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ASPECTS OF FELID PREDATOR CONTROL AND CONSERVATION IN COSTA RICA

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Abstract: The 2 large felid predators (i.e., jaguars [*Panthera onca*] and mountain lions [*Felis concolor*]) have become rare in Costa Rica and are protected by law. Relatively little is known about these felids. Based on interviews with landowners, we estimate that large felids are being removed from the population, usually because of livestock depredations, at a rate of about 4/year. Resolving problems and assuring the viability of large felid populations will be difficult. A program to conserve large felids could include improved data bases, education programs, use of nonlethal methods, and alternative lethal methods.

Resumen: Los 2 grandes felinos (Jaguars [*Panthera onca*] y leones de montaña [*Felis concolor*]) han venido a convertirse en raros en Costa Rica y son protegidos por la ley. Se conoce relativamente poco acerca de estos felinos. Basado en entrevistas con dueños de tierras, hemos estimado que los grandes felinos son removidos de la población, usualmente por la depredación de ganado, en un promedio de 4 por año. Resolver los problemas y asegurar la viabilidad de la población de grandes felinos será difícil. Un programa para conservar los grandes felinos podría incluir el mejoramiento de datos, programas educativos, uso de métodos no letales, y alternativas de métodos letales.

Key words: conservation, Costa Rica, depredation, felids, jaguar, livestock, mountain lion.

Costa Rica is a Central American country, about 50,000 km² in size, with a population of about 3 million, growing at an annual rate of about 2.6%. It is a land of contrasts with elevations from sea level to $\geq 3,000$ m that include dry scrub forests to lush, wet tropical forests. Major agricultural products include coffee, bananas, and beef. About 50

million pounds of beef are exported each year. The clearing of forest land for agriculture and human habitation has resulted in the loss of about 70% of the forest cover in Costa Rica (Vaughan 1990). Wildlife have numerous important roles in the lives of Latin Americans (Redford and Robinson 1991). Among the diverse fauna are 2 large carnivores: jaguars and mountain lions.

Although these large cats are protected by national and international laws (Swank and Teer 1989, Emmons 1990), they have become very rare. The legal and illegal trade in cat pelts for coats greatly reduced many populations before 1970 (Redford and Robinson 1991). After 1970, populations of large felids were still adversely affected by loss of habitats, declines in prey base, and opportunistic killing (Swank and Teer 1989). Despite a large system of national parks (NP) and preserves, few if any areas can be expected to support viable populations of large felids entirely within their boundaries (Vaughan 1983, 1990).

The large felids depredate a variety of livestock in Costa Rica (Hilje and Monge 1988). Problem cats are eventually killed, legally (by permit) or illegally (Swank and Teer 1989). Conflicts will continue as more forest is cleared and natural prey populations decline from over-harvest or declining habitat (Vaughan 1983). The illegal harvest of game animals (e.g., white-tail deer [*Odocoileus virginianus*] and peccaries [*Tayassu* spp.]) greatly exceeds the legal harvest (Vaughan and Rodriguez 1991).

We interviewed landowners and ranchers across a large part of Costa Rica in May 1990. We sought information on the extent of livestock predation problems, the numbers of problem cats being killed to protect livestock, and the methods used to resolve problems.

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BACKGROUND ON JAGUARS AND MOUNTAIN LIONS IN COSTA RICA

The original range of jaguars has greatly diminished (Swank and Teer 1989). In Costa Rica, they are confined to a few secluded, large primary forest tracts: Santa Rosa NP area (NW), Corcovado NP area (SW), forested volcanic peaks along the axis of the country from the Nicaraguan border to La Tigra, wet forests from La Selva Preserve and Braulio Carrillo NP to the Barra del Colorado National Wildlife Refuge-Tortuguero NP area (NE), and the Talamanca Range (SE) (Vaughan 1983).

Jaguars are territorial, solitary predators that prefer remote areas where they feed on a variety of prey species such as tapirs (*Tapirus bairdii*), deer, sloths (*Choloepus* spp.), armadillos (*Dasyprocta* spp.), peccaries, pacas (*Agouti* spp.), agoutis (*Dasyprocta* spp.), caimans (*Caiman* spp.), and turtles (Rabinowitz and Nottingham 1986, Tewes and Schmidly 1987, Arita et al. 1990, Emmons 1990). Jaguars

have a preference for wet areas and their sign is often seen along watercourses. The territory of an individual covers ≥ 25 km² and there may be 25–30 jaguars in a 250 km² area of adequate habitat (Rabinowitz 1986, Arita et al. 1990). There may be only 150–200 jaguars remaining in Costa Rica (Fitzgerald 1989).

Mountain lions have a much larger range throughout North, Central, and South America than do jaguars. This is due in part to their ability to use a wide array of landscapes. They, too, are territorial and solitary, prefer remote areas with little human disturbance, and feed on a variety of prey species, including pacas, agoutis, brocket deer (*Mazama americana*), and white-tailed deer (Emmons 1990). Although occurring in low densities, mountain lions are widely distributed throughout Costa Rica (Vaughan 1983, Arita et al. 1990). They occur in the areas occupied by jaguars, and in the dry scrub forest lands of the Guanacaste region.

LIVESTOCK PREDATION AND PROBLEM RESOLUTION IN COSTA RICA

Because jaguars and mountain lions occur throughout Costa Rica, we learned of livestock losses almost everywhere we visited. Problems occurred most frequently in the northwest region and on the Caribbean side of Costa Rica. We did not visit the southwestern part of Costa Rica (near Corcovado NP), but we learned later that 1 or 2 large felids are killed there each year. Both species also occur in and near Santa Rosa NP, but we did not learn of any problem animals there. Low densities of cats and the presence of a large protected area may explain this lack of reported problems. The year we give for when a problem cat was killed are from the interviews and should be interpreted as approximate. Furthermore, it appears that most persons could not distinguish between jaguar and mountain lion kills or their sign so we will use a generic term “a problem cat” or a “cat was killed” to mean a jaguar or mountain lion.

We learned of a number of current and past problem cats from the northwestern volcanic peaks (Volcan Orosi and V. Rincon) across to Cano Negro and down to La Tigra. There were several current problem felids killing cattle, horses, and pigs. One jaguar was killed in 1990 after killing about 20 cattle in 1 year (nearby losses of sheep and pigs may have been due to the same cat). Two cats were killed in 1988 near Cano Negro after killing cattle. In about 1986, a cat was trapped and moved. We do not know the fate of that animal; typically, transplanted large felids do not survive (Rabinowitz 1986). Two other young cats were trapped in 1988 and given to La Pacifica Zoo.

On the eastside, both felids and their sign are seen on occasion near La Selva Preserve. One was killed in that area in 1989 after killing many cattle. At least 2 other problem cats were reportedly killed in the area between 1985 and 1990. A cat was killed in 1989 in the northeast (Tortuguero area) after killing pigs. A cat was killed in 1990 south of

Limon after killing cattle along with 2 other cats in 1988. There was a problem cat near Siquilles and near Chirripo that was killing cattle at the time of the survey, but it had not yet been killed. Also, a black (melanistic) cat south of Limon has killed cattle, but has not been killed. Further south, in the Talamanca Range, Indians reported losing pigs to cats, but the cats usually are not killed.

Based on our interviews (that do not represent a complete survey), we can conservatively estimate that ≥ 15 cats (primarily jaguars) have been killed or removed between 1985 and 1990 in the areas that we visited. Undoubtedly, several others have been killed in areas that we did not visit or that were not reported to us. Therefore, we estimate that these large felids are being removed at a minimum rate of about 4/year as a result of livestock depredations. Undoubtedly, other large cats are being lost to disease, accidents, and other causes, but there appears to be no estimates of those population losses or of recruitment. Consequently, it is difficult to assess the effects of this level of losses on the populations. Most of those killed were not taken with a permit, hence are considered illegal kills (Swank and Teer 1989). Swank and Teer (1989) estimated that 12 jaguars had been taken in the past few years with kill permits, but that most cats taken were killed without a permit. It appears that the level of harvest of jaguars that they reported continues in Costa Rica despite protective measures. Nonetheless, it is important to protect landowners from excessive livestock losses (Freese and Saavedra 1991).

Several persons commented that the cats tended to specialize once they begin killing livestock (e.g., killing primarily cattle, or primarily horses, or primarily sheep and goats). It appears, however, that various livestock species being killed in nearby areas in the same relative time frame may have been killed by the same cat. Ranchers also commented that there was often a period of ≥ 20 days between detected livestock kills and noted that livestock kills often followed a period of heavy rains.

METHODS OF PREDATOR RESOLUTION IN COSTA RICA

There are many potential methods to reduce livestock losses to predators, although they vary widely in cost and effectiveness (Table 1). Methods used by the USDA Animal Damage Control Program in California for problem mountain lions included (in decreasing order): dogs/shooting, foot snares, cage traps, and shooting (Schuler 1992). Tully (1991) surveyed station and provincial agencies in North America on the ways that livestock depredations by mountain lions were handled. The most commonly used methods included recreational hunting, special hunts for problem animals, issuing kill permits to landowners with losses, recommending various husbandry practices, using dogs to harass or assist in taking problem animals, providing persons to trap or snare problem animals, or compensating for losses. We documented a variety of methods used

Table 1. Methods and techniques for predation control that have been suggested, tested, or used for various problems (from Fall [1990]).

Physical	Chemical	Biological	Other
Fencing	Toxicant ejectors	Disease	Bounty
Penning	Den fumigants	Parasitism	Fur price
Herders	Toxicant collars	Carrion removal	Compensation
Shed lamb	Single-dose baits	Immunogens	Insurance
Check sheep	Bait stations	Competitive exclusion	
Frightening	Bait collars		
Guard animals	Liquid baits		
Den hunting	Bait posts		
Mechanical ferret	CLOD		
Ground hunting	Smear posts		
Call and shoot	Systemic toxicants		
Hunt with dogs	Aversive agents		
Aerial hunting	Repellents		
Trapping	Sterilants		
Snaring			

to deal with problem cats in Costa Rica, but based on our interviews, lethal methods are the more commonly used. Nonlethal methods included trapping and relocating, or donation to a zoo or animal park, harassing with dogs, practicing better livestock husbandry, and allowing some livestock losses. Lethal methods include shooting at the site of the carcass or staked dog or livestock, poisoning the carcass with strychnine or other toxicants, hiring a professional shooter or hunter, and using poisoned arrows.

Because of their protected status in Costa Rica, ranchers suffering livestock losses are required to obtain a permit to kill a problem jaguar or mountain lion. It appears that few ranchers do this, however, preferring to deal with the problem informally as they see fit. Additionally, the use of poisons applied to carcasses is illegal because of risk to nontarget animals. Several of the above methods are not very effective: dogs dispatched after jaguars are commonly killed by the cat, unlike mountain lions that can be treed by dogs and then shot or tranquilized for removal; relocated jaguars usually return to their former area or merely resume killing livestock in or near the relocation area (Rabinowitz 1986). We were surprised to learn that landowners and ranchers did not know about leghold traps and snares; apparently, there are few experienced trappers in Costa Rica. This was especially surprising given what appears to be increasing losses of calves to coyotes (*Canis latrans*), which have become common in Costa Rica (Hilje and Monge 1988).

ADDITIONAL OR NEW APPROACHES TO PROBLEM RESOLUTION

Assuring the viability of jaguar and mountain lion populations in Costa Rica will be difficult because of the continued loss of individual cats and because of changes in habitat and native prey base due to the expanding human population and land uses. A relatively undisturbed area of 4,000 km² may be necessary to assure the production of a relatively

few jaguar young each year (Seymour 1989). It should be possible to reduce the opportunistic killing of jaguars and mountain lions. More research is needed to document densities, distributions, habitat use, and mortality causes and rates of these felids. Additionally, a program could be developed that would consider other options.

1. Environmental education, covering the importance of natural ecosystems, the diversity of native flora and fauna, species identification, predator-prey relationships, the importance of habitats and key elements to wildlife, rules and regulations related to wildlife and other natural resources. Ecotourism could be a part of this program and could help produce much needed funds.
2. Extension service publications, including the diversity of approaches to problem resolution emphasizing nonlethal approaches; information on suppliers of equipment, information, and expertise; development of a decision key that would help landowners and ranchers identify their problem and to put the situation and alternatives in perspective.
3. Training programs for resource management staff in wildlife law enforcement; rules, regulations and alternatives; the identification of predator sign and kill characteristics; and conflict resolution.
4. A buffer zone system around major national parks and preserves with altered rules and regulations for those areas. If possible, forested corridors should be included between parks and preserves for felid dispersal.
5. A compensation system, possibly as part of the buffer zone system, for livestock losses to felids.
6. Better livestock husbandry practices (lambling/calving near human habitations, use of guarding dogs, shepherds, and carcass removal).
7. Trap and snare use (requires trained personnel)

that would allow nontarget animals to be released.

8. An auction/permit system for big game hunters to remove problem cats or excess males that are prone to becoming problem animals. This system could provide funds that could be used to administer a buffer zone or compensation system, for research projects, method development, publications, or habitat acquisition.

CONCLUSIONS

There is a growing concern about the loss of biodiversity in the world. The large carnivores are among the most vulnerable species because of their large habitat requirements and conflicts with humans. Long-term prospects for their conservation in many areas are not good: the problems that must overcome to maintain biodiversity are numerous and immense (Vaughan 1990, Freese and Saavedra 1991). Nonetheless, progress is being made in many areas such as sustainable, ecologically sound development; the creation of large parks or preserves; sustainable harvest programs for key species; species-specific management plans; and captive breeding programs. We are hopeful that with foresight and careful management, the large felids can remain as viable elements of the biodiversity of some Central and South American countries while keeping conflicts with other resources and land uses at an acceptable level.

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