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Field Report

A technique for attracting bush dogs *Speothos venaticus* in the wild

Karen E. DeMatteo*[1], Osvaldo Carrillo[2], Gerald L. Zuercher[3], Silverio Ramírez[2], Kelli Smith[4] and Ingrid J. Porton[1]

*Corresponding author:
[1]Saint Louis Zoo, Research Department, Forest Park/1 Government Drive, St. Louis, MO 63110, USA and Saint Louis University, Biology Department, Macelwane Hall, St. Louis, MO 63103, USA.
Email: KDeMatteo@aol.com

[2] Fundación Moisés Bertoni (FMB), Procer Carlos Argüello 208, C.C. 714, Asunción, Paraguay.

[3] University of Dubuque, Department of Natural and Applied Sciences, 310 Goldthorp Hall, Dubuque, Iowa 52001, USA.

[4] Kansas State University, Kansas Cooperative Fish and Wildlife Research Unit, Division of Biology, 205 Leasure Hall, Manhattan, KS 66506-3501, USA.

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Abstract

The bush dog (*Speothos venaticus*) is a small unique canid whose distribution, ecology, and habitat requirements are poorly understood. This study, conducted in the Mbaracayú Reserve, Paraguay, tested whether conspecific urine and vocalisations lured bush dogs to a specific location. Evidence (tracks, response vocalisations, physical disturbance, urine-marks, and faeces) suggests that the techniques used can serve as an important tool in gaining an understanding of this secretive canid within its natural habitat. The ability to attract bush dogs to a specific location would prove invaluable for current and future researchers to complete the critical first step of an ecological study: locating and marking research subjects. In addition, it could provide access to genetic material needed to investigate a range of questions from bush dog systematics to group social composition and population size. All of this information is critical to forming an accurate and much needed conservation strategy for this potentially endangered canid.

Introduction

The bush dog, listed as Vulnerable (IUCN 2003), is a small, unique, and poorly understood canid that primarily inhabits tropical rain forests in Central and South America (Eisenberg 1989; Redford and Eisenberg 1992; Eisenberg and Redford 1999). Developing a conservation strategy for this species is dependent on in-depth field research focused on its socio-ecology; however, bush dogs have proven to be difficult to study in the wild. This paper describes a method to facilitate the capture of study animals, using intraspecific olfactory and acoustic signals.

Bush dog communication

While the bush dog's unique morphology may be advantageous in maneuvering through dense underbrush (Kleiman 1972), it is likely a disadvantage for visual communication, and perhaps accounts for its greater reliance on auditory and olfactory communication (Porton 1983). The bush dog's vocal repertoire includes whines, squeaks, long-distance calls, and growls (Kleiman 1972; Brady 1981). The structure and frequency of pulsed vocalisations (long call) is suited for long distance ground-level transmission (Marten 1980; Brady 1981), allowing communication with separated or distant group members, e.g. in the forest at night (Ventre 1993; Beccaceci 1994). Research on captive bush dogs indicates long calls have distinct auditory components that may distinguish individuals (Brady 1981; K.E. DeMatteo, unpubl. report).

Urine is the primary method of olfactory communication in canids (Kleiman 1966; Porton 1983). Bush dogs utilize a variety of postures (e.g. handstand in female, 180^{o} leg-tilt in males, straddle marking in both sexes) to deposit urine (Porton 1983; I.J. Porton, unpubl. report). In bush dogs, urine is an important communication tool both before and after pair bond formation and marking frequency increases with exposure to opposite versus same sex urine. Unlike other canids (Dunbar and Buehler 1980), both mated pairs and juvenile bush dogs participate in sequence urine marking (Porton 1983).

A secondary, less frequently used scent-marking behaviour is deposition of faeces (Macdonald 1996). Captive bush dogs defecate throughout their environment (Kleiman 1972), typically on the ground (93.2%) but occasionally on vertical surfaces, logs or even their den (Macdonald 1996). Group members defecate more or less simultaneously and in close proximity of each other (Macdonald 1996), and sequence marking with faeces has been observed (K.E. DeMatteo, unpubl. report).

Objectives

The goal was to use insights on olfactory and auditory communication to develop a field technique to increase the probability of locating and, thereby, studying bush dogs in the wild. The first objective was to design an indirect censusing technique by eliciting long call responses to tape recorded calls of unfamiliar conspecifics. It was reasoned that if calls can be individually recognized, the number of animals calling could potentially be counted. The second objective was to determine if playback recordings of bush dog long calls and tracking stations scented with novel bush dog urine or both could provide the basis for a technique to reliably attract bush dogs to a capture site.

Methods

Vocalisation tape

The vocalisation tape contained nine opportunistically recorded individual long calls (mean=15s; SD=4s) with at least one call from each of the six (4.2) sexually mature bush dogs at the Saint Louis Zoo (STL), Missouri. On the tape, each call was separated by a 10s interval of silence to allow for response from conspecifics during censusing (Objective 1). Each 10-min segment of tape contained 5min of the repeated vocalisation series followed by 5min of silence (Ogutu and Dublin 1998). The primary function of this 5min silence period was to reduce the potential confounding effects of habituation of the bush dogs to the playbacks; however, this was not tested.

Captive study methodology

In April 2000, preliminary testing of the field methodology occurred with captive bush dogs:

six at STL and two male-female pairs at Oklahoma City Zoo (OKC), Oklahoma. Table 1 describes the components of the portable electronic call system and setup. One-hour tests took place at both zoos in late afternoon for decreasing 0.25km increments between 1.5 and 0km from the animal's enclosure. In addition, opportunistic testing was done near an animal's enclosure with STL individuals recently or temporarily separated from a group.

Table 1. A comparative summary of the portable electronic call system and setup for the vocalisation playbacks for the trial with captive bush dogs. Included are the physical components of the playback unit, the set volume level and audible range of playbacks, and speaker positioning.

	Captivity	**Comments**
Portable electronic call system	Model MS512 *	
Long range speaker	8-ohm 180° speaker (Model 2500 *)	
12-volt amplifier unit (Louder™) *	Yes	Functioned to nearly double the volume of the caller.
Automatic on/off timer	No	
Battery charging solar panel	No	
Volume level	Maximum	
Audible range of playbacks	0.25km	While the volume level and use of an amplifier should have allowed the audible range to be ~1km, surrounding concrete structures prevented this.
Vocalization tape	Original	
Distance speaker to ground	2m	
Direction of speaker	Parallel (90°) to ground	

* Johnny Stewart Wildlife Calls™, Waco, Texas

Field study methodology

Table 2 provides a comparative summary of the vocalisation equipment, setup, and methodology used in 2000 and 2001. Only in 2000 did researchers remain <0.25km from the treatment site to listen for response calls from wild bush dogs (Objective 1). Confirmed response vocalisations were defined as calls that were clearly audible and distinguishable from bird calls (e.g. rufous motmot (*Baryphthengus ruficapillus*) and red-ruffed fruitcrow (*Pyroderus scutatus*)). "Potential" response vocalisations were typically not as clear due to brevity of the response or lower call volume.

Table 3 provides a comparative summary of the field study methodology for 2000 and 2001. Both field trials were conducted in the 64,400ha Mbaracayú Reserve, a tract of undisturbed, subtropical moist forest on the eastern edge of Paraguay bordering Brazil (FMB 1998). The trial areas, the treatment sites, and tracking station setup are compared in Table 3. Figure 1a and 1b visually depict how the treatment sites, tracking station positions, and applied treatments compare. Urine and faeces were obtained from STL bush dogs (4.4) (Table 3) and maintained frozen until transported to Paraguay.

A comparative summary of station checks and urine application schedules is provided in Table 3. Footprint and stride measurements from local tracking manuals (Villalba and Yanosky 2000) and from captive bush dogs (K.E. DeMatteo, unpublished report) were used to positively identify bush dog tracks. When track clarity was poor (e.g. rain, leaf litter), if the track(s) matched bush dog dimensions, stride length, and/or shape, and if other similar-sized carnivores could be eliminated, it was classified as "probable" bush dog.

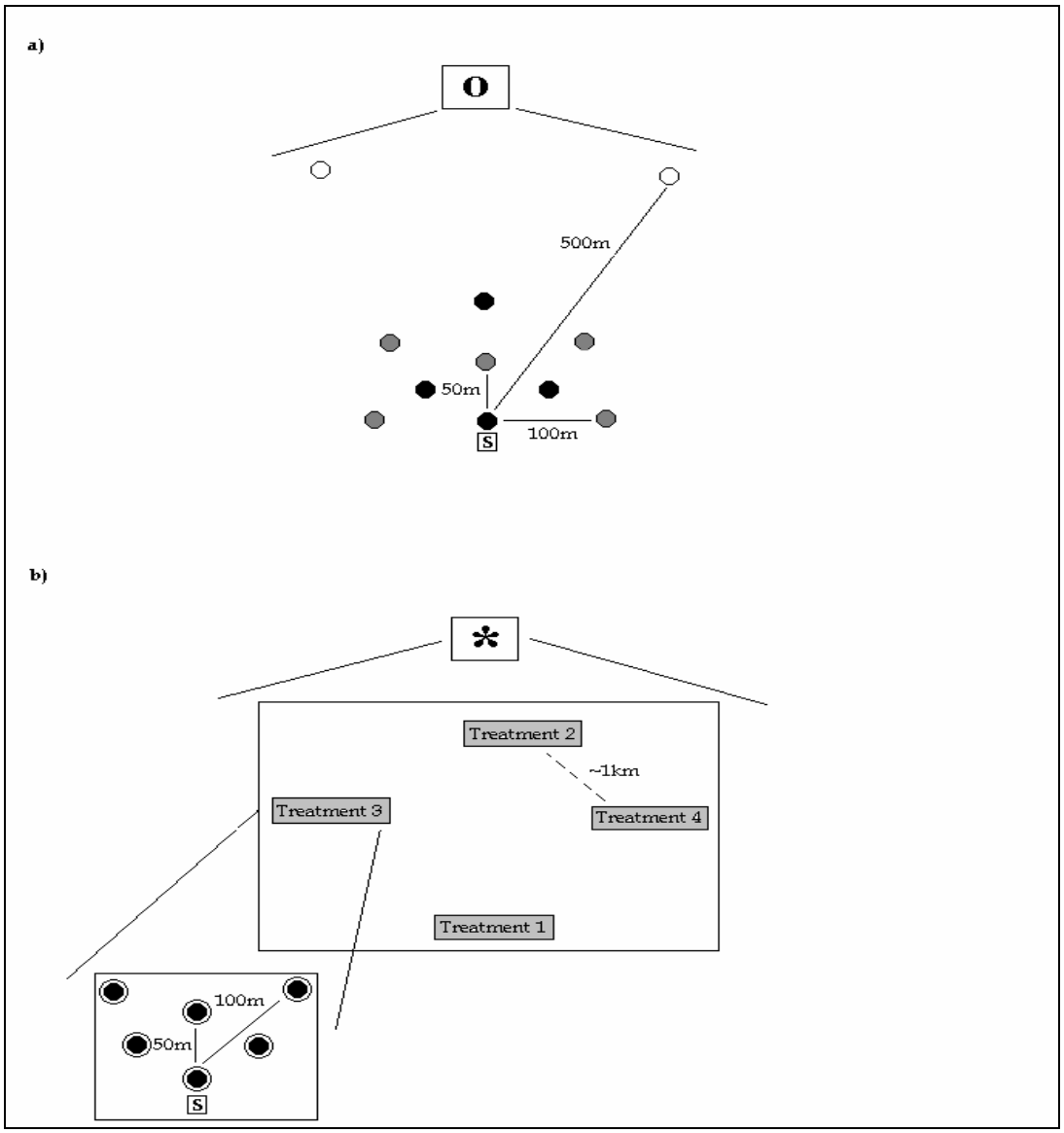

Figure 1. a) Within each 2000 trial area (**o**) was a single treatment site with 11 tracking stations. Nine of the tracking stations received a scent treatment of either urine (gray circles) or urine and feces (black circles) and were positioned at 0m, 50m, or 100m relative to the central location. Two stations placed at 500m from the central location served as scent treatment controls (white circles). Each site had a speaker (S) set at the central location and had long call vocalizations broadcast at the set interval for 4 consecutive days. b) Within each 2001 trial area (*) were 4 sites each containing 6 tracking stations and each receiving a different treatment. The 4 treatment sites (1) no scent or vocalization playbacks, 2) scented with novel urine, 3) daily playbacks of long call vocalizations, and 4) scented with novel urine and daily playbacks of long call vocalizations) within each area were randomly placed approximately 1km from each other. At the 2 treatment sites with vocalization playbacks (3 and 4), the speaker (S) was set at the central location.

Table 2. A comparative summary of the portable electronic call system and setup for the vocalisation playbacks for the two trials with free-ranging bush dogs. Included are the physical components of the playback unit, the set volume level and audible range of playbacks, and speaker positioning. While the number of consecutive days did not differ between the two trials, the number of playback sessions each day, the duration of the playback sessions, and the times of day the playbacks were conducted did differ. * Johnny Stewart Wildlife Calls™, Texas.

	2000	**2001**	**Comments**
Portable electronic call system	Model MS512 *	Model MS612 *	2001: Caller equipped with an auto-reverse, which allowed the use of the automatic timer.
Long range speaker	8-ohm 180° speaker (Model 2500 *)	8-ohm 360° speaker	2001: The 360° speaker increased the effective area that the playbacks covered.
12-volt amplifier unit (Louder™) *	Yes	No	2000: Functioned to nearly double the volume of the caller.
Automatic on/off timer	No	Yes	2001: Corrected for limitation faced in 2000 where only daytime vocalization playbacks were possible as the presence of jaguars prohibited manual activation after dark and dense vegetation prevented remote activation of the system.
Battery charging solar panel	No	Yes	2001: Reduced the number of replacement batteries required for a trial.
Volume level	Maximum	2/3 of maximum	2001: Lower volume and lack of an amplifier better approximated a natural bush dog call. While this decrease the audible range, it was thought it might enhance the chance of luring bush dogs closer to a specific area.
Audible range of playbacks	~1km	0.5km	
Vocalization tape	Original	Digitally cleaned	2001: Clarity of tape improved.
Distance speaker to ground	1.5km	0.3km	2001: Simulated a calling bush dog.
Direction of speaker	Point down towards ground (45° from the tree base)	Point towards the sky (45° from the tree top)	2001: Simulated a calling bush dog.
No. consecutive days	4	4	
No. playback sessions/day	4	6	
Duration of Playbacks/Session (min)	60	30	The decrease in playback duration from 2000 to 2001 was aimed at balancing attracting versus habituating wild bush dogs to the playbacks.
Times of playbacks (hr)	0800 1030 1330 1600	0600 0800 1000 1600 1800 2000	

Analyses

In 2000, a Goodness of Fit Test (G-test) of Independence compared the effectiveness of vocalisation playbacks with and without scent (Sokal and Rohlf 2000) and included both "probable" and confirmed bush dog tracks. In 2001, a R X C Test of Independence using G-test examined the importance of disturbed ground (control), conspecific vocalisations, and novel conspecific urine scent in luring bush dogs to a specific location (Sokal and Rohlf 2000).

Table 3. A comparative summary of the field study methodology and tracking station setup used in the two trials in the field. The number of rReserve regions and number of trials per each region differ between the two years. The sequential roman numerals in the trials within the regions of Lagunita and Horqueta'mí indicate that the 2000 and 2001 field trial areas were distinct and separate locations. The positioning of the tracking stations relative to the central location and the respective treatments applied at each are summarized. The schedule of set station checks and days urine/faeces were applied are listed. Day 1 is defined as 24hr after the initial vocalisation playback. The design of the tracking stations and placement of urine/faeces are described.

	2000	**2001**	**Comments**
Dates of study	mid-July to mid-August 2000	late June to late July 2001	
No. reserve regions	4	2	
Reserve regions	Jejui'mí Lagunita Horqueta'mí La Morena	Lagunita Horqueta'mí	Regions selected based on bush dog sightings.
Total no. trial areas	5	5	
No. trials/region	1 - Jejui'mí 1 - Horqueta'mí 1 - La Morena 2 - Lagunita	2-Lagunita 3- Horqueta'mí	Each trial area was situated near waterways containing good prey populations (e.g. agouti (*Dasyprocta azarae*) and paca (*Agouti paca*) and used only a single time in the 2 years.
Trial area identifications	Jejui'mí Horqueta'mí-I La_Morena Lagunita-I Lagunita-II	Lagunita-III Lagunita-IV Horqueta'mí-II Horqueta'mí –III Horqueta'mí-IV	
No. treatment sites/trial area	1	4	
Total no. treatment sites	5	20	
No. tracking stations/treatment site	11	6	
Stations distance from central location	1- 0m 3- 50m 5- 100m 2- 500m	1- 0m 3- 50m 2-100m	At each treatment site, a designated central location served as a reference mark for tracking stations (0m), established 180° off the front axis of this location, and the playback system speaker position.
No. applied treatments	3	4	

	2000	2001	Comments
Treatments	1) Vocalisations-only 2) Urine and Vocalisations 3) Urine, Faeces, and Vocalisations	1) Untreated/Bare Ground (Control) 2) Urine-only 3) Vocalisations-only 4) Urine and Vocalisations	2001: The addition of treatment sites within a trial area, separation of applied techniques (i.e. auditory versus olfactory), and use of a control was aimed at understanding which component or combination of components optimised attraction of bush dogs to a location.
No. treatments/treatment site	3	1	
No. stations/treatment/treatment site	2-Vocalisations-only 5-Urine/ Vocalisations 4- Urine/Faeces/ Vocalisations	One of four applied treatments (see above)	
Tracking station structure	1-m diameter circle	2 0.5-m width concentric rings around a 1-m diameter circle	2001: The concentric rings were set greater than the average bush dog stride length (~20cm: K.E. DeMatteo unpubl. report; 28cm: Villalba and Yanosky 2000) in order to capture track impressions from bush dogs that approached the station but failed to enter the centre ring.
Scent post	Yes	Yes	The centre of each tracking station contained a single, 0.5m high, natural plant (scent post) which urine could be placed while allowing it to drip to the soil.
Vegetation removal	Complete	Circle: Complete Inner ring: Partial Outer ring: Complete	*Complete vegetation removal*: All flora growth above and below the ground (e.g. roots) was cleared and the sandy soil was broken and smoothed but not compacted. *Partial vegetation removal*: Large vegetation (e.g. lianas, bamboo) was cleared but ground debris (e.g. leaves, branches) remained undisturbed. 2001: The alteration of the two-vegetation removal levels and use of concentric rings was done with the thought this could reduce the reluctance of a bush dog to approach the station.

	2000	2001	Comments
Urine composition	Male and female combined	Male and female separate	
Amount of urine/station	1–2ml	3ml female 15ml male	
Placement of urine	Top of scent post	Female above and separate from male on scent post	2001: The urine was placed in a typical sequence urine mark pattern with the sexes separate which is believed to function so the scent of either sex is not masked (Dunbar and Buehler 1980).
Scheduled station checks	Day 1 Day 4	Daily (Days 1 – 4)	***Direct station check:*** Examining the tracking station surface, recording tracks, and then smoothing the surface. *Indirect station check:* Examining the ground around and trails between tracking stations for signs of bush dog activity (e.g. tracks, faeces, or urine marks). 2000: While only 2 station checks were scheduled, impending rainstorms necessitated additional check(s) at 4 of the 5 treatment sites.
Days urine applied	Day 0 Day 1	Day 0 Day 2	Day 1 was designated as 24-hr after the initial Vocalisation playback (Day 0)
Faeces	Yes	No	
Placement of Faeces	Base of scent post	-	
Days Faeces applied	Day 0	Day 0	

Results

Results from trials with captive bush dogs.

Bush dogs housed individually typically responded to playbacks with long calls (Objective 1); whereas, those housed in pairs or groups responded with short calls. The latter also showed increased activity levels including more frequent social contact (e.g. nuzzling) and urine-marking behaviours (Objective 2). For example, one of the OKC pairs living in a large outdoor yard oriented its activity (e.g. running, scent-marking, exploring) towards the playback speaker even when its location was changed from the upper to the lower portion of the enclosure.

Results from trials with free-ranging bush dogs

All positive results from direct (tracking station surface) and indirect (area around tracking station) station checks were summarized by the number of stations per trial area with positive evidence, independent of technique (e.g. three tracking stations at Jejui'mí=3/Jejui'mí). In 2000, bush dog tracks were confirmed at one trial area (1/Horqueta'mí-I) and "probable" bush dog tracks were found at three trial areas (1/Lagunita-I; 3/Lagunita-II; 1/La_Morena). In 2001, confirmed bush dog tracks were found in four of the five trial areas (2/Lagunita-III; 1/Horqueta'mí-II; 1/Horqueta'mí-III; 1/Horqueta'mí-IV). One of these areas (Horqueta'mí-IV; treatment: urine and vocalisation; day 4) had evidence of physical disturbance with numerous tracks in and surrounding the central location station, chew marks on the tree where the speaker was tied, and tearing of the cable leading to the

playback speaker. Evidence of bush dog activity in the form of tracks (2/Lagunita-I; 1/Horqueta'mí-I; 1/Horqueta'mí-II), urine marks (2/Lagunita-I; 1/Horqueta'mí-I; 1/La_Morena), and faeces (1/Jejui'mí; 1/Lagunita-I) was found outside the tracking stations both years.

In 2001, opportunistic re-checks of the four treatment sites in Lagunita-III for an additional six days provides potential insight into the nomadic and long-ranging movement patterns of bush dogs (Goldman 1912, Stellfeld 1974 (as cited in Drüwa 1982), M. Swarner, University of California-Davis, unpublished report, O. Carrillo, unpublished report.). Footprints of a single bush dog were found at one of the four treatment sites on days 2 and 8 and at a different treatment site, 1km away, on day 3.

In 2000, confirmed vocal responses to the taped long calls were heard at a single trial area, Lagunita-I; the responses occurred during a playback session at 0800hr and lasted 15min, involving at least three individuals (two northwest in close proximity of each other and one south of the central location) (Objective 1). Unconfirmed but "potential" responses were heard at two other 2000 trial areas (Horqueta'mí -I and La_Morena). In 2001, researchers did not remain in the trial area during the playbacks; however, one "potential" response was heard at Horqueta'mí-III.

Within each year, the total number of bush dog tracks at the stations was compared across the different treatments to determine relative effectiveness (e.g. two tracking stations at urine-only treatment site=2/urine-only). In 2000, both confirmed (1/urine and vocalisations) and "probable" (5/urine and vocalisations) tracks were found at one of three treatments. In 2001, confirmed tracks were found with three of the four treatments (1/bare ground (control); 1/playbacks-only; 2/urine and vocalisations). In 2000, if "probable" and confirmed tracks are combined the combination of urine and vocalisations was more effective ($p=0.01$) at luring bush dogs to a specific location than the use of playbacks alone. While no difference ($p>0.05$) was found in 2001, the data show a trend towards the combined urine and vocalisation technique as the most effective.

Discussion

Results from trials on captive individuals suggest that if bush dogs hear long call playbacks, whether or not the recorded individual is familiar, they may respond vocally (Objective 1) but the type of vocalisation is dependent on group dynamics at the time (e.g. whether there are separated group members or the unit is complete). While long calls may not be elicited by all playbacks, increased activity oriented towards the taped calls suggest they could be useful in luring even cohesive groups to a specific area (Objective 2).

Field trials for Objective 1 were directed at testing the use of taped long calls to indirectly census bush dogs. In 2000, both confirmed and "potential" vocal responses were heard; respondents could be counted on the basis of identifying unique syllable(s) in the long calls of individual bush dogs. The confirmed response of the three individuals at Lagunita-I is strong evidence that a vocal reply to unfamiliar conspecifics is possible in the field. This technique allows estimates of minimum group size; however, actual group size cannot be determined because it can't be known if all individuals within a group are responding vocally. Furthermore, other groups may go uncounted if they respond with short calls only due to the shorter hearing range for this vocalisation. Based on these results, vocalisation playbacks may not be a useful method to census wild bush dogs. However, they can potentially be used to indicate presence of the species in an area.

Trials in the field for Objective 2 were directed at developing a technique, which could reliably attract bush dogs to a specific area for physical or photo capture. Previous attempts to lure bush dogs to a targeted site through the use of artificial lures were unsuccessful (Zuercher et al. 1999). This study indicates that the combination of taped long calls and deposition of conspecific urine may lure bush dogs to a specific location. The calls likely lure bush dogs to a general area while urine marks may attract the animal to the specific location. However, bush dogs could prove to be similar to other canids (e.g. coyotes (*Canis latrans*): G. Stewart, Johnny Stewart Wildlife Calls, personal communication) in becoming habituated to playback calls, by stopping to respond or

reducing the approach distance to the stimulus. More data on visitation frequency and stimulus habituation are needed to optimize the technique's potential value. Developing a number of variations of this technique may also prove useful in reducing habituation effects and enhancing the researcher's ability to lure and trap bush dogs (Appendix 1). Knowledge gained in these studies and in captive observations may help optimize results when applying this technique (Appendix 2).

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Appendix 1

1) Replacing bush dog urine with urine from prey species (e.g. agouti, capybara: C Soulsbury, Bristol Fox Group, Scotland, unpubl. report).

2) Adding prey distress calls to the vocalization tape, which may potentially eliminate the need for an olfactory lure.

3) Varying the time between vocalizations, which may decrease the possibility of habituation.

Appendix 2

1) A playback volume equal to a natural bush dog call may increase effectiveness and allow bush dogs to be lured closer.

2) It appears that a minimum of four consecutive days in an area may be adequate, but longer calling periods may be needed due to the nomadic nature of the bush dog or because of differing weathering conditions.

3) While the presence of a stream or water source (<500m) may be a sampling artifact that associates bush dogs near water (Funk et al. 1999), this does seem to increase the likelihood that bush dogs, as well as other species, will travel through an area and, therefore, should be considered when selecting areas.

4) Within a chosen area, traps should be placed at a variety of distances (e.g. 0 to 500m) from the central playback location.

5) Due to the neophobic nature of the bush dog (K.E. DeMatteo, unpubl. report), a trap that is not visible may be a better alternative to the traditional live-box trap. If leg traps are used, the use of a sedative within the leg-hold would be recommended (R. Leite, pers. comm.). If box traps are used, then an extended prebaiting period would be recommended.

6) In terms of handling captured animals, work with captive bush dogs can provide guidelines for species tranquilization dose ranges (5-10mg/kg Telazol (range of light to heavy sedation): C. Dutton and R. Junge, pers.comm.).

Karen DeMatteo has worked with *Speothos* since 1998. Her Ph.D. work on their reproductive physiology provided invaluable insight into their behaviour and opportunities to test field techniques under controlled conditions. She plans to use her knowledge and the developed techniques to study their basic ecological needs in the field.

Osvaldo Carrillo has been dedicated to patrolling and protecting the Mbaracayú Reserve for FMB since 1993. His extensive knowledge and experience with the local flora and fauna has provided insight into the active conservation of both. He provides insight, guidance, and assistance in research projects directed by international colleagues.

Gerald L. (Gerry) Zuercher is an Assistant Professor of Vertebrate Ecology at the University of Dubuque (Iowa, USA) and Research Associate with Sunset Zoological Park (Manhattan, Kansas, USA). Gerry holds a Ph.D. in wildlife biology from Kansas State University. His research has focused on mammalian carnivore ecology in eastern Paraguay.

Silverio Ramirez has been with FMB since 1993 and currently leads efforts to maintain and control the Reserve limits as well as provide support to visitors and scientists. His broad knowledge of the local flora and fauna is essential in his work and has provided assistance to several scientific studies.

Kelli Smith received her Bachelor of Science degree in biology through the Kansas Cooperative Fish and Wildlife Research Unit at Kansas State University and is currently pursuing various scientific interests.

Ingrid Porton received a B.S. and M.S. in wildlife biology after which she studied the behaviour of bush dogs at National Zoological Park's Conservation and Research Center. Employed at the Saint Louis Zoo since 1983, she is now Primate Curator and is actively involved in lemur conservation initiatives.