Economic Incentives for Management of Venezuelan Caiman

JOHN THORBJARNARSON* AND ALVARO VELASCO†

†PROFAUNA, Ed. Camejo, Entrada Oeste, Mezzanina, Centro Simon Bolivar, Caracas 1010, Venezuela

Abstract: In Venezuela, the harvest of spectacled caiman (Caiman crocodilus) has generated significant economic benefits for citizens and the government wildlife department. Between 1983 and 1995 more than 1 million caiman were harvested, with an export value in excess of $US 115 million. Although limited survey data restrict quantitative comparisons, most indications suggest that the harvest has been within sustainable limits. Hunting is conducted on private lands in the central Venezuelan plains where caiman populations benefit from cattle ranching management activities, particularly the construction of dry-season water holes. For ranchers, caiman hunting produces a high return on investment, but the overall earnings are small when compared to those produced by cattle. Caiman are mostly a quick and easy source of income that complements cattle ranching, and there is little incentive to actively manage caiman populations. The only evidence that the income from caiman harvests generates economic incentives to protect caiman populations is that landowners sold the skins of caiman illegally hunted in other areas, so as not to reduce their own caiman populations and possibly diminish future hunting quotas. There is no evidence that caiman harvesting generates economic incentives to protect natural habitats, because caiman benefit from human alteration of savanna habitats associated with the much more economically important cattle ranching activities. Recent changes in how hunting quotas are assigned have reduced economic incentives for landowners to protect caiman populations, but the changes have made the quota-setting procedure simpler. One of the greatest conservation benefits of the program has been its ability to generate operating funds for the traditionally cash-strapped government wildlife agency through a variety of taxes and user fees. Due to a recent government re-structuring, however, program proceeds will now go to the central treasury and will no longer benefit wildlife management programs.

Incentivos Económicos para el Manejo del Caimán de Venezuela

Resumen: En Venezuela, las cosechas de baba (Caiman crocodilus) han generado beneficios económicos significativos tanto para ciudadanos como para el departamento gubernamental de vida silvestre. Entre 1983 y 1995 más de un millón de babas fueron cosechados con un valor de exportación de más de 115 millones de dólares. Aunque los datos de los estudios son limitados y restringen comparaciones cuantitativas, la mayoría de los indicadores surgen que las cosechas han estado dentro de límites sustentables. La caza es llevada a cabo en propiedades privadas de la planicie central venezolana, donde las poblaciones de babas se benefician de las actividades de manejo de ganado, particularmente de la construcción de pozos de agua para la temporada de seca. Para los rancheros la caza de babas produce un alto retorno en la inversión, pero las ganancias generales son pequeñas cuando se compara con las del ganado. Las babas son mayormente vistas como rápidas y fáciles fuentes de recursos que complementan la ganadería y hay muy pocos incentivos para manejar activamente las poblaciones de babas. La única evidencia de que las ganancias generadas por babas genera un incentivo económico para proteger poblaciones de babas es que los propietarios de tierras venden pieles ilegalmente cazadas en otras áreas, para así no reducir sus propias poblaciones de babas (y posiblemente disminuir futuras cuotas de caza). No hay evidencia de que las cosechas de babas generan incentivos

Paper submitted February 5, 1998; revised manuscript accepted September 21, 1998.
Worldwide, the commercial use of wildlife has been conducted largely on a nonsustainable basis for the purpose of short-term economic gain. In recent years attempts have been made to harvest wildlife on a sustainable basis as part of species management programs, and the sustainable use of wildlife has been promoted as a tool for conservation based on the premise that economic incentives will bolster support for conservation efforts. The ideas surrounding sustainable use have generated considerable debate and much skepticism (Geist 1988; Noss 1991). Proponents argue that having wildlife pay for its own conservation is practical given the accelerating pressures on wildlife populations and the limited funds available for their conservation. For wildlife, two of the most frequently used arguments in favor of commercial management approaches are that (1) they generate economic incentives for the protection of wild populations of the species in question, and (2) these same economic factors create incentives for protecting the harvested species’ habitat. Nevertheless, instilling wildlife populations with commercial value will not lead to their conservation unless conditions are met (Robinson 1993) to overcome the shortsightedness that has characterized the history of natural resource use (Caughley & Gunn 1996).

Crocodilians, with high reproductive rates and valuable skins, qualify as animals for which sustainable use management has considerable potential, and over the last 20 years sustainable use programs for crocodilians have been widespread (Jenkins 1994; Ross 1997). Programs involving species such as the Nile crocodile (Crocodylus niloticus) and American alligator (Alligator mississippiensis) have been held up as examples of successful sustainable use (Messel 1991; Messel & Ross 1992; Joanen et al. 1997).

Since the late 1960s, the majority of crocodilian skins traded worldwide have come from South American caiman. Reported numbers of caiman skins in trade (derived from reports of the Convention on International Trade in Endangered Species [CITES], so representing minimum values) since the 1980s have varied from just under 300,000 per year to over 1.4 million per year (Collins & Luxmoore 1996). Although past harvests have been largely unregulated, over the last 10 years sustainable management of two species of caiman (Caiman crocodilus and C. yacare) has become more common. The first of these programs was initiated by Venezuela in 1983 and has been viewed widely as a pioneering effort to use sustainably an economically valuable species of crocodilian. We examined the caiman program of Venezuela and analyzed the role that economic incentives play in the conservation of wild caiman populations and their habitat.

Venezuelan Caiman Management Program

The spectacled caiman (Caiman crocodilus) is a small to medium-sized species with a maximum reported length of 2.5 m (ca. 1.8 m in females) (Brazaitis 1973; Medem 1981). The ecology of the caiman has been well studied in Venezuela (Staton & Dixon 1975, 1977; Gorzula 1978; Seijas & Ramos 1980; Ayarzagüena 1983; Thorbjarnarson 1991, 1993a, 1993b, 1994, 1995), and these studies have provided the scientific basis for Venezuela’s caiman management program. In 1983 an experimental caiman harvest was begun in the central Venezuelan plains (Llanos). The primary objective of the harvest is the sale of caiman skins, and the secondary objective is the sale of meat. The program is based on a series of 30 legal resolutions published in the government’s official gazette (Velasco & DeScola 1997). Ten of these resolutions contain regulations for program operations, whereas the others deal with temporary changes in the program timetable. The regulations established a series of legal requirements and technical requirements (pertaining to the size and composition of the caiman populations) for landowners to meet before they can harvest caiman.

Harvests are restricted to private lands in five states in the central Llanos (Apure, Barinas, Cojedes, Guárico, and Portuguesa). Landowners apply to the Venezuelan management authority (MARNR) for permits to hunt caiman. The MARNR uses an estimate of the caiman population size on the private landholding to decide if harvesting is feasible and, if so, to determine the number of caiman
that can be taken. Harvests are limited to caiman at least 1.8 m total length, which are almost exclusively adult males.

Hunting is restricted to several months during the annual dry season (January-April), when caiman are easily located, and prior to the annual breeding season. In most areas the caiman are captured at night with a harpoon. Because the ventral scales of caiman are heavily ossified, only the lateral body scales (flanks), leg, and lateral tail sections are preserved by salting. Before 1992 the salted meat was sold locally, and its commercial value was small compared to that of the skin. After 1992 some of the meat was exported frozen, but this practice was discontinued in 1997. We focus entirely on the sale of caiman skin.

Before being transported off the property where they were hunted, caiman hides and meat are marked with uniquely numbered plastic tags provided by MARNR. The tags remain attached to the skins until they reach the tanners. Tanners are allowed to remove the tags because they maintain that the tags damage skins during tanning. Prior to export in a semi-tanned (crust) state, all skins are re-tagged to comply with the CITES Universal Tagging Resolution (CITES 1992).

Setting of Harvest Quotas

The caiman harvest began in 1983 as a relatively small, experimental program. From the initial figure of 50 hunting permits in 1983, the program peaked in 1989, when 560 permits were issued. The numbers of caiman harvested on an annual basis increased from 2319 in 1983 to 231,453 in 1985 (Fig. 1). Following a 1-year ban on hunting in 1986, implemented due to reported irregularities in the program and to allow evaluation of the status of the wild caiman population, the program entered a period of moderately stable harvests (85,000–165,000) between 1987 and 1991. After a drop in skin prices the harvest was reduced greatly in 1992, but harvest size subsequently increased slowly. Another ban on hunting was authorized in 1996, due to an overstock of skins in Venezuela and the desire to census caiman populations without interference from hunting activities. The total number of caiman legally harvested from 1983 through 1995 was 1,043,874.

Initially, harvest quotas were established based on estimates of the caiman population made by government personnel for each ranch requesting a permit (MARNR 1986). Initial harvest quotas were based on the estimated caiman population and a sliding scale of harvest rates (8–15% of the total population), which was a function of the size of the property. Early population estimates were based on diurnal counts, but in 1988 more accurate, nocturnal spotlight counts were made. In 1985 and 1987 the harvest rate was lowered to 7% of the total nonhatchling population (estimated caiman population excluding young-of-the-year). Beginning in 1988 the harvest quota was based only on the number of caiman larger than 1.8 m total length, with the figure ranging from 20% to 25% of this legally harvestable subset of the population (Quero de Peña 1993). These harvest quotas, which include only large adult males, are generally viewed as conservative and likely to result in a sustainable harvest (Velasco et al. 1995).

As the number of permit requests grew, it became increasingly impractical for MARNR to conduct the census work. A major change was initiated in 1989 when landowners were required to hire individuals trained and accredited by MARNR to carry out the censuses and to report their findings to MARNR in the form of technical reports. Many of the individuals were poorly trained and did not perform censuses adequately (evident in high densities or disproportionate percentages of adult male caiman; Colegio de Egresados de Ciencias 1990), resulting in low-quality technical reports (Medina 1990; Useche 1990; Velasco & Ayarzagüena 1995). As a result, MARNR again changed its population estimation procedure in

---

**Figure 1. Annual totals of caiman harvested in the Venezuelan Llanos, 1983–1995.**
1993. The number of harvested caiman is now calculated from average values of caiman density and population size-class structure in each of seven ecological regions within the Venezuelan Llanos (Velasco & DeSola 1997). These values are based on MARNR censuses carried out during the dry seasons of 1991–1992 and 1995–1996.

Economic Value of the Harvest

SKIN PRICES

Prices paid (Venezuelan Bolivars) to landowners by tanners or skin dealers have increased steadily, with the exception of a brief period during the early 1990s (Fig. 2; Thorbjarnarson & Velasco 1998). Part of this increase was a result of a highly inflationary economy in Venezuela (Espinoza 1994), and skin prices in terms of U.S. dollars actually fell during the early 1990s (Fig. 2). The export value of tanned caiman skins (measured as $US per square foot of tanned skin) increased steadily through the early 1990s, then fell dramatically in 1991–1992 (Fig. 3; Quero de Peña et al. 1996).

Estimates of the export value of tanned skins were calculated from the number of skins exported, and the mean export price of tanned skins for that year (Fig. 4; Thorbjarnarson & Velasco 1998). The export value of skins increased through the 1980s, reaching a peak of $26 million in 1990. Following the drop in skin prices in 1991 and reduced harvest levels, export earnings fell. The estimated total export value of caiman skins from 1983 to 1994 was $US 115,980,966.

PRIVATE-SECTOR EARNINGS

Several analyses have examined the value of the harvest program to the various participating groups. At the level of raw, untanned skins (prior to sale to tanners), Espinoza (1994) found that landowners reaped the largest benefits, with 73% of the proceeds. But significant earnings accrued to the hunters (16%), MARNR (6%), and biologists or technicians hired to census the caiman population (4%). By quantifying the present worth of the benefits and costs of caiman hunting to ranchers, Espinoza (1994) assessed the economic value of caiman hunting to landowners. For a sample of 10 ranches between 1988 and 1993, caiman ranching was clearly a lucrative business, with a mean economic benefit-cost ratio ranging from a low of 3.24 to a high of 5.49 (Espinoza 1994).

Other economic analyses have been based on the commercial value of exported, partially tanned skins.
Thorbjarnarson (1991) used data from Rivero Blanco (1985) to estimate the percentage of the export value of caiman products that went to ranch employees and hunters (10.4%), land owners (45.3%), tannery employees (29.6%), and tannery administration (14.8%). For the 1989 harvests, Colegio de Egresados de Ciencias (1990) estimated that 0.5% of the program’s proceeds went to professionals (biologists and trained technicians) who conducted the caiman population surveys on the ranches, 1.8% to the hunters, 3.7% to MARNR, 24.5% to the landowners, and 69.5% to the tanners. The percentage that went to tanners may be an overestimate because an excessively high export value of $65 per square foot for crusted skins was used in the calculations. Both studies agreed, however, that a major portion of the proceeds of the harvest went to tanners, which to a degree is a reflection of the high costs of tanning caiman skins.

Hoogesteijn and Chapman (1997) evaluated the economic benefits of harvesting caiman and capybara (Hydrochaeris hydrochaeris) for ranches in the Llanos. Based on mean values of density (0.241 caiman/ha), a harvest of 7%, and a mean price of $US 53 per caiman, they estimated the annual value of the caiman harvest to be equivalent to $US 0.89/ha (Hoogesteijn & Chapman 1997). Comparative values for cattle ranching varied depending on the type of cattle management used but were 7.9–26.4 times greater (Hoogesteijn & Chapman 1997). Because regional values for calculating the harvest quotas vary, the economic benefits of harvesting vary according to the location of the ranch in any one of the seven ecological regions, defined by MARNR. To estimate the value of caiman to landowners in different parts of the Llanos, we calculated the mean number of caiman that could be harvested per hectare of land in the harvest area in each ecological region (Table 1; Velasco & Ayarzagüena 1995). These calculations show that in some cases the economic benefits can vary by more than an order of magnitude. Overall earnings are small, however, compared to those provided by cattle. The mean annual income from the sale of caiman skins for an average-sized ranch (9435 ha) was estimated to be $US 2114 (Table 1). Based on data reported in Hoogesteijn and Chapman (1997), a similar-sized ranch would earn $66,800–$223,043 from cattle over 1 year.

Table 1. Value ($US) of caiman harvest per hectare and gross income for average-sized ranches in each of the program’s seven ecological regions.*

<table>
<thead>
<tr>
<th>Ecological region</th>
<th>Harvest area (ha)</th>
<th>Mean ranch size (ha)</th>
<th>Density (no./ha)</th>
<th>&gt;1.8 m (%1 year old)</th>
<th>Number harvestable</th>
<th>B$/ha</th>
<th>$US/ha</th>
<th>Gross income $US/ranch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alto Apure</td>
<td>1,448,062</td>
<td>6,323</td>
<td>0.215</td>
<td>0.240</td>
<td>0.0101</td>
<td>123.84</td>
<td>0.2553</td>
<td>1614</td>
</tr>
<tr>
<td>Bajo Apure</td>
<td>285,823</td>
<td>6,352</td>
<td>0.392</td>
<td>0.233</td>
<td>0.0183</td>
<td>219.21</td>
<td>0.4520</td>
<td>2871</td>
</tr>
<tr>
<td>Aguas Claras</td>
<td>694,802</td>
<td>12,867</td>
<td>0.090</td>
<td>0.207</td>
<td>0.0186</td>
<td>44.71</td>
<td>0.0922</td>
<td>1186</td>
</tr>
<tr>
<td>Cajon de Arauca</td>
<td>144,652</td>
<td>6,437</td>
<td>0.190</td>
<td>0.244</td>
<td>0.0093</td>
<td>111.26</td>
<td>0.2294</td>
<td>2212</td>
</tr>
<tr>
<td>Guárico</td>
<td>841,656</td>
<td>17,535</td>
<td>0.127</td>
<td>0.070</td>
<td>0.0089</td>
<td>21.54</td>
<td>0.0440</td>
<td>772</td>
</tr>
<tr>
<td>Hoya Arismendi</td>
<td>597,648</td>
<td>4,300</td>
<td>0.345</td>
<td>0.230</td>
<td>0.0159</td>
<td>190.44</td>
<td>0.3927</td>
<td>1689</td>
</tr>
<tr>
<td>Llanos Boscosos</td>
<td>992,544</td>
<td>9,023</td>
<td>0.115</td>
<td>0.181</td>
<td>0.0042</td>
<td>49.91</td>
<td>0.1029</td>
<td>928</td>
</tr>
<tr>
<td>Mean</td>
<td>9,435</td>
<td>0.211</td>
<td>0.201</td>
<td>0.0453</td>
<td>0.0091</td>
<td>108.67</td>
<td>0.2241</td>
<td>2114</td>
</tr>
</tbody>
</table>

*Based on an average value of 12,000 Bolivars (B$) per skin. Size of harvested area and mean ranch size are for the 1997 harvest. Meat sales are not included. The number of harvestable caiman is based on the density of caiman (>1 year old), the percentage of the population longer than 1.8 m, and a harvest rate of 20% of caiman longer than 1.8 m.
autonomous department within MARNR whose responsibility was the management and conservation of wildlife. The actual amounts charged landowners and tanners was set in the various governmental decrees and are increased annually according to the official level of inflation.

The creation of PROFAUNA and its ability to charge fees directly to program users provided a mechanism by which the harvest program could fund wildlife management activities. Revenue from the caiman program was substantial and to a large degree underwrote PROFAUNA activities, not only for caiman but for all wildlife programs nationwide. The 1989 caiman harvest contributed 40.8 million Bolivars (US$ 1.1 million) to PROFAUNA’s income (Colegio de Egresados de Ciencias 1990). The director of PROFAUNA (J. L. Mendez Arocha, in Colomine & Ramos 1991) reported that in 1989 the government received 44 million Bolivars (US$ 1.26 million). Based on information on the size of hunting quotas and the annual fees charged to both landowners and tanners, Thorbjarnarson and Velasco (1998) calculated that PROFAUNA’s average annual income from the caiman program (1989–1995) was US$ 694,199 (Fig. 5).

Population Monitoring and Harvest Sustainability

The monitoring of Venezuelan caiman populations has been carried out sporadically but has suffered from a lack of clearly defined objectives and standardization (Thorbjarnarson & Velasco 1998). The MARNR conducted broad surveys of the caiman population in the Llanos in 1982 (Seijas 1984), 1986–1987 (MARNR 1987), 1991 (Velasco & Ayarzagüena 1995), and 1995–1996 (Velasco et al. 1997). The first three censuses were of variable quality, however, because they used different techniques, which makes quantitative comparisons impossible.

Despite the lack of good survey data, most indications suggest that the harvest has been within sustainable limits. Based on the most recent survey data for population and size-class composition (Velasco et al. 1997a), a conservative harvest level of 20% of the caiman larger than 1.8 m long would result in an annual production of 60,000–76,000 skins (Thorbjarnarson & Velasco 1998). Although it is clear that in many years the reported harvest greatly exceeded these values (Fig. 1), the average annual harvest from 1983–1995 (80,298) was only slightly higher. Although the number of caiman killed exceeds the number reported (based on skins sold to tanners) by an unknown amount, recent population surveys indicate that spectacled caiman remain abundant in most areas, and population densities and population size-class structures are similar in hunted and unhunted areas (Velasco et al. 1997b). Measurements of the size of skins purchased by tanners over the period 1988–1995 have shown no trend toward a reduction in size of harvested animals (Velasco & De Sola 1997).

Discussion

The Venezuelan caiman harvest has been a clear success in terms of economic development. Since its inception in 1983, the managed caiman harvest has generated significant revenues for skin buyers, tanners, and landowners. Ranch employees also benefited, and the program provided seasonal employment opportunities for biologists and other individuals trained in caiman census techniques. But, what are the conservation consequences of the program? Here we discuss the effects of the program on the conservation of caiman populations, protection of habitat, and generation of funds for the government wildlife agency. We also examine recent changes in how harvest quotas are established and comment on the need for economic planning and the dependency of the program on external markets.

Program Incentives to Protect Caiman

Among the strongest arguments for commercial management of wildlife is that it generates economic incentives to protect the harvested species. Although the profitability of

![Figure 5. Estimated government income from fees and taxes charged to caiman program participants. Beginning in 1989, over 95% of the income went directly to PROFAUNA.](image-url)
caiman hunting for landowners was reduced by a highly inflationary economy, it nevertheless generated a high rate of return on the investment (Espinoza 1994). During the late 1980s, many of the details of obtaining permits and harvesting the caiman were taken care of by tanners, or skin buyers, and little involvement was required of landowners. So although the overall earnings are minor compared to those of most cattle ranching operations, caiman harvesting is seen as a lucrative, short-term activity.

Ironically, the best indication of the value of caiman to ranchers comes from illegal hunting. Throughout the history of the program, control of illegal hunting has been one of the most problematic aspects of the harvest (Thorbjarnarson & Velasco 1998). The most widely reported problem was that of caiman hunted outside legally authorized ranches and outside the normal hunting season (Medina 1990; Colomine & Ramos 1991), which were then sold to landowners with hunting permits. Much of the incentive for this trade came from the desire of the landowners not to reduce the size of the caiman population on their property, which they thought would jeopardize or reduce the size of future harvests. Thus, caiman were illegally hunted throughout the year in a variety of locations to sell to landowners with legal hunting permits. Although these caiman skins were illegal, these infractions did not actually increase the total number of caiman killed; they only changed the areas from which they were harvested. Because of a tendency to take these illegal skins from specific areas of public land or poorly protected private land, the illegal trade resulted in an over-harvest in these regions but reduced the number killed on many of the ranches with hunting permits. The illegal trade was diminished in the 1990s due to tighter program controls, a reduced overall harvest, and a change in the way harvest quotas were assigned.

Other factors, however, may have resulted in larger numbers of caiman being killed than is allowed under the authorized quotas. In Venezuela the price paid for skins is determined solely by size, with larger skins commanding higher prices. In order to fill hunting quotas as quickly as possible, hunters will take small animals (near the lower limit of 1.8 m) but may throw these skins out if larger ones become available. Also, during hunting some animals escape and die without being skinned. During the early years of the program, a significant proportion of skins were lost due to poor preservation and were replaced with other skins. Also, tanners are allowed to remove the skin tags, creating a mechanism whereby smaller skins could be cut up and exported in pieces (which are not controlled) and replaced by larger, illegal skins. The combination of these factors resulted in many more caiman being killed than were permitted under PROFAUNA regulations, which indicates the need for conservative harvest quotas.

Has the harvest program directly benefited caiman populations? For a number of species of large crocodilians, economic incentives are seen as a way to generate acceptance of these potentially dangerous animals by the general populace (Webb & Manolis 1993). The spectacled caiman, however, is a small, nonthreatening crocodilian that is widely viewed as a benign species. Although residents of the Llanos will kill the much larger Orinoco crocodile (Crocodileus intermedius) because of a perceived threat to their well-being, this is not the case with caiman. It may be argued that if a legal harvest had not been initiated, some illegal killing would have occurred to supply overseas markets with skins. It is not conceivable, however, that this would have exceeded the number killed as a result of the harvest program. In all probability, in the absence of the caiman management program, caiman populations would be at least as large as they are today.

Program Incentives for Habitat Preservation

Aside from creating incentives to protect the animals themselves, among the postulated conservation benefits of crocodilian harvest management programs has been the generation of economic incentives to protect habitat. In the Venezuelan Llanos, this argument is not applicable because caiman harvesting was done within the context of cattle ranching, the dominant economic activity of the region. Much "natural" Llanos savanna habitat, with a dearth of dry-season wetlands, is not particularly favorable for caiman. Habitat improvements for cattle ranching have greatly benefited caiman populations, however, which are most limited by the availability of water during the annual dry season. The creation of stock ponds by damming streams or building windmills has increased the availability of savanna wetlands during the critical 4-month dry season. Other human activities, particularly road-building, have also improved caiman habitat by creating large numbers of borrow-pits that fill with water and form dry-season habitat. Although caiman have benefited tremendously from human alteration of the Llanos, none of these activities were conducted specifically for caiman. This was clearly demonstrated when, as part of the process of applying for hunting permits after 1988, landowners were required to submit a management plan describing actions taken to nurture caiman populations on their property, including habitat improvement. No ranchers reported any efforts taken to preserve or "improve" habitat for the benefit of caiman.

As a result of habitat alterations for cattle, caiman populations are now much higher on many ranches than in the past (Thorbjarnarson 1991), in some cases by an order of magnitude or more. Because much natural Llanos habitat is marginal or uninhabitable by caiman, caiman today are to a large extent symbiotes of cattle and people in the Llanos, and the success of the harvest in the Llanos is a result of the compatibility of caiman with cattle...
ranching activities. A consequence of this close relationship with cattle is that harvesting caiman required no real management on the part of cattle ranchers, and caiman were viewed principally as a quick and easy source of income.

Caiman management is subordinate to cattle ranching, but if caiman hunting were combined with harvesting programs for other economically important species and with wildlife ecotourism, the economic benefits for landowners would be increased. Although ecotourism is not an option for most landowners, it can be a lucrative business for certain large ranches with abundant and diverse wildlife (Hoogesteijn & Chapman 1997). The MARNR has also demonstrated interest in developing managed harvest for other species of economically valuable Llanos wildlife, including tegu lizards (Tupeinambis teguirox) and anacondas (Eunectes murinus), both for their skins. Provided that the programs are biologically and economically feasible, commercial management of a suite of species could provide some incentives for landowners to protect natural Llanos landscapes and wildlife communities.

Program Benefits for PROFAUNA

Perhaps the clearest conservation benefit of the harvest has been its ability to generate operating funds for the Venezuelan wildlife department, PROFAUNA. When PROFAUNA was created in 1989, a mechanism was established for program fees to go directly to the wildlife authority. To a large degree, funds from the caiman program underwrote a major expansion of wildlife management activities, the hiring of new personnel, and the opening of regional offices in several parts of the country.

Although the caiman harvest generated funds for PROFAUNA, most of the proceeds were used for projects not related to caiman, and little money was reinvested in the caiman program itself. The failure to reinvest, particularly for control and population monitoring activities, has been one of the program’s major failures. In 1990 a national review committee (CONABABA) recommended that 20% of the program’s income be devoted to establish a national research program to determine the effects of the harvest on the wild population; this recommendation was never acted upon. Monitoring of caiman populations has been especially problematic. When a monitoring effort was finally undertaken in 1991–1992, it was not funded with program income but with money from the European Community and the Japanese government, coordinated through the CITES Secretariat. Only in 1994 were funds for monitoring established by creating a separate fee to be paid by landowners.

Finally, as the result of a major restructuring of the Venezuelan government in 1997–1998, the future of the caiman program and its funding are in doubt. Funds from future caiman harvest will go directly to the central government treasury, and PROFAUNA will be funded by annual appropriations from the federal government, thus perhaps eliminating the strongest potential conservation benefit of the current program.

Consequences of Changes in Hunting Quotas

During the late 1980s the caiman harvest program was criticized for lax controls and lack of population monitoring (Colegio de Egresados de Ciencias 1990; Medina 1990; Colomine & Ramos 1991). Subsequently, in an attempt to simplify and systematize the quota-determining process, the mechanism for assigning harvest quotas was based on more standardized surveys and determined by the size of property and mean regional values of caiman density and size-class structure. Now, hunting quotas and the economic benefits derived from the harvest are not a reflection of the status of the caiman population on a landowner’s property but rather represent mean regional caiman population parameters.

Among the strongest arguments for a sustainable-use program is that it creates a situation in which it makes economic sense to protect both wild animals and their habitat. Although the present system greatly simplifies the procedure for assigning harvest quotas, the unit of management has been changed from the private ranch to the ecological region. Under the present system, landowners can still benefit economically from harvesting caiman, but the economic incentives to protect caiman and their habitat have been diminished. For those landowners who would take steps to protect their caiman, and who as a result have caiman populations with a density and size-class above the regional mean, no extra economic benefits accrue.

Because of the caiman-cattle relationship, however, there is no evidence that economic incentives have led ranchers to take any positive steps to manage or improve their caiman populations. And because one of the major problems in the early program had been claims that some ranches were given high harvest quotas based on poor or made-up survey results, the new system improves the program by making it simpler, more transparent and less open to abuse. Ironically, the new quota-setting procedure represents an improvement for the Venezuelan program partly as a result of the lack of economic incentives for landowners to protect caiman.

Economic Planning and Dependence on External Markets

One of the greatest frailties of the caiman harvest program is its ultimate dependence on external markets for high-priced luxury items made from caiman skins. During the early 1990s, the harvest program changed significantly in response to a major reduction in the price of crocodilian skins on the international market. The drop in skin prices in 1991-1992 was a worldwide event for
all crocodilians traded commercially and was attributed to a number of factors, including low demand for products in Japan, a poor world economy, consumer resistance to wildlife products, a paucity of manufacturing facilities worldwide, an imbalance of production and consumption in the United States and South America, a ban on wildlife trade with Italy, and an oversupply of skins worldwide (Van Jaarsveldt 1992; Woodward et al. 1994). The result was a significant reduction in purchases of crocodilian skins, with major repercussions for crocodilian management programs based on commercial use, including that of Venezuela (Quero de Peña 1993). In Venezuela, prices of crust hides fell almost 40% from 1990 to 1992, and the number of permit requests dropped from a high of 1006 in 1991 to 279 in 1992. In 1991 only three of six tanners were purchasing skins (Gorzula 1991). During this period of low skin prices, many ranches withdrew from the harvest program, and at least one (of seven) Venezuelan tanners went bankrupt. Due to these external market factors, the harvest has been greatly reduced and the corresponding income of landowners, tanners, and PROFAUNA scaled back.

Wildlife management programs based on harvesting are regularly proposed or evaluated based on their biological feasibility, but the history of the Venezuelan program points out the importance of prior economic planning (Thorbjarnarson & Velasco 1998). Models such as that of PROFAUNA, in which program fees go directly to the wildlife management authority, have considerable potential in many developing countries with chronically underfunded wildlife agencies. Nevertheless, commercial harvest programs need to be based on the premise that they will be self-sufficient, that all program activities—particularly administration, control, and population monitoring—will be paid for through fees or taxes charged to program participants. Unfortunately, in the case of programs based on the sale of crocodilian skins, a luxury item sold mostly in Europe, the United States, and Asia, it is extremely difficult if not impossible to make long-term predictions concerning future markets.

Acknowledgments

This study is based on the efforts of a large number of people who have been associated with the Venezuelan caiman harvest program. M. Quero de Peña shared her experience and vision of the caiman program and was the main guiding force behind the program in recent years. Under her direction, the program is currently operated by R. De Sola, E. Roa, M. Silva, and A. Ochoa. T. and C. Blohm made it possible for J.T. to work in Venezuela over a 13-year period. Invaluable information on a number of topics was provided by T. and C. Blohm, A. Eloy Seijas, S. Guitierrez, P. Azuaje, and M. Denis. Several individuals read this paper in one form or another and provided invaluable comments; they include R. Elsey, E. Espinoza, A. Grajal, F. W. King, J. Robinson, P. Ross, and G. Webb.

Literature Cited


