

REINTRODUCTION OF BLACK HOWLER MONKEYS (*ALOUATTA PIGRA*)  
INTO THE COCKSCOMB BASIN WILDLIFE SANCTUARY, BELIZE

Fred Koontz<sup>1</sup>, Robert Horwich<sup>2</sup>, Ernesto Saqui<sup>3</sup>, Hermelindo Saqui<sup>3</sup>,  
Kenneth Glander<sup>4</sup>, Charles Koontz<sup>1</sup> and Wendy Westrom<sup>1</sup>

<sup>1</sup>Wildlife Conservation Society, Science Resource Center, Bronx, NY 10460

<sup>2</sup>Community Conservation Consultants, RD 1, Box 96, Gay Mills, WI 54631

<sup>3</sup>Belize Audubon Society, 12 Fort Street, Belize City, Belize

<sup>4</sup>Duke University Primate Center, 3705 Erwin Road, Durham, NC 27705

### Introduction

The reintroduction of black howler monkeys (*Alouatta pigra*) into the Cockscomb Basin Wildlife Sanctuary in Belize was considered as a part of a broader effort to conserve the species (Horwich, 1988; Horwich and Lyon, 1990; Horwich et al., 1993; Koontz, 1993). While once thought to be a subspecies of the mantled howler (*A. palliata*), which ranges throughout Central America, increasing morphological, behavioral and genetic evidence indicates that *A. pigra* should be considered as a separate species (Smith, 1970; Horwich 1983). Due to its relatively low numbers and limited range within the Yucatan Peninsula of Mexico, northern Guatemala, and Belize, the species is listed as "threatened" under the Endangered Species Act, Appendix II of CITES, and "insufficiently known" by IUCN (Wolfheim, 1983; IUCN, 1990). Although its overall range continues to shrink and fragment (Horwich and Johnson, 1984, 1986), there apparently are still some healthy, growing populations in Belize (Horwich, pers. obs.).

Black Howler Ecology and Background Information. Black howlers lives in small groups of four to ten individuals, usually with only one or two adult males, one to four adult females, and their progeny. On occasion, single males and females are observed (Horwich, pers. obs.). These single animals might be explained by Glander's (1992) discovery that in the closely related mantled howlers, 79% of the males and 96% of females leave their natal groups, and after dispersal, males spend up to four years and females up to one year as solitaries. In support of this, Bolin (1981) observed young black howler males being forced out of their natal group by dominant males, and new groups formed by heterosexual pairs. Territory size is small, often 1-10 hectares (Horwich and Lyon, 1990). Other details of the species' social biology largely are unknown.

The black howler, like the other five howler species found throughout Central and South America, is one of the most folivorous of New World primates (Eisenberg et al., 1972). Although they lack a modified digestive tract found in many herbivores to accommodate a high cellulose leaf diet (Milton, 1980), all howlers maintain a sluggish lifestyle, resting for much of the day, allowing for microbial digestion' (Milton et al., 1979; Milton, 1980; Milton and McBee, 1983). Black howlers, for example, rest 80% of the day (Horwich and Lyon, 1990). Black howlers consume flowers, leaves, and fruit, specifically selecting new leaves and ripe fruit when available. They are capable, however, of eating mature leaves as well, especially before the main fruit production in April and May (Lyon, pers. obs.). Despite their use of mature leaves, the howlers' food supply is not unlimited, since they feed only on about 20% of the available tree species (Glander, 1977, 1982). Since many tropical plants have strong toxins, howlers are known to feed selectively from specific (individual) trees of poisonous species, which apparently are low in toxins (Glander, 1977). They also choose parts of the trees which have either less toxins or contain important nutrients (e.g. old leaf stems or new leaves) (Glander, 1977).

Black howlers are not confined to undisturbed rain forest as was once thought (e.g. Smith, 1970), but can utilize all successional stages of forest including secondary growth (Horwich and Johnson, 1984). The species is highly arboreal, and does not normally travel on the ground, preferring to use aerial pathways. This arboreality makes natural recolonization of disturbed areas difficult or slow at best, even when impediments to their survival have been removed.

Black Howler Conservation in Belize. Black howlers live in a number of relatively small populations in Belize; a more detailed description of their distribution is not possible, as there has been no complete census taken. Unfortunately, most of these populations are located on private, unprotected lands. Rapid expansion of the citrus industry and other forms of development threaten the black howler's long-term survival chances, both in Belize and throughout its range. One promising population, however, is found on the property of a community of subsistence farmers living along the Belize River in northern Belize. In an attempt to conserve these animals, the Community Baboon Sanctuary (CBS) was established in 1986, as a program that aimed to interweave conservation, education, research and ecotourism on private lands (Horwich 1988, 1990). The population of black howlers at CBS is growing (25 sq km area) and is estimated at 1500 animals (Horwich, pers. obs.).

Since the CBS was on private lands which were not totally protected, and since there were no major howler populations on protected lands in Belize, a reintroduction of black howlers into the Cockscomb Basin Wildlife Sanctuary (CBWS) from source animals taken from CBS (100 km north of CBWS) was considered as early as 1986. It was not until 1991, however, in response to a sudden increase in deforestation in southern Belize and an expansion of the CBWS to 400 sq km, that we renewed our interest in translocating black howlers for reintroduction. Black howlers historically ranged into the Cockscomb Basin until as recently as 1978, when they became locally extinct --- apparently a victim of yellow fever (1957-1959), hurricanes (1961) and over hunting (1963-1978).

There is a wide variety of reasons to relocate animals, from conservation to compassion (Caldecott and Kavanagh, 1983; Campbell, 1980). Although rapid forest destruction may be making primate translocation an unrealistic prospect in many areas of the world (Strum and Southwick, 1986), we believe it is still possible in Belize. Since the basic criteria for reintroduction could be met (IUCN, 1992), and since the species' biology seemed ideal for translocation (e.g. sedentary folivores, small group size and small home ranges), reintroduction by translocating wild-caught black howlers into the Cockscomb Basin seems an appropriate alternative to an unlikely (see below) natural recolonization.

### Reintroduction Goals and Objectives

The primary goal of the reintroduction was to reestablish a *viable* population of black howlers in the Cockscomb Basin Wildlife Sanctuary (near Maya Center, Belize) by translocating founding stock from the Community Baboon Sanctuary (near Bermudian Landing, Belize), so as to enhance the long-term survival of the species by creating a relatively large, protected population in southern Belize. The Cockscomb Basin actually consists of two sub-basins (a smaller "Eastern Basin" and a larger "Western Basin"). The release was proposed for the Eastern Basin, which had easier access and better protection, and where we estimated sufficient habitat for 5,000 howlers. Our primary objective was to release about 60 animals (12 to 15 troops) over a two-year period, into a 25-sq-km area, centered about the park headquarters, in hope that these founders would form the breeding nucleus of a new population.

Secondary aims, included: 1) studying howler monkey responses to translocation (especially survival, dispersal and reproduction), so as to determine if this methodology is an appropriate tool for *Alouatta* conservation; 2) increasing ecotourism in the CBWS by establishing a visible, diurnally active,

primate in the park; 3) training CBWS managers in translocation methods, radio tracking techniques, and scientific study; 4) providing additional financial support for the CBWS and its management authority, the Belize Audubon Society; and 5) increasing public appreciation of wildlife conservation and black howler monkeys.

### Multidisciplinary Approach

The project directors, Robert Horwich, Fred Koontz and Ernesto Saqui believed from the onset that it was necessary to assemble a team of persons drawn from a variety of backgrounds to participate in the reintroduction. The directors shared in all major decision making, but at the same time they brought different skills to the team: Robert Horwich, an authority on black howlers initiated the project, and also has worked in Belize for many years on a variety of conservation projects (including founding the CBS), and thus, served as the project's community liaison person; Ernesto Saqui, CBWS Park Director, coordinated logistics and operations at the release site; and Fred Koontz supervised post-release monitoring, conducted fund raising efforts, and coordinated the overall project administration.

Primary team members, included: wildlife veterinarian, Wendy Westrom; primatologist and howler capture expert, Ken Glander; and CBWS warden, Hermelindo Saqui, who was responsible for radio tracking the monkeys after release. Secondary team members, included: Belize Audubon Society (BAS) Executive Director, Virginia Vasquez; BAS Protected Areas Director, Osmany Salas; Wildlife Conservation Society's General Curator and Mammalogy Chairman, James Doherty; and data analyst and mapping consultant, Charles Koontz. In addition, Belize Principal Forestry Officer (Conservation), Richard Belisle, provided valuable advice concerning government regulations and permitting procedures. Fordham University pre-doctoral ecology students Linde Ostro and Scott Silver joined the research team in 1994. A long list of volunteers provided much needed help, from building release cages to cooking delicious meals for very hungry scientists!

### Pre-Project Activities

Feasibility Study. In March 1991, the project directors conducted a feasibility study on the possibility of reintroducing howlers to CBWS. A survey of howler habitats in the vicinity of Cockscomb Basin found few howlers living there, and a great amount of habitat conversion to citrus plantations was observed to be taking place. One small howler population was noted along the Sittee River, in an area only about 10 km from the northern boundary of the park, but it was concluded that the location made these monkeys unlikely migrants into the Basin because of intervening high areas, > 300 meters, altitudes that seem to be avoided by black howlers (Horwich and Johnson, 1986). Local residents also reported to us that in 1990 two howlers lived for about a year near Maya Center, a village situated 9 km from the park's eastern boundary, and these monkeys were thought to have dispersed from the same small population along the Sittee River by outskirting the high Cockscomb Basin's mountain perimeter. These two animals eventually disappeared; one animal was killed by villagers, the other moved east, away from the Basin (E. Saqui, pers. obs.).

No other black howlers have been seen inside the Basin since 1978 (E. Saqui, pers. obs.; Kamstra, 1987). Over hunting, the most likely major factor for the local extinction of howlers in the Basin, has largely been controlled since the establishment of the Sanctuary; yellow fever has not been reported in the area for many years (E. Saqui, pers. obs.). Hurricane risk remains, but a howler population in a new location will add to the overall chances that the species will survive any severe storms hitting Belize in the future. During the feasibility study, discussions with Belizean wildlife officials indicated that the government would support a reintroduction project.

Choice of Release Site. Evaluation of the release site (CBWS) revealed that it was an excellent location for a reintroduction, because: 1) it is within the historic range of the species; 2) it is relatively large and well protected; 3) no other primate species is living in the Eastern Basin (minimizing disease transmission risk); 4) the park is surrounded by a perimeter of mountains (minimizing long dispersal risk); 5) park wardens are available for long-term monitoring of the released monkeys; 6) vehicles can get to within several km of the release sites; and 7) park headquarters includes lodging and radio communication facilities for the researchers, and a trail system for ready access into the forest. A 5 km by 5 km study area was established (later expanded to 7 km by 5 km), centered about the park headquarters, which included mapping of 20 km of trails, and marking over 300 trees with location markers, so that radio tracking positions could be accurately fixed.

A phenology study conducted at CBWS by the team between February 1991 and January 1992 indicated that there was no sharply delineated seasonality in fruiting patterns, but that the month of May seemed to be a time of somewhat greater amounts of fruits. For this reason, and the fact that the roads are most passable during the dry season (January - May), the team decided that the translocations should take place during May. As part of the phenology study, the team also estimated that about 60% of the food species that are present at CBS (source of the animals) were also found at CBWS.

Availability of Suitable Release Stock. Black howlers were captured about 100 km north of the Cockscomb Basin release site, within the Community Baboon Sanctuary, along the Belize River between the villages of Big Falls and Flowers Bank. Sixty-five animals from 14 troops were captured between May 1992 and May 1994 (62 of these animals survived and were released, see below). Animals were selected so as to sample (perhaps reflecting a genetic gradient) from along the Belize River's entire 7 km length within the CBS. Specifically: May 1992, 14 howlers were captured in the center of the CBS, near Bermudian Landing and Double Head Cabbage; May 1993, 25 monkeys were translocated from the northern boundary of the CBS, near Flowers Bank; and May 1994, 26 animals were removed from the CBS's southern boundary, near Big Falls. Removal of 65 animals over a two-year period from a population of 1500 animals (estimated growing at 8-10 % per year) was judged by the team and local wildlife managers as not causing any harm to the source population.

Legal Activities and Socio-economic Considerations. Prior to the capture of the howlers permission for the reintroduction was obtained from: 1) the Belizean Ministry of Natural Resources; 2) the CBS governing board and local village representatives; and 3) the Belize Audubon Society, the overseers of the CBWS. In addition, to import blood samples into the United States for analysis, permits were required from the Center for Disease Control, Department of Interior, CITES (import and export), and the US Public Health Service was informed. As part of the pre-project development, the directors discussed with the Belize Audubon Society and the CBS managers ways for the project to hire local persons, so as to provide an economic benefit to the region. It was agreed that administrative costs associated with the project incurred by the Belize Audubon Society would be paid for from project money, and the yearly salary of the CBWS warden responsible for monitoring the monkeys would be charged to the reintroduction program.

The three-year budget for the project was approximately \$90,000.00. This translates into a "cost per reintroduced monkey" of \$1452.00. This figure includes all team expenses for travel and lodging, and all supplies and equipment, including the cost of the radio telemetry required for post-release monitoring. The budget included salaries for most of the local staff, but the salaries of US-based team members were donated by their respective institutions. Helicopter time was kindly donated in 1992 and 1993 by the British Royal Air Force. Funding for the project was provided by supporters of the Wildlife Conservation Society.

Veterinary Concerns. It has been suggested by many (e.g. Strum and Southwick, 1986) that if translocated animals are held in holding pens prior to being set free ("soft release") they are more likely to stay in the release area, than if immediately set at liberty ("hard release"). Surprisingly, perhaps, this relationship was not supported in a review survey on translocation conducted by Griffith et al. (1989). Nevertheless, the team wanted to release most of the howlers in a soft manner, and to try a few hard releases for research purposes. Soft releases are difficult for this species, however, because howler monkeys (like most folivorous primates) historically have fared poorly during acclimation to captivity (Meritt, 1982). Therefore, the team decided to hold the monkeys at the release site for no more than three days. The purpose for holding was simply to allow the animals time to recover from anesthesia, to be rehydrated, and for us to observe the animals' overt behavior. Of the 14 troops translocated, 10 were released softly (24 to 72 hours after capture) and four were hard released (less than eight hours after capture). With this limited data set, there were no differences in the two techniques, as far as the animals' ultimate survival, group cohesion or dispersal distance. Yet, the team still recommends soft releases because they allow for appropriate veterinary response if any unforeseen problems occur.

A previous translocation of mantled howler monkeys suffered losses when the new monkeys were attacked by residents very soon after their release (de Vries, 1991). Therefore, the team released the black howlers of this study in their own social groups (12 of 14 troops were captured as complete social groups, two were only partially complete due to difficult capture conditions) at a distance of 700 - 1000 m to the nearest neighboring troop. This method probably was especially important in Year Two and Year Three, after some howlers were already established as residents (recall that in Year One there were no howlers in the Park).

At the time of capture, all monkeys were: 1) given complete physical exams; 2) measured, weighed and aged by dental tooth wear patterns; 3) marked for permanent identification with transponder chips and colored ankle bracelets; 4) fitted with radio telemetry collars (adults only); 5) treated for minor wounds; 6) bled for later hematology, serum chemistries, nutritional variables (e.g. minerals and vitamins), genetic variation, and to establish a blood bank for disease study, if needed; and 7) sampled for fecal parasite checks. In general, the monkeys appeared to be in very good condition. It is noteworthy, however, that there was a high incidence of bot fly infestation. Of 65 animals involved in the translocations, two died during capture due to trauma (an adult male who hit a tree branch in a fall, and a newborn infant that was accidentally struck with a capture dart). One infant was immediately rejected by its mother and is being reared in captivity, we hope for eventual release. Thus, 62 of 65 howlers (95%) that we captured survived to be released.

### **Release Methodology**

Pilot Release Project. In May 1992, the team conducted a pilot study by capturing and translocating 14 black howlers, comprising three social groups, using the methods described below. The animals were closely followed by radio tracking and visual observation for one year, to judge if future translocations should take place. All fourteen (100 %) of these animals survived 30 days, and 12 of 14 howlers (86 %) survived at least one year. Dispersal from release sites was minimal (mostly < 3 km), feeding behavior seemed normal and successful reproduction took place. Only after this pilot study showed such promising results did the team decide to translocate an additional 50 animals, split between efforts in May 1993 and 1994.

Capture. Troops were carefully chosen for translocation, so that none of the monkeys were too small for darting (those less than 18 months old were not collected, unless they were young enough that

they were still being carried by their mothers, who the infant could cling to when the mother was darted). Each troop was followed until nightfall, after which the monkeys stayed put for the night, so that the troop's location was known the following sunrise, when the capture took place. In 1994, four of six troops captured were studied for three months prior to capture by Silver and Ostro (in prep.), so that post-release behavior (feeding and ranging) could be compared to their pre-translocation activities. On the day of capture, the howler troops were captured by darting each monkey (using a "Pneu-Dart rifle") with the anesthetic Telazol, in the early morning hours while it was still relatively cool. After a monkey was drugged, it usually fell to the ground within several minutes, where it would be caught in a net (string hammock) by team members working in pairs. In some cases, the monkeys remained clinging to a branch, and a person had to climb the tree (or in some way shake the branch) and release the grasping limbs. Entire troops could usually (12 of 14 groups were complete; two groups were mixed-sexed subsets of larger troops) be caught in this manner, one monkey at a time, as they rarely fled.

Transport, Caging and Captive Care. All captured animals were individually crated in standard sky kennel crates ("P-200s") and transported to Cockscomb by either by a 45-minute helicopter ride or a four-hour journey in an air-conditioned van. The helicopter was the preferred method for monkeys and researchers alike, but its high cost (\$4,000 per transport hour) was deemed not necessary, after several comparison trials. Immediately after arriving at Cockscomb, the ten troops that were soft released were carried into the forest and placed in their holding cages. (Monkeys comprising the four troops that were hard released were held in their transport crates to late afternoon, when they were carried into the forest and released.) The soft release cages measured 4.92 m x 2.46 m x 3.08 m (length x width x height), and were constructed of lumber and 2.5-cm-chicken-wire several months in advance of the translocation. Sites for release cages were chosen to be about 1 km from any other howlers, and we tried to locate the cages at the base of a food tree that we suspected would be fruiting during the May release. The soft release groups were held for 24-72 hours (depending on how we thought the monkeys appeared), during which time they were provided water, available fruit, and freshly collected browse. During holding, human disturbance was minimized by observing them from a nearby blind, but someone was always present to protect the monkeys against predators (e.g. jaguars).

Release. The releases were always somewhat anticlimactic! We always freed the monkeys in the afternoons (usually 1500-1600 hours), based on our assumption that an afternoon release might help prevent a "panic dispersal," because as night fell the howlers would stop traveling and prepare to sleep. The soft release animals were simply let out of their cages by cutting a large hole in the wire screen. It is noteworthy that we always insisted that only a few persons would be in attendance at the releases, and they were required to remain as quiet as possible. In all cases, the animals calmly exited and stayed within 100 meters of their release cages the first day. Hard release groups were carried into the forest for release in late afternoon (1600-1800 hours), to sites located about 1 km from any other monkeys; releases were accomplished simply by opening the crates of all group members simultaneously. The hard release animals behaved similarly as the soft release ones, and always settled down for the night within 100 meters of their release point.

### Post-Release Activities

Monitoring Results. Between May 1992 and May 1994, 28.34 (male:female) howlers were released into the CBWS comprising 14 troops, of which 22.29 were adults. All adults were outfitted with radio telemetry for post-release study by the wardens of CBWS. The telemetry was designed to last for 12 months, but some units failed prematurely. Results discussed below are preliminary, and few data are available on the recent 1994 release, so sample sizes vary. Survival statistics indicated: 1) 63 of 65 animals (97%) survived capture and 62 of these 65 howlers (95%) were released; 2) 37 of 37 animals

(100 %) (data from 1992 and 1993 "translocation cohorts") survived 30 days; 3) 34 of 37 monkeys (92%) (1992 and 1993 translocation cohorts) survived at least six months; 4) one year survival for the 1992 and 1993 translocation cohorts is at least 30 of 37 howlers (81%), and probably is higher as we only know of three animals that died (one was shot by a poacher and two died for unknown reasons), and four other howlers are missing, but keep in mind that it is difficult to find them after their radios stop transmitting; and 5) two year survival for the 1992 translocation cohort is 12 of 14 animals (86%). At least 12 infants have been born in Cockscomb over the last two years, of which nine are alive as of 1 August 1994. The black howler population estimate on 1 August 1994 for Cockscomb Basin Wildlife Sanctuary is 65 monkeys.

Studies of the ranging behavior of the 1992 and 1993 translocated howlers showed that seven of 37 released monkeys (19%) deserted their troops and dispersed, usually within six months after release. Of these seven "deserters," within one year: one died, three transferred to other groups, two formed a new group and one female continues to lives alone. It is worth noting that as a consequence of the 19% deserters, average troop size decreased from a median of 4.0 at the time of capture to 3.5. The 37 howlers released in 1992 and 1993 varied in their responses to release site fidelity, as some stayed put and some traveled fair distances, but in general dispersal distances were short. Specifically, seven of nine troops (29 animals) dispersed less than 2 km; two of nine troops (seven animals) dispersed about 7 km, and one male dispersed 9 km and was shot by a poacher. The average movement from release sites was estimated at less than 3 km. Home ranges seemed mostly to be established during the first six months, however, two troops made large changes in location between six and eight months after release. Home range core areas were much larger (average = 57 ha) than those reported for howlers living at the Community Baboon Sanctuary (1-10 ha). To summarize, the translocated howlers have showed high suvivability (80-90%), low dispersal (0-9 km, mostly < 3 km) and high infant survivability (75%).

Educational Activities. We have attempted to educate the local Belizean community about both the reintroduction project, and the importance of black howler and primate conservation, through a series of activities, including: 1) inviting television crews to film the translocation each year for the Belizean News; 2) conducting radio interviews; 3) holding a public lecture sponsored and advertised by the Belize Audubon Society; 4) submitting yearly articles in the Belize Audubon Society's Member's Newsletter; and 5) setting up a display board in the CBWS visitor center. In addition, the Wildlife Conservation Society distributed a "video news release," which was played on a number of television stations in the United States and in Europe.

### **Future Direction and Conclusions**

Few primate translocations have been studied to date (for review, see de Vries, 1991), and as a result, the effectiveness of translocation as a primate conservation tool is untested. It is encouraging, therefore, that the preliminary results of this on-going study with black howlers is promising. While it is too soon to make any final conclusions, the authors believe that with some demographic luck the 65 black howlers now living in the Cockscomb Basin Wildlife Sanctuary have a reasonable chance to reestablish a population, which we hope will contribute to the species' long-term survival.

Finally, it is our intention that this new population will become a longer-term research site, not only to study the process of primate translocation, but also to study the behavioral and ecological consequences of a rapidly growing population on individual animal behavior. We have discovered that this reintroduction has provided an excellent "natural experiment" opportunity to investigate a range of topics that are population density dependent (e.g. territoriality, foraging patterns, communication and social group size). As so often is the case in science, new methods provide new insights.

## Literature Cited

- Bolin, L. 1981. Male parental behavior in black howler monkeys (*Alouatta palliata pigra*) in Belize and Guatemala. *Primates*, 22:349-360.
- Campbell, S. 1980. Is reintroduction a realistic goal? In: Conservation biology: an evolutionary perspective, pp. 263-269, M. E. Soule and G. A. Wilcox (eds.), Sinauer, Sunderland, MA.
- Caldecott, J. and M. Kavanagh. 1983. Can translocation help wild primates? *Oryx*, 17:135-139.
- de Vries, A. 1991. Translocation of mantled howling monkeys (*Alouatta palliata*) in Guanacaste, Costa Rica. M.A. thesis. University of Calgary, Alberta, Canada.
- Eisenberg, J. F., Muckenhirn, N. A., and R. Rudran. 1972. The relation between ecology and social structure of primates. *Science*, 176:863-874.
- Glander, K. E. 1977. Poison in a monkey's garden of Eden. *Natural History*, 86:34-44.
- Glander, K. E. 1982. The impact of plant secondary compounds on primate feeding behaviors. *Yrbk. Phys. Anthropol.*, 25:1-18.
- Glander, K. E. 1992. Dispersal patterns in Costa Rican mantled howling monkeys. *Int. J. Primat.*, 13(4):415-436.
- Horwich, R. H. 1983. Species status of the black howler monkey, *Alouatta pigra*, in Belize. *Primates*, 24:288-289.
- Horwich, R. H. 1988. The Community Baboon Sanctuary: an approach to the conservation of private lands. In: Saving the tropical forests. J. Gradwohl and R. Greenberg (eds.). Earthscan, London.
- Horwich, R. H. 1990. How to develop a community sanctuary: an experimental approach to the conservation of private lands. *Oryx*, 24:95-102.
- Horwich, R. H. and E. D. Johnson. 1984. Geographic distribution and status of the black howler, *Alouatta pigra*. *IUCN/SSC Primate Group Newsletter*, March (4): 25-27.
- Horwich, R. H. and E. D. Johnson. 1986. Geographic distribution of the black howler, *Alouatta pigra*, in Central America. *Primates*, 27:53-62.
- Horwich, R. H., Koontz, F. W., Saqui, E., Saqui, H., and Glander, K. 1993a. A reintroduction program for the conservation of black howler monkeys in Belize. *Endangered Species*, 10(6):1-6.
- Horwich, R. H. and J. Lyon. 1990. A Belizean rain forest - the Community Baboon Sanctuary. Orang-utan Press, Gay Mills, WI.
- IUCN, 1990. 1990 IUCN Red list of threatened animals. IUCN, Gland, Switzerland.
- IUCN, 1992. Draft guidelines for reintroductions. *Reintroduction News*, May:2-3. IUCN, Gland, Switzerland.
- Kamstra, J. 1987. An ecological survey of the Cockscomb Basin, Belize. MS Thesis, York University. Ontario, Canada.
- Koontz, F. W. 1993. Trading places: reintroduction of black howler monkeys into the Cockscomb Basin, Belize. *Wildlife Conservation*, May/June:52-59.
- Merrit, D. A. 1982. Behavioral considerations in the acclimatization and nutrition of young black howlers. *Int. Zoo Yrbk.*, 22:128-131.
- Milton, K. 1980. The foraging strategy of howler monkeys. Columbia University Press, New York.
- Milton, K., Casey, T. M. and K. K. Casey. 1979. The basal metabolism of mantled howler monkeys (*Alouatta palliata*). *J. Mamm.*, 60:373-376.
- Milton, K. and R. H. McBee. 1983. Rates of fermentative digestion in the howler monkey, *Alouatta palliata* (Primates: Ceboidea). *Comp. Biochem. Physiol.*, 74A:29-31.
- Strum, S. C. and C. H. Southwick. 1986. Translocation of primates. Pp. 949-957. In: *Primates: the road to self-sustaining populations*. K. Bernirschke (ed.). Springer-Verlag, New York.
- Smith, J. D. 1970. The systematic status of the black howler monkey, *Alouatta pigra* Lawrence. *J. Mammal.*, 51:358-369.
- Wolfheim, J. H. 1983. *Primates of the world*. University of Washington Press, Seattle, WA.