TECHNICAL CONTRIBUTION

SURVIVAL AND ADAPTATION OF A RELEASED GROUP OF CONFISCATED CAPUCHIN MONKEYS

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Abstract *Animal Welfare 2001, 10: 191-203*

One commonly used method of managing confiscated wild primates in Latin American countries is to release rehabilitated individuals back to their natural habitats. However, little information has been collected from confiscated animal releases, so no clear guidelines have been developed to measure the success of this type of procedure. In most countries, the collection of critical post-release data is too costly and time-consuming for it to be incorporated into the routine procedures of institutions managing confiscated fauna. Therefore, this project was carried out in conditions similar to those of other Colombian and Latin American rehabilitation centres. A group of eight confiscated and rehabilitated brown capuchin monkeys (Cebus apella) *was released in Los Llanos Orientales in Colombia, and monitored for 6.5 months to determine their adaptation and survival after release. Results were analysed according to how the animals adapted to their new environment in terms of foraging, feeding, locomotion, sleeping, social interactions between the group and with other animals and species, predation, orientation, and establishment of a territory. The results show that the short-term adaptation and survival of the group 6.5 months after release was successful. Five of the eight animals remained together, two separated, and only one was lost during the first month. Implications for animal well-being are discussed.*

Introduction

Reintroduction is used increasingly to manage wild populations (Stanley Price 1991; Beck *et al* 1994). Post-release studies on wild animals have focused mainly on the release of captive-born animals to reintroduce or reinforce wild populations (Wilson & Stanley Price 1994). There is also information on post-release studies of rehabilitated animals (Ludwig & Mkolajczak 1985; Reeve 1998), and some reports on release as a method of disposing of confiscated animals (Chacón & Janik 1999; Sanchez 1999; Weber & Weisel 1999; Nassar-Montoya & Crane 2000).

Data on survival rates, techniques for release and identification of potential risks from reintroduction, translocation and rescue projects, are valuable when confiscated fauna are considered for return to the wild. Released animals may pose biological, epidemiological and behavioural threats to natural populations and human inhabitants. In addition, released animals may be disoriented, may not have the adaptive capabilities to survive, or may seek out humans (Gipps 1991; AAZV 1993; Olney *et al* 1994; Reeve 1998).

Organizations such as the IUCN (1987; 1998; 1999) and CITES (1997) have produced valuable guidelines on the release of confiscated fauna to their natural environments. In Latin America, however, costs, time and personnel may limit the feasibility of comprehensive release programmes; such projects require pre-release preparation and post-release monitoring (Chivers 1991; Kleiman *et al* 1991; Crawford 1992; Wiley *et al* 1992; Miller *et al* 1994). Therefore, species-specific protocols for returning confiscated animals to the wild are needed (Nassar-Montoya 1999). This is particularly important in the tropics, where the illegal trade in native fauna results in the confiscation of many individuals of a variety of species (Drews 1999).

This study was designed to evaluate the post-release adaptation and survival of a rehabilitated group of confiscated brown capuchin monkeys (*Cebus apella*), a species commonly held as a pet and traded illegally. We also try to identify possible short-term negative effects of such releases on the welfare of confiscated capuchins and on their environment. Methods were adapted to the structure and facilities of the confiscated fauna rehabilitation centres in Latin America (Karesh 1995).

Methods
Personnel and resources
The personnel for this study included a rehabilitation biologist, a wildlife veterinarian, an ecologist, a keeper, two researchers and a field assistant. Field and monitoring equipment included transportation cages, binoculars, cameras, boots and field clothes. A 4x4 off-road vehicle was necessary for the transfer of animals and personnel to the release site, and for collecting natural food for the animals' training.

Animals and husbandry
A group of nine *C. apella* was formed from confiscated or donated individuals which had arrived at the Wildlife Rehabilitation Centre of the World Society for the Protection of Animals (WSPA) in Bogotá during 1995 (Table 1). As a result, the composition of the group was unplanned. This circumstance reflects a realistic situation in Latin America.

Rehabilitation procedures
At the rehabilitation centre, the animals were initially placed in quarantine for at least two months. During quarantine and rehabilitation, at least three clinical examinations were conducted on each animal to rule out any risk of transmitting disease to other animals. The examinations included haematology and clinical chemistry; parasitological examination of faeces and blood; and whole body radiographs. In addition, prior to release, the animals were screened twice for antibodies to toxoplasmosis and tuberculosis.

Capuchins showing good clinical and tooth condition were then transferred to a rehabilitation enclosure. All animals were introduced simultaneously to reduce the possibility of aggressive interactions. The enclosure was made of wire mesh, measuring 15x8x4 m. The mesh walls were covered with synthetic material to ensure visual isolation from staff and researchers. Animals were kept here for 5 months. The group was rehabilitated in terms of

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habitat use, locomotion, foraging and feeding strategies, sleeping, avoidance of predators, and interaction as a group, as recommended by Box (1991) and Miller *et al* (1994). To help the rehabilitation, the enclosure was enriched with trees, ropes, and fixed and mobile perches. Audiovisual stimuli were provided by playing tape recordings of natural habitats, other primates and bird calls. Food was presented on several occasions every day, at varying times, to decrease predictability; it was provided in a way that prevented the capuchins from seeing staff (by using poles through a window, to minimize the association with humans). Animals were fed with natural foods consisting of fruits and invertebrates collected at the site of release. Fruits were hung on the poles. Invertebrates were hidden in boxes placed high in the enclosure, containing leaves and organic material. Water was provided *ad libitum* in a cement pool (1.0x0.7x0.3 m) on the ground of the enclosure. Gamboa and Suarez (1996) describe the pre-release procedures in detail.

Table 1   **Group of capuchins formed at the WSPA-Rehabilitation Centre in Bogotá, during 1995.**

Animal	Sex	Age[c]	Origin	Arrival date
1	Male	Adult	Voluntary donation*[a]	15 June 1995
2	Male	Adult	Voluntary donation*[a]	7 April 1995
3	Male	Adult	Confiscated	28 September 1995
4	Male	Juvenile	Voluntary donation*[a]	26 April 1995
5	Female	Sub-adult	Voluntary donation*[a]	21 November 1995
6	Female	Juvenile	Voluntary donation*[a]	11 January 1995
7	Male	Juvenile	Confiscated	28 September 1995
8	Male	Juvenile	Voluntary donation*[a]	5 June 1995
9	Female	Adult	Voluntary donation*[a,b]	21 March 1995

*   Voluntary donation: animals were given to the authorities voluntarily by their owners

[a]   Geographical origin and time in captivity unknown

[b]   Never adapted to the group. Died on February 26th 1996 during rehabilitation, presumably as a result of stress

[c]   Age was estimated by size and physical characteristics, as described by Izawa (1980)

Observations during rehabilitation

During rehabilitation, animals were observed to evaluate their progress. Observations were made Monday to Friday, for 20min, three times per day (at 1100h, 1300h and 1500h). Focal sampling was carried out to construct an activity diagram and to record the development of the rehabilitation process; all animals were observed in every session for five minutes. The frequency of occurrence of pre-defined behavioural categories was recorded (Table 2). Behaviour sampling was also performed (Martin & Bateson 1986; Paterson 1992). The entire group was observed for 15min in each session and only social interactions (dominance, agonistic behaviour and associative behaviour) were recorded. In addition, animal responses to a specific stimulus (ie response to a predator) were recorded.

Release/study site

The group of eight *C. apella* was released on the Hacienda la Morena farm in Colombia, municipality of Puerto Lopez, department of Meta (4° 05′ N and 72° 58′W). This location is 220m above sea level with a diurnal mean temperature of 28°C and a relative humidity of 75 per cent. The area is characterized by savannahs that are crossed by 25m-tall secondary gallery forests along rivers and streams. It is used for cattle grazing and has a low human population. The local residents were aware of and supportive of the project.

The forest chosen for the release of the group was 3km in extent and varied from 3-300 m in width. It was connected to other forests. Vegetation included bushes (1–5m) and trees (up to 15m), but it was dominated by trees of 5-10m (with diameter at chest height up to 0.2m). The site was selected because it was located in the natural range of the species. Wild groups of *C. apella* had previously been observed in the locality, but they had not been seen in the specific gallery forest where the group was released. In addition, preliminary observations of the area indicated that fruit (eg *Jessenia batava, Astrocaryum chambira, Heliconia* spp and *Ficus* spp*)* and invertebrate foods were abundant (Izawa 1979; Defler 1982; Stevenson *et al* 1991). Finally, the site was located in a private farm where intruders, including hunters, were not permitted.

Table 2   Categories of behaviour pre-established for use during the study (in both pre-release training and post-release monitoring).

Behaviour	Description
Feeding	Capuchin searching for food either visually or with hands. Hunting, physical contact with food and eating.
Locomotion	Capuchin moves. Walking, jumping or climbing.
Sleeping-resting	Capuchin is quiet with its eyes open or closed. To record this category, the animal must be clearly visible.
Agonistic	Supplant, threat, persecution or physical aggression, from one capuchin towards another or towards a human being (Freese & Oppenheimer 1981).
Socialization	Any non-agonistic interaction between two or more familiar or unfamiliar capuchins involving active physical or visual interaction including playing, hugging and facial expressions (Freese & Oppenheimer 1981).
Predator avoidance	Recording the presence of eagles, boas or felids in nearby locations to the capuchins, and their response. These responses include ignoring the predator, flight, alarm call or attacking the predator. During rehabilitation, the response to models (made with skins of boa and ocelot, and a black wooden silhouette of an eagle) introduced and moved through the enclosure was recorded.
Abnormal behaviour	Recording any aberrant behaviour during pre- and post-release. For example, stereotypic behaviour, self-aggression and aberrant appetite.

Post-release monitoring

Prior to release, non-toxic dyes were used to mark the tails of each monkey. In addition, each animal exhibited distinct age/gender-related morphological characteristics typical of *C. apella.*

Following release, the animals were observed for a total of 150h over 6.5 months, from June 1996 to January 1997. During the post-release period, at least two observers monitored the monkeys during observation periods in case the group separated. Animals were followed and located by sounds and direct observation. The monkeys were observed daily during the first month after release. Observations were made three times per day, initially at 0600h, 1200h and 1600h, for 30min at each session after visual contact had been established with the group. As it proved impossible to observe the animals at 1200h, when they were presumably resting on palm trees at canopy level, we discontinued this observation during the first month. For the following 5.5 months, the researchers observed the monkeys on 14 consecutive days per month, at 0600h and 1600h, for a continuous 30min period at each session. Capuchins could be located and followed without radio transmitters. Behavioural observations consisted of scan sampling and *ad libitum* observations. A minimum of two observers recorded the behaviour of the group, each one focussing on different areas or trees, so that a broad area could be observed. Observers recorded the behaviour of all animals

present by continuous scanning. If an observer saw a behaviour that he/she considered relevant (eg hunting or fighting) they recorded it until its completion; these behaviours lasted for short periods of time and scanning resumed immediately upon their completion (Martin & Bateson 1986). Behaviour categories had been established previously during pre-release monitoring (Table 2). When an animal was sighted its location was mapped (Figure 1) (Sanderson 1966). Also, its elevation was recorded as ground, mid or canopy, based on its position in a tree (Table 5).

This schedule was followed to evaluate whether this methodology was adequate for the purposes of post-release monitoring of confiscated capuchins, as an alternative to the more expensive long-term monitoring of reproductive success and habitat assessment sometimes carried out in Latin American centres.

Results
Personnel and resources
Finding a suitable place to release the group was not difficult because a sufficient number of farmers were interested in the programme. The species is broadly distributed in Colombia, and only one sub species (*Cebus apella apella*) has been described for the country (Defler 1994). To determine whether there was genetic differentiation between the capuchins in the study and the Colombian population, molecular analysis was carried out by Ruiz-Garcia *et al* (in press). The results showed that the genetic diversity in *Cebus apella* in Colombia is low; in addition, it is lower than that of *Cebus albifrons* (Ruiz-Garcia *et al* 1999; Ruiz-Garcia *et al* in press), suggesting that there is no population variability in this species in Colombia.

The duration of this project was 2 years, of which 17.5 months were dedicated to the pre-release procedures (Gamboa & Suarez 1996), and 6.5 months to the post-release study reported here. We estimated an overall direct cost of US $ 25 000 (Table 3). This included pre-release procedures (US $ 20 000; 80 per cent of the total budget) and the post-release monitoring (US $ 5000; 20 per cent of the total budget). The final cost per animal was US $ 3125.

Table 3   **Costs estimated in US$ incurred during the pre-release rehabilitation and post-release monitoring of the group of eight capuchins.**

	Personnel	Equipment and supplies	Alimentation	Travelling	Other	Sub total
Pre-release	6068	3565	7735[a]	-	2605	19973
Post-release	2288	1040	–	1040	655	5023
Subtotal	8356	4605	7735	1040	3260	
Total						24996

[a] Alimentation during pre-release rehabilitation includes travel to the release site. Food was collected and preliminary observations of the habitat were conducted

Post release dispersal and survival
The capuchins moved a maximum of 10.5km from the release point within 6.5 months. During the first month (July), individual daily movements covered no more than 150m and were contained within an area of 1km of the release point (Figure 1a). However, the capuchins dispersed from one another in different directions in the forest, with the result that individuals were located up to 200m apart from one another; they remained in vocal contact throughout. Five individuals (animals 1, 4, 5, 6, 7) were usually observed in palm trees, keeping a distance of approximately 2m between each other, but the other three (animals 2, 3

a)

b)

c)
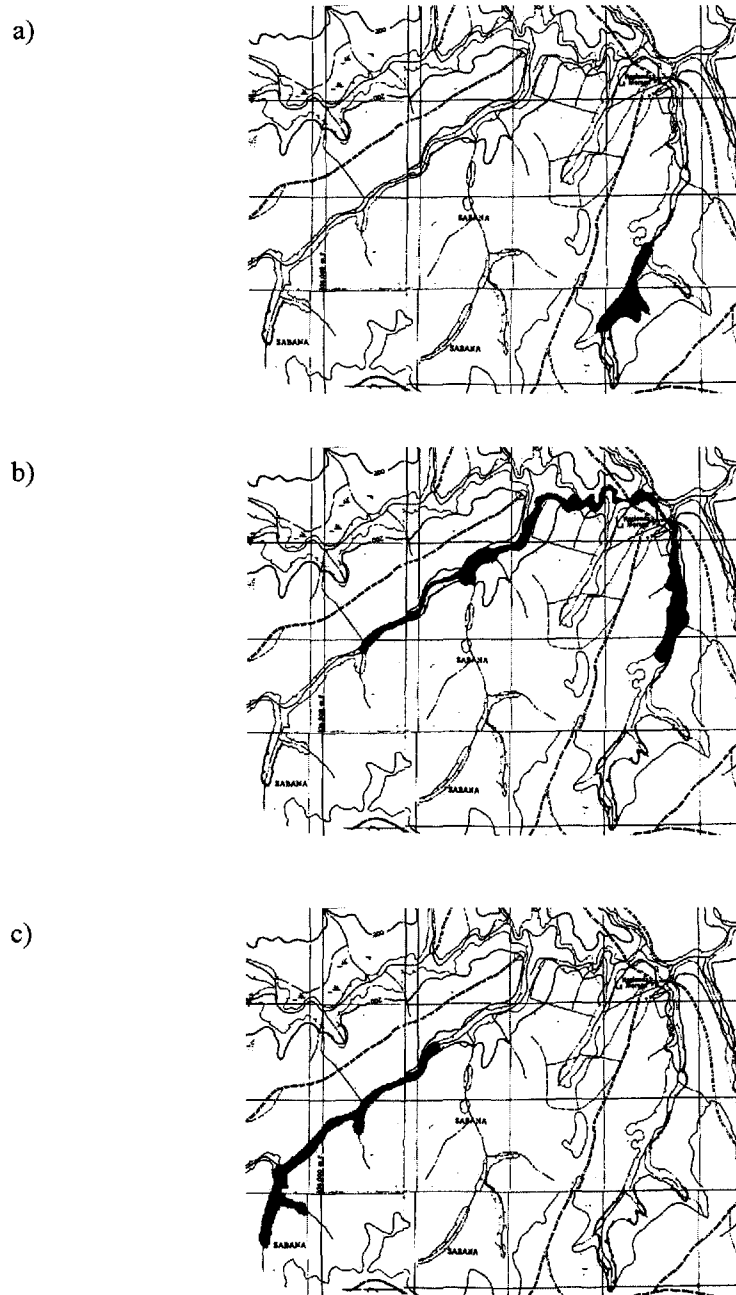
Figure 1   a) Area where the released group was seen during month 1; b) Area where main group was seen during months 2-3; c) Area where main group was seen during months 4 - 6.5. Note the long distance covered during months 2-3. (Scale 1:25,000. Source: IGAC [Iinstituto Geográfico Agustin Codazzi], Bogotá, Colombia.)

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and 8) were observed about 10m from the main group in different trees. On the second day post-release, male 1 separated from the group but returned on day 6. Coinciding with the absence of male 1, male 3 moved closer to the main group (consisting of animals 4, 5, 6 and 7). Upon the return to the group of male 1, male 3 withdrew from the group and left the area. We lost male 3 from day 7.

During the second month (August), the group occupied an area near the farmhouse (Figure 1b). Local farmers captured male 2, which did not appear to be a constant group member, when he broke into their house on day 46 after release. He was returned to the release site.

During months 3 and 4 (September and October), the main group consisted of five animals (animals 1, 4, 5, 6 and 7) and moved 4.5km from the farmhouse (Figure 1b), to a wet forest dominated by trees that were 10-15m in height. Animals 2 and 8 were not seen after day 134 after release, when they were 2km from the release site.

During the last 2.5 months (November to January), the remaining group (animals 1, 4, 5, 6 and 7) moved approximately 3km to a mature forest, dominated by trees that were 15-20m in height (Figure 1c). During this time, the group used the same tree to sleep in on many nights and was seen moving in different directions to forage and feed.

Post-release behaviour
Feeding and foraging
All the capuchins were seen foraging and feeding and were able to sustain themselves immediately upon release. No changes in their physical condition or symptoms were observed that suggested deterioration in their state of health. Food supplementation was not necessary.

The main group (animals 1, 4, 5, 6 and 7) spent 83 per cent of the 150h of observation foraging and feeding (Table 4). Some social behaviours, like associations and grouping, were observed; these were always associated with either feeding or locomotion and were, therefore, recorded in these two behavioural categories. During months 1 and 2, the majority of food consumed included invertebrates like butterflies, crickets, spiders, worms, ants, termites, insect larvae, and fruits like *Mauritia* spp. During month 3, consumption of fruit increased. We found remains in their foraging areas of fruits from the families *Palmae, Mimosaceae, Sapotaceae, Musaceae, Moraceae* and *Sterculiaceae*. Three monkeys (animals 1, 5 and 8) attempted to catch a bird unsuccessfully.

Table 4   **Behaviours recorded during post-release observation of the main group of capuchins. Results are expressed as percentage of the total observation time (150h).**

Animal	Feeding (%)	Locomotion (%)
1	100	0
4	70	30
5	95	5
6	80	20
7	70	30
Group average	83	17

Foraging behaviours were similar to those of wild capuchins reported by Terborgh (1983), Robinson and Janson (1987) and Stevenson *et al* (1991). Invertebrates were found in tree holes, on leaves and in decomposing organic material on branches, on palm leaves, and on the ground. Foraging for fruits was performed mainly in the morning.

Locomotion and habitat use

The main group (animals 1, 4, 5, 6 and 7) spent 17 per cent of the 150h of observation travelling (Table 4). All of the animals were skilful in the forest immediately post-release and displayed different forms of locomotion including quadrupedal, bipedal, climbing and jumping. They used different climbing substrates such as branches and trunks in diverse positions and of differing form, size and texture. Table 5 shows how the animals increased the time spent in the higher levels of the forest throughout the study. Only animals 1, 2 and 5 were seen on the ground. During month 1, the favourite sleeping sites were palm trees *Mauritia flexuosa* and *Mauritia armata* but these later changed to different trees. Throughout the study, animals preferred to sleep in the canopy level.

Table 5 **Percentage of observations* spent by the main group of capuchins in ground (G), mid (M) and canopy (C) levels during post-release monitoring.**

Animal	JUL			AUG			SEPT			OCT			NOV			DEC		
	G	M	C	G	M	C	G	M	C	G	M	C	G	M	C	G	M	C
1	24	76	0	0	23	77	0	17	83	0	20	80	0	0	100	0	0	100
4	0	88	12	0	23	77	0	43	57	0	20	80	0	0	100	0	0	100
5	14	79	7	0	23	77	0	43	57	0	20	80	0	0	100	0	0	100
6	0	88	12	0	18	82	0	14	86	0	0	100	0	0	100	0	0	100
7	0	84	16	0	10	90	0	17	83	0	0	100	0	0	100	0	0	100
Mean	8	83	9	0	19	81	0	27	73	0	12	88	0	0	100	0	0	100

*   Position of the capuchin was recorded when the researchers made their initial visual contact with an animal at the beginning of an observation period.

Agonistic and social behaviours were observed during the study period. However, they occupied less than one per cent of the observation time and consequently were omitted from the budget analysis.

Agonistic behaviour

One agonistic encounter was observed between adult males 1 and 2 on day 6 after release. It occurred when male 2 tried to feed on a palm tree where male 1 was eating with animals 4, 5 and 6. Vocal and physical threatening and fighting characterized the behaviour. Non-agonistic contact with a group of howler monkeys, *Alouatta seniculus,* seen in the area was observed. Resident capuchin groups did not come to the area occupied by the study group. The study group displayed alarm calls and aggression toward unfamiliar humans; before fleeing, they vocalized and threw palm fruits at people.

Social behaviour

Five animals (1, 4, 5, 6 and 7) maintained contact with one another and created a group during the study. They were seen sharing the same food source and sleeping sites. However, social behaviours reported for *C. apella*, such as grooming, hugging and playing, were not observed during this study. Animals 2, 3 and 8 kept their distance from the main group from the first day of release. No social contact with local capuchin groups or other species was seen.

Discussion
Personnel and resources
The costs and resources directly associated with post-release monitoring were only 20 per cent of the total attributed to the pre-release and post-release process. Thus, an institution that claims it can carry out a technical pre-release process should also be able to do post-release monitoring. The methodology proposed for post-release monitoring was successful in accomplishing the objectives of this study. However, it could be improved without increasing expenses considerably. For example, using conventional telemetry could facilitate the location of animals and would only increase costs by approximately five per cent of the total budget. Monitoring animals in such a schedule would reduce personnel costs, but it would still be easy to lose animals and, therefore, lose the opportunity to collect some of the data required.

Despite the short-term overall success of this study for the welfare of the monkeys, the high costs and resources involved in this study make us doubt the usefulness of release back to the wild as a safe and routine means of managing confiscated animals in Latin America.

Post-release behaviour and survival
This study provided information on the survival, adaptation and welfare of a group of rehabilitated capuchin monkeys after release to a natural habitat. We feel that the short-term adaptation and survival of the group was successful upon 6.5 months post release. Five of the eight animals remained as a social group, two males separated from the group but were observed for 134 days, and only one male was lost within the first month.

However, it took a year to form the group in captivity. The partial incompatibility of the original group emphasized the difficulty of making compatible groups when working with confiscated fauna. Since the group was composed of six males and two females, we expected it would not be stable (Izawa 1990), and indeed, three males left the group (animals 2, 3 and 8). The formation of compatible groups is one of the most important limitations on the welfare of confiscated monkeys when they are released.

Initially, movement through the forest seemed to be the most important short-term limiting factor affecting the monkeys. During the first month, the animals moved in an erratic manner, generally going round in circles within 1km^2. They became separated from one another over distances of up to 200m and tended to follow the researchers whenever possible; therefore, it was decided to restrict the observations to a maximum of one hour per day. During this period, vocalization was the only tool that they seemed to utilise to maintain contact with one another. Otherwise, animals were skilful from the first day in the wild. Training the animals pre-release was of value in developing the skills demonstrated by the group and may have had important implications for the welfare of the monkeys after release (Shepherdson 1994). Although we did not know the early history of these animals, we assumed that they were trapped as infants; this is usual in the country, as there are no commercial places breeding primates in Colombia. Having an early experience with their original group in the wild probably helped them to adapt to their new wild environment at the time of release (Castro et al 1998; Miller et al 1998).

The capuchins moved to a more mature forest where fruits were abundant. This movement was in relation to forest fruit ripening events; fruits included Mauritia flexuosa and Mauritia armata. Therefore, the long distance travelled by the group in the absence of inter-specific or intra-specific pressure suggested that this movement was related to fruit ripening events and was motivated by foraging. Releasing the group near to the farmhouse may have had two

opposing effects; it may have helped to avoid agonistic encounters with resident conspecifics, but it also may have helped the released animals to break into the farmhouse.

Animal welfare implications

Release to natural habitats provides an alternative to permanent captivity or euthanasia for confiscated animals. However, as with reintroduction programmes (Gipps 1991; Olney *et al* 1994), releasing confiscated fauna to natural environments is a procedure involving biological, epidemiological, financial, social, humanitarian and conservation factors. Therefore, any project aimed at releasing an animal to a natural environment must study, evaluate and minimize the biological, epidemiological and behavioural implications involved. If there is a significant doubt as to the outcome of a release, the likelihood of survival of the animal, or consequences to the habitat or local inhabitants, the release should not be carried out. Most importantly, the ability of the animals to live in the new environment must be evaluated pre- and post-release.

Special efforts should be made to create compatible groups when releasing confiscated primates. Social incompatibility may be an important factor limiting the adaptation and well-being of monkeys to a new environment. Through the cooperation between institutions managing confiscated fauna in a country, gathering compatible animals would enhance the formation of groups. Also, it would help to reduce the amount of time and resources required during the pre-release process.

During this study, the capuchins' well-being benefited from the absence of predators, hunters (the site was protected from hunters) and wild conspecifics at the site of release.

Acknowledgements

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