmed areas are separated from the forests by two-lane dirt roads with approximately 25 m-wide verges. Gallon Jug was selectively logged up until the mid-1960’s. Even so, Brokaw and Mallory (1993) believe that the term “secondary forest” exaggerates the degree of past disturbance. The Gallon Jug property is located near the center of the extensive tri-national Selva Maya (Maya Forest).

As far back as the 1940’s until the mid-1980’s, Belizeans previously engaged in logging operations, chicle harvest, or commercial and/or jaguar trophy hunting at Gallon Jug unanimously report that the area was widely recognized for excellent hunting (B. Hassan, pers. comm). Some of the highest jaguar track densities for the country were found in Gallon Jug by Rabinowitz (1983). The forests within the Gallon Jug area have been protected from hunting since the purchase of the property in the mid-1980’s, assisted by protected area designation and buffering by adjacent properties and reserves. Consequently, the area is rich in wildlife, including game species such as deer (Odocoileus virginianus, Mazama americana), peccary (Tayassu pecari, Pecari tajacu) and Ocellated Turkey (Meleagris ocellata), normally decimated by unregulated hunting in other areas.

Observational Data- Chan Chich Lodge was established in the southwestern corner of the Gallon Jug property in 1988. In 1991, managers of this ecotourism facility began a “Bird and Mammal Sightings Logbook” in which guests and staff were encouraged to contribute wildlife encounters. Date, time, location and unlimited space for comments were provided in the logbook for entries. The result is a comprehensive record of wildlife sightings, including jaguar, spanning an 8-year period.

Observational data collected by amateurs has frequently come under fire. In the case of birds, the quality of Christmas bird count (CBC) data has been the subject of discussion and debate for years. However, amateur-collected CBC data is a significant but often overlooked data set (Arbib, 1981; Bock and Root, 1981; Drennan, 1981). In fact, Bock and Root (1981) suggested that CBC data are good indicators of patterns among common and well-dispersed species. Butcher et al. (1990) found that for birds wintering in the United States, CBC data were found to estimate population trends that were similar to formal surveys (e.g., Breeding Bird Survey). Although there are almost certainly errors associated with amateur-collected data, it
can still be considered a rich source as long as researchers are aware of its limitations (Drennan, 1981).

With these caveats in mind, the Chan Chich logbook felid data was compiled from observations by three categories of observers: local staff and Gallon Jug residents, multiple observers comprised of one or more tourists under the supervision of a trained and licensed local natural history guide, or tourists who were alone or did not mention being accompanied by a natural history guide. Because Chan Chich Lodge caters primarily to birding groups and those interested in natural history, many tourists are conversant with charismatic Neotropical species such as jaguar. While this would not make them expert observers, neither were they totally naive.

At capacity, Lodge guests and staff comprise a maximum of 52 potential observers. The Lodge is at capacity (24 guests, 28 staff) about four months of the year. A minimum of 15 potential observers occurs during September when the Lodge closes and a core staff remains on site (T. Harding, pers. comm.). Chan Chich owners and managers were scrupulous in ensuring that sightings were recorded in the logbook so that extensive species lists of multiple taxa are found. I compiled felid sightings from the logbook (excluding *Herpailurus yaguarondi*) beginning in 1991 through 1998, augmented with my own records kept since 1989.

**Camera-traps** -
Camera-traps were used as a non-intrusive technique for the detection of cryptic terrestrial species (Wemmer et. al., 1996) on three occasions in the Gallon Jug area. In each case, an overall sample of species (i.e., including, but not limited to, felids) using the study sites was desired. Trail Master camera-traps (Lenexa, Kansas, USA) were operated during three periods in the Gallon Jug area.

During 1993-1994, three camera-traps were operated at three locations within 500 m of Chan Chich Lodge. They were positioned across major trails that received human traffic en route to other trails on the property. The camera-traps documented presence/absence of animals in conjunction with human use of trails.

Trail Master camera-traps were operated in 1997-1998 to document forest mammal use of secondary growth fragments in a cornfield at Gallon Jug. Six camera-traps were placed on three habitat fragments (two per site), one was placed on a narrow vehicle track in the cornfield, and two were placed in adjacent forest typical of the area (nine total). The camera-traps operated for a period of 13 months in Gallon Jug.

Finally, 10 Trail Master camera-traps  were operated along a 2-km forest transect, on Gallon Jug property, for a one month period in late 1998. The camera-trap set up and deployment was field-tested for its potential as a La Selva Maya regional monitoring method.
RESULTS

Visual Observation Results-

One criticism has been that amateur observers may confuse jaguar and ocelot (Leopardus pardalis) identifications even though there is a marked difference in size. Thus, records describing a partial view with an uncertain identification (e.g., “probably a jaguar”) were discarded during the compilation.

Two other factors helped to separate jaguar and ocelot identifications. First, 200 of 224 jaguar observations were recorded by the most experienced observers, i.e. resident staff and guides with tourists. In fact, tourists with a guide were more likely to see a jaguar or ocelot than they were alone (Table 1). The reverse was true for pumas (Puma concolor). Twenty-four records specifically described jaguars as “big,” “large,” “powerful,” or “full adult” which would tend to separate those records from ocelots.


<table>
<thead>
<tr>
<th>Species</th>
<th>Staffa</th>
<th>Guideb</th>
<th>Touristc</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marga</td>
<td>8 (100%)</td>
<td>0</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>Ocelot</td>
<td>31 (26.7%)</td>
<td>61 (52.6%)</td>
<td>24 (20.7%)</td>
<td>116</td>
</tr>
<tr>
<td>Puma</td>
<td>29 (50.9%)</td>
<td>11 (19.3%)</td>
<td>17 (29.8%)</td>
<td>57</td>
</tr>
<tr>
<td>Jaguar</td>
<td>155 (69.2%)</td>
<td>45 (20.1%)</td>
<td>24 (10.7%)</td>
<td>224</td>
</tr>
</tbody>
</table>

aStaff and local residents
bLicensed natural history guide with tourists
cTourist(s) who did not mention being accompanied by a guide

The second factor that tends to separate jaguar from ocelot sightings concerns temporal activity patterns. Jaguars are known to be active throughout the day (Schaller and Crawshaw, 1980; Rabinowitz and Nottingham, 1986) while ocelots are primarily nocturnal (Navarro, 1985; Ludlow, 1986; Emmons, 1988) and avoid open areas (Emmons et al., 1989). Of 205 jaguar sightings in which the time of observation was recorded, 156 (76.1%) were diurnal, when visibility was most apt to be optimal. “Diurnal” was considered to be between the hours of 0600 and 1800, roughly a 12 hour daylight period, with a slight variance owing to seasonality. Less frequent ocelot sightings during daylight hours (20 of 116 sightings; 17.2%) would tend to discourage confusing the two species.

Overall, jaguar sightings were fairly consistent throughout the day (Figure 2). Periods with fewer observations appeared to correspond with times when potential observers (particularly Lodge tourists, guides and staff more often than Gallon Jug employees) were apt to
be taking their meals (e.g., 0700 h, 1200 h, and 1900 h) based on daily Lodge schedules. The peak of jaguar observations between 2000-2100 h (Figure 2) may be explained by after-work staff activity (i.e., driving to the store, church, other errands) and guided nightwalks around the Lodge for tourists beginning at 2000 h. Comparatively few jaguars were recorded after 2100 h, undoubtedly due to few observers.

Figure 2. Jaguar sightings by hour (n=197).

The frequently traveled 8-km Chan Chich to Gallon Jug road accounted for 77 of 224 sightings (34.4%). Because this two lane dirt road is hilly and winding, visibility is seldom more than 200 m so that observations occurred at fairly close range. Forty sightings (17.9%) occurred on Chan Chich’s 14-km trail system which surrounds the Lodge. The footpaths traverse tropical forest. Thus, when a cat was seen, it was within several meters of the observer since dense vegetation obscured most off-trail viewing. The Gallon Jug property and environs (roads, edges, and agricultural areas) account for the remaining 107 observations (47.7%).

The incidence of jaguar sightings generally increased from 0 recorded in 1990 to 62 in 1998 (Figure 3). This may reflect increased jaguar populations or more human habituated jaguars. The greatest number of jaguar sightings (15%) were recorded in December; 33 of 224 sightings. A six month period (November-April) which roughly corresponds with high season and capacity Lodge bookings constituted 59.3% (133) of sightings. Fewer jaguars (91) were recorded during low season (May-October) although July, showed increased activity with 28 sightings (13%) during this month.
Types of sightings-

Often, looks at jaguars were more than a fleeting glimpse. Of 78 records in which observers described the sighting as “close” or “excellent look,” nine “good looks” were estimated to last more than two minutes and as long as five minutes. Four observers mention having had enough time to take photographs.

Eleven accounts described jaguar in proximity to potential prey. Four of these were either chasing white-tailed deer or standing near deer. Two accounts mentioned the jaguar watching peccary, three described the jaguar watching or chasing an Ocellated Turkey. In one encounter, the observer saw a jaguar kill a turkey. In another encounter witnessed by a busload of tourists, a tayra (*Eira barbara*) emerged from the forest. It was swiftly dispatched by a jaguar they had been viewing for several moments in the road. The tayra was subsequently carried into the forest by the jaguar and out of view. Chan Chich staff recorded a jaguar on three occasions near or “at” the local landfill where ocelots are also regularly seen; a fourth described a jaguar “outside my house, eating in a trash can.”

On eight occasions, two or more jaguars were recorded by observers. On two occasions, two jaguars were seen in the road together; presumably two adults. An adult with two cubs was seen on the trails of Chan Chich three times by unrelated observers during a single day. An adult with one cub was seen on two occasions, an adult and subadult were seen once. One account by a staff member documented the occurrence of two adults and two young seen together at Chan Chich Lodge. Sightings of four jaguars together are rare but not unknown (Schaller and Crawshaw, 1980).
With one possible exception, no aggressive behavior toward humans by jaguars has been recorded at Gallon Jug. Descriptions of interaction or the potential for interaction are recorded in 11 observations. Once, a jaguar crossed the suspension bridge near the Lodge and walked directly toward a group of tourists illuminating it with flashlights during a guided nightwalk. After crossing, it walked over to a trail entrance where it disappeared from view. On three occasions, Lodge guests report jogging past a jaguar with no apparent reaction. However, an anecdotal report from Rio Bravo, adjacent to Gallon Jug, asserts that a female student jogged 5 km with a jaguar following her. When she repeatedly stopped to monitor its behavior, it also stopped and sat down. No further interaction was reported.

On separate occasions, five observers reported following a jaguar into the forest and seeing it more than once. In May 1998, a woman came face to face with a sleeping jaguar in a Maya tomb. As she backed hastily down the hill, the jaguar unconcernedly followed her down the steep incline before turning off into the forest after photographs were snapped by her husband. A resulting high quality photograph was subsequently matched with camera-trap photographs taken of a female jaguar that was resident near the Lodge during 1993-94. In 1999, a Gallon Jug employee was changing a tire when a jaguar emerged from the forest and sat in the road a short distance away observing him. It did not flee when he clapped his hands and waved his shirt at it.

However, in late December 1996, a male jaguar was killed by the gatekeeper at one of the Gallon Jug access roads. It had been perceived that this animal was a threat since it regularly visited his home at night during a three month period, passing under the raised house and entering the outdoor kitchen. It was eventually shot by the gatekeeper less than 5 m from his front door, where it was reportedly stalking his dog.

A postmortem examination revealed a subcutaneous fat layer and a small partially digested peccary in its stomach. It weighed 57.8 kg and total body length measured 267 cm, similar to that reported for male jaguars in Belize (Rabinowitz and Nottingham, 1986). It appeared sleek and healthy, unscarred and with no apparent old injuries. There was a broken carnassial but its other teeth appeared unworn. I photographed this animal extensively. Its pelage patterns did not match those of previously camera-trapped jaguars. Because there had been several jaguar sightings along this road during the previous months (including multiple 2-animal sightings) as well as vocalizing, this animal’s behavior may have been territorial in nature.

Camera-trapping results-
During a 13-month period (1993-1994), 11 jaguar photographs were taken less than 500 m from Chan Chich Lodge. Seven photographs depicted one female, determined by matching spot patterns. Two individual males were recorded within two months of each other. The remaining two photographs could not be matched to known individuals, although both jaguars appeared smaller and thinner than any of the preceding animals. Thus, it appears that during that period, three to five individual jaguars used the area immediately surrounding the Lodge. The same period yielded 17 puma and 254 ocelot photographs. No attempt has been made to determine individuals by matching the photographs although certain ocelots became
recognizable after repeated photographing. No margays (*Leopardus wiedii*) were photographed at these locations.

Year-long camera-trapping in second growth fragments in Gallon Jug cornfield areas resulted in two jaguar photographs in 1997-1998. Neither photograph showed enough detail to sex the animals. There were four photographs of pumas in the fragments and one photograph at the forest site (one appeared to be a subadult; there were no other distinguishing characteristics to allow definitive matches). There was a total of 31 ocelot photographs. Twenty-six photographs of ocelots in the second growth fragments depicted five individuals (a male, two females, two of undetermined sex). Of the 26 ocelot photographs, 10 photographs could not be matched to the previous individuals. Five forest ocelot photographs could not be matched to each other or to the fragment ocelot photographs. Two individual margays were photographed in the forest, one three times. No margays were camera-trapped in the second growth fragments.

In 1998-99, camera-trapping during a one month period in forested habitat typical of the area resulted in 14 jaguar photographs. A male (10 photographs), a female (two photographs), and one jaguar of undetermined sex (two photographs) were depicted. Photographs of these animals could not be matched with any previous jaguar photographs taken either near Chan Chich Lodge or the fragment sites. There were five puma photographs depicting at least three individuals as determined by size differences and scars. No ocelots were camera-trapped and just one margay during the one month span.

*Livestock, agriculture and prey base-

Although only two jaguars were camera-trapped in agricultural areas, there are 27 records of jaguars sighted in or near the agricultural fields and pastures of Gallon Jug. This is explained by the small areas sampled by the camera-traps in densely vegetated second growth fragments in the heart of the cornfields. The camera-traps operated for 13 months whereas the observations in Gallon Jug covered a 9-year span. In all but three cases, jaguars observed in agricultural areas were usually within 50 m of vegetated cover but based on the camera-trapping data, they seldom ventured through exposed fields to second growth “islands.”

Although jaguars have been seen near Gallon Jug livestock no aggressive behavior has been reported nor have there been livestock losses attributed to depredation. The well maintained approximately 150 head of cattle have been resident on the property for approximately 10 years. They are immunized and healthy, fenced, and separated from the forest perimeter by 50 m or more of mown grass intersected by a two lane dirt road. These conditions coincide with recommendations to discourage depredation (Rabinowitz, 1986; Quigley and Crawshaw, 1992). Adjacent Yalbac Ranch and Cattle Company reported no livestock depredation by jaguars although jaguars are frequently seen (M. Plowey, pers. comm.).

Quigley and Crawshaw (1992) also pointed out the need for a healthy prey base so that jaguars are not compelled by hunger to attack livestock. Because Gallon Jug is buffered by other protected areas, bans hunting, and has its own security gates to control access, the prey base appears to be healthy if not abundant. For example, 29 9-km transects gave a mean of 22.5 white-tailed deer observed (28 November 1998 -18 February 1999; C. Miller, unpub. data). In
fact, white-tailed deer and Ocellated Turkey may be seen at any hour of the day, ringing the farm at its margins.

The 809 ha corn fields, in existence for 10 years, have provided a food resource for white-tailed deer, both peccary species, opossum (*Didelphis* spp.), coatimundi (*Nasua narica*), raccoon (*Procyon lotor*), Ocellated Turkey, and Great Curassow (*Crax rubra*). These species feed on growing corn plants as well as spilled corn when the fields are fallow. Gray fox (*Urocyon cinereoargenteus*) and ocelot are common in this area and rodents which thrive in the cornfields (including *Oryzomys palustris*) comprise a major food resource for these species (C. M. Miller, unpub. data).

**DISCUSSION**

With the exception of camera-trap data, the majority of the data examined was anecdotal. Although I made every effort to evaluate and discard suspicious records, the data almost certainly contained some errors in identification or possibly “wishful thinking” on the part of some observers. Even making allowances for misidentifications, the sheer number of sightings argues that jaguars and other felids are present in apparently healthy numbers. This is further reinforced by numerous camera-trapped individuals. Focused research to quantify density and abundance of jaguars would be a valuable next step.

The Gallon Jug property, as well as the neighboring Rio Bravo Conservation Management Area and Yalbac Cattle and Ranch Company, comprise a vast holding of private lands in NW Belize. These private properties are differ from most public parks and reserves in that all are well funded. They represent an apparently unique situation in which jaguars coexist peaceably with agriculture and livestock ranching. Extensive, good quality habitat, a healthy prey base, good livestock husbandry, as well a “live and let live” philosophy probably account for this.

Regular sightings of jaguars in and around an ecotourist facility have proven beneficial by enhancing the wildlife experience guests are likely to have. Even if tourists do not personally encounter a jaguar during their stay, the logbook relates experiences that many others have had. Such accounts enrich the wildlife experience of tourists and encourage repeat visits. With adequate funding and sufficient political will, these conditions could be emulated elsewhere with potentially beneficial consequences for jaguars and other wildlife.

Because of its unique location near the heart of La Selva Maya, the importance of the Gallon Jug area extends well beyond its property lines. From this population source jaguars and other species can potentially disperse throughout La Selva Maya and beyond.
ACKNOWLEDGMENTS

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LITERATURE CITED


