

# **SIFAKA DATABASE MANUAL**

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## **PREFACE**

This Manual provides methodological and contextual information about The Sifaka Database. Part I focuses on the Database, and Part II on how data were collected in the field. Further information is provided in seven appendices.

### **Part I: The Database**

1. Data Downloads
2. Age and Mortality Criteria
3. Database contributors & sources used

### **Part II: Field data collection**

1. The study population
2. Census & location
3. Capture & release
4. Naming groups

### **Appendices**

1. General information about Bezà Mahafaly Special Reserve
2. Map of the Parcel I grid system
3. Ear-notch system
4. Capture sheets
5. Standardized group names and abbreviations
6. Standardized collar/tag abbreviations
7. History of group names

## **PART I: THE SIFAKA DATABASE**

### **I:1 DATA DOWNLOADS**

All data are downloadable as CSV files.

#### **I:1.1 Census Matrix:**

Sifaka ID: current ID; previous given ID(s) also included for recaptured animals when applicable  
 Mother Sifaka ID: mother of sifaka, when known  
 Group Name: social group in which sifaka was censused  
 Group Abbreviation: social group abbreviation used in field notes  
 Census Day(s)  
 Census Month(s)  
 Census Year(s)  
 Sex  
 Lon Lat WKT(s): Aggregate longitude and latitude coordinates for the individual's group location in WKT (Well Known Text) format.  
 Birth Day  
 Birth Month  
 Birth Year  
 Birth Date Type: EST = estimate of birth year based on tooth wear; CER = certain birth day, month, and year; UNK = unknown birth year (see I.2.1).  
 Death Day  
 Death Month  
 Death Year  
 Death Date Type: Known = confirmed death; Declared= animal not seen / censused for 2 years for females, and 3 years for males (see I.2.2).

#### **I:1.2 Capture and Morphometrics Matrix:**

Sifaka ID: current ID; previous given ID(s) also included for recaptured animals when applicable  
 Mother Sifaka ID: mother of sifaka, when known  
 Group Name: social group in which sifaka was censused  
 Group Abbreviation: social group abbreviation used in field notes  
 Capture Day  
 Capture Month  
 Capture Year  
 Sex  
 Lon Lat WKT: Aggregate longitude and latitude coordinates for the individual's group location in WKT (Well Known Text) format.  
 Birth Day  
 Birth Month  
 Birth Year  
 Birth Date Type: EST = estimate of birth year based on tooth wear; CER = certain birth month and year; UNK = unknown birth year (see I.2.1).  
 Death Day  
 Death Month  
 Death Year

Death Date Type: Known = confirmed death; Declared= animal not seen/ censused for 2 years for females, and 3 years for males (see I.2.2).

Collar Color: color of collar given animal when captured

Tag Form: shape of ID tag

Tag Color: color of ID tag

Verbatim Markers: collar color, tag form, and tag color as aggregate

Is new: Yes=a new captured animal; No= a recaptured animal.

### **Weight (kg)**

**Outside hip (cm).** Greater trochanter to greater trochanter. Animal on stomach, knees together, legs extended. Measurement highly sensitive to position of legs.

**Bi-acromial width (cm).** Distance between the most lateral extensions of the scapulae. Animal on stomach, elbows tucked in to trunk. Measurement highly sensitive to position of arms

**Scapula (cm).** Vertebral border to acromion process.

**Dorsal basion to tail base (cm).** 1984-1989: called “head to rump length”. Animal on stomach, nose pointing forward. Head of tape tucked tightly under dorsal basion, tail held up, tape fitted tightly into right-angle thus formed with vertebral column.

**Tail length (cm).** Head of tape tucked into right-angle as for (4), measured to last vertebra in tail.

**Chest circumference at the nipple (cm).** 1984 -1989: measured as maximum chest circumference. Taken just below armpits under moderate tension.

**Upper forelimb (cm).** Acromion process to lateral epicondyle of humerus.

**Upper forelimb circumference at midpoint (cm).** At the midpoint between shoulder and elbow, with moderate tension on the tape measure.

**Lower forelimb (cm).** Lateral epicondyle to radial styloid.

**Lower forelimb circumference at midpoint (cm).**

**Radial styloid to tip of longest digit (cm).** Done holding hand up, with tape head against edge of radial styloid, dorsal surface of hand flattened against the tape.

**Radial styloid to crease under longest digit (cm).** Same technique as in #11. Crease at base of digit, not the big crease running across the palm.

**Palm and longest digit (cm).** Tape head where fur ends on wrist.

**Upper hindlimb (cm).** Greater trochanter to lateral epicondyle of tibia. Leg loosely bent, tape head on middle of greater trochanter.

**Upper hindlimb circumference at midpoint (cm).**

**Lower hindlimb (cm).** Lateral epicondyle of tibia to lateral malleolus of fibula.

**Lower hindlimb circumference at midpoint (cm).**

**Calcaneus to tip of longest digit (cm).** Done holding foot up, with tape head on the most posterior point on the calcaneus, measured off the digit tip.

**Calcaneus to crease under longest digit (cm).** As in #18, with point about the crease as in #12.

**Back of skull to snout tip (cm).** Furthest projection. Taken using digital calipers.

**Maximum cranial width at level of ear (cm).** Taken using digital calipers directly in front of ears.

**Testes width right (mm).** Animal on back with legs extended. Measured with digital calipers, light pressure. ND=not descended.

**Testes width left (mm).**

**Testes length right (mm).**

**Testes length left (mm).**

**Big toe (cm)** Done holding foot up, with tape head on tip of toe, measured to crease at base of toe.

### **I:1.3 Birth Matrix**

Sifaka ID: Only adult female IDs listed; current ID; previously given ID(s) also included for recaptured individuals when applicable

Years 1984 thru ...: '0' = no infant for that year; '1' = infant seen. Total = total number of offspring for a particular female

### **I:1.4 Ages Matrix**

Sifaka ID: only animals with known birth years listed; current ID; previous ID(s) also included for recaptured animals when applicable

Sex

Birth Date

Last Seen Date: date the animal was last seen on a census report

Last Seen Source: census (see Part I, 2.2); primary=identified cadaver

Years 1984 thru ...: Number in cell indicates age of individual in that year. The ages cutoff date is November 1<sup>st</sup>, i.e. an animal annually advances in age by one year if it is still alive after that date.

## **I:2 AGE AND MORTALITY CRITERIA**

### **I:2.1 Age**

Estimated vs. known ages: Most animals captured before 2002 of unknown birth year have been assigned a birth year on the basis of tooth wear. These animals are designated EST (Estimate) for birth date type. Other animals captured of unknown birth year are designated UNK (Unknown) for birth date type. These animals are described on the capture sheet as having no dental wear, light wear, moderate wear, or heavy wear, but not assigned a birth year.

The birth date assigned an animal of known age, designated as CER (Certain) for birth date type, represents the first time it was seen as an infant, which in many cases was within a few days of its birth. Infants born outside the intense sampling period between mid-July and mid-August – i.e. June, early July, late August, September, and October -- were often not discovered until the monthly census; birth date estimations for these individuals are of slightly lower resolution.

The Sifaka Database supersedes the age class system used earlier (Richard *et al.* 1991 - *Am.J.Phys.Anthropol.* **84**, 307-322), and does not include age estimates derived from that system.

### **I:2.2 Mortality**

Cadavers of marked animals are sometimes recovered. These animals are designated as 'Known' for death date type. All other presumed deceased sifaka are designated as 'Declared' for death date type. Criteria for declared dead differ for males and females. A male not seen for 3 years is declared dead, retroactive to the year and month after he was last censused. A female not seen for 2 years is declared dead, retroactive to the year and month after she was last censused. Females commonly remain in their natal group or, in the case of those who leave, disperse to neighboring groups or forest adjacent to their natal group. We are reasonably confident, thus, that a female not seen for 2 years is dead. Males disperse further, and so we allow 3 years to elapse before retroactively declaring them dead.

On rare occasions, an animal is “resurrected” after not being observed for a number of years, and the Database allows for corrections of this kind. In the main, however, animals stay close enough to home to give us confidence in this system.

From 1985 through 1992, censuses were conducted annually, and declared deaths were recorded as occurring on April 15<sup>th</sup>. From 1993 until 1999, increased frequency of censuses enabled declared deaths to be recorded on two assigned dates annually (April 15<sup>th</sup> and October 15<sup>th</sup>), according to the time of last sighting. Starting in 1999, the monthly census was used to provide higher resolution for dates of disappearance.

### **I:3 DATABASE CONTRIBUTORS & SOURCES USED**

#### **I:3.1 Contributors**

Pothin Rakotomanga (1984-1995) and Joelisoa Ratsirarson (1996-present) oversaw data collection, with the support of Alison Richard (1984-present) and Jeannin Ranaivonasy (1999-present). Hélian Ratsirarson, Sylvia Ravelonjatovo, Jeannicq Randrianarisoa, Jacky Youssof, Miandrisoa Razafindrabe, Sibien Mahereza and Zovelosoa Raharinalomanana served as field coordinators over the years. Behaligno (1984-1994) and Enafa Rajaonarisoa (1995- present) conducted censuses and captured animals, assisted by other members of the BMSR monitoring team: Efitira, Elahavelo Efitroarana, Edidy Ellis, Emahalala Ellis, Rigobert Emady and Edouard Ramahatratra.

The following contributed to field observations and/or assisted with the capture program: Andry Andrianandrasana, Merrill Baker, Diane Brockman, Chloe Chen-Krauss, Laurie Godfrey, Kashka Kubzdela, Richard Lawler, Sheila O’Connor, Mark Pigeon, Elysé Razanajaonarivalona, Roshna Wunderlich, Ny Yamashita, the late Robert Dewar and the late Patricia Whitten.

Marion Schwartz created and compiled the Schwartz Database (1984-2012). Joelisoa Ratsirarson and Jeannin Ranaivonasy created and compiled the Next Generation Database (2012-2022), with the assistance of Notahinjanahary Rasamimanana, Miora Ramanakoto and Mikoja Rambinintsoa. ESSA faculty, students and staff (Joelisoa Ratsirarson, Jeannin Ranaivonasy, Mikoja Rambinintsoa, Rija Randriamialison, Mia Razafimahefa) collaborated with Yale faculty and staff (Nelson Rios, Isabella Fiorentino, Alison Richard and Lawrence Gall) to merge and transfer the legacy databases to a new platform.

#### **I:3.2 Sources used**

*Capture Sheets	1984-present
*Note books (AR)	9/84-present
*Note books (Enafa Rajaonarisoa)	1995-present
*Note books (Kashka Kubzdela)	7/93-6/1994
*Note books (Diane Brockman)	2003-2005
Note book (Patricia Whitten)	2003 & 2005
*Annual compiled censuses (M. Schwartz)	1995-2012
Monthly compiled censuses (J. Ratsirason)	2012-present

\*Scanned copies archived, available upon request.

## **PART II: COLLECTION OF FIELD DATA**

### **II:1 THE STUDY POPULATION**

The study population comprises all marked animals in social groups with home ranges partly or completely within the boundaries of Parcel I of the Bezà Mahafaly Special Reserve (BMSR; see also Appendix 1). As of 2023, it includes over 900 animals captured since 1984, about a third of which have been followed from birth. The annual capture program steadily reduced the proportion of untagged individuals in the population, and today most animals >12 months of age are tagged. Infants that die before reaching their 1<sup>st</sup> birthday are present in the Database as untagged. Untagged subadults and adults are not included in the Database. Since 2016, a few animals in groups surrounding Parcel I have been tagged and followed, and records for these individuals are included.

### **II:2 CENSUS & LOCATION**

#### **II:2.1 Trail system**

Parcel I (80 ha) is part of a larger contiguous forest, bounded by the Sakamena River in the east, an unpaved road in the west, an oxen cart trail in the south and a forest path in the north. In 1979, Parcel I was enclosed by a 3-stranded barbed wire fence, about 1m high, to exclude cattle and goats. The trail system inside Parcel I was begun in 1981 and completed in 1984-85. Compass directions were used to cut narrow (<1m), parallel trails at 100m intervals north-south, and east-west. In 1986, one further trail (Pink IV) was added. The trails did not all run perfectly parallel, and the actual grid was mapped, first by compass and then by GPS coordinates (Appendix 2).

Trails were marked with rings painted around tree trunks at intervals along them, and are identifiable by the color and number of rings.

The following names and shorthand were commonly used to record data for east-west trails (from South to North):

Blue I (one blue ring): coded BI  
 Blue II (two blue rings): coded BII  
 Blue III (three blue rings): coded BIII  
 Pink I (one pink ring): coded RI [Rose], or PI  
 Pink II (two pink rings): coded RII, or PII  
 Pink III (three pink rings): coded RIII, or PIII  
 Pink IV (four pink rings): coded RIV, or PIV

Colors of the north-south trails followed (more or less) the order of colors in the rainbow. The sequence was repeated once to complete the grid. The following names and shorthand were commonly used to record data for north-south trails (from East to West):

Red East (one red ring): shorthand R or RE  
 Orange East (one orange ring): shorthand O or OE  
 Yellow East (one yellow ring): shorthand J, JE or YE  
 Green East (one green ring): shorthand V, VE or GE

Blue East (one blue ring): shorthand B or BE  
 Pink East (one pink ring): shorthand M, R or PE  
 White East (one white ring): shorthand F, Bl, BIE or WE  
 Black, or Black East (one black ring): shorthand N or Center  
 Red West (one red ring): shorthand R2 or RW  
 Orange West (one orange ring): shorthand O2 or OW  
 Yellow West (one yellow circle): shorthand J2 or JW  
 Green West (one green circle): shorthand V2 or VW  
 Blue West (one blue circle): shorthand B2 or BW

The barbed-wire fence along the western boundary was referred to as Vala-W, along the northern boundary as Vala-N, and along the southern boundary as Vala-S.

## **II:2.2 Census**

Trails were walked at a slow steady pace during a census, and the presence of animals was detected by sight, sound or, occasionally, scent. The objective was to record the location and group affiliation (if any) of tagged individuals, the presence of infants, and total group size and composition. Two to three days were usually sufficient to census all groups living wholly or largely in Parcel 1 and to record the presence/absence only of tagged individuals in groups adjacent to the Reserve.

## **II:2.3 Individual and group locations**

The two trails (N/S and E/W) closest to an observed individual was used to record location from 1984-2005, and GPS coordinates thereafter. An individual was recorded as with a named group when other members of that group were identified close by. If the individual had not previously been seen with that group, it was recorded as "Visiting". When no other animals were detected, it was recorded as "Alone", or "Wandering".

## **II:3 CAPTURE & RELEASE**

### **II:3.1 Capture**

Three classes of animals were excluded from capture: individuals <12 months old, as estimated by size or knowledge of birth date; adult females during months of possible gestation (Jan-September); and females with offspring <12 months old.

Animals were captured using a Telinject blowgun with a reach of about 10m., and darts loaded with a sedative. From 1984-1992, Ketamine in combination with Rompun was used for sedation. After 1992, Telazol was used because it is more soluble and does not cause an excitatory phase. Telazol is a cocktail of tiletamine hydrochloride and benzodiazepines.

2.5ml sterile water was added to a 500mg vial of Telazol in powdered form on the day of use. Each dart delivered 0.4-0.5ml, at a dosage of 40-50mg/kg. The elapsed time to full sedation varied from a few minutes to 15 minutes, and some animals were sedated only after the addition of 0.2ml and, occasionally, a further 0.1ml. The reasons for this variation likely include the volume of drug actually delivered, the drug's temperature at the time of injection, the animal's activity prior to darting, and variations in

individual resistance to the drug. On hot days, bottles containing the drug in solution were wrapped in a wet sponge to keep them cool in the forest.

Typically, the darted individual fell out of the tree once sedated, and was caught in a sheet held out above the ground. Occasionally, a darted individual remained lodged in the tree, and was retrieved by a member of the field team. If that was not possible, an observer remained until the animal was fully alert again.

### **II:3.2 Care of sedated individuals**

Sedated animals were carried back to camp in baskets and released early in the day after their capture, at the capture site, to which they were carried in holding cages covered with a sheet. From 2003, capturing was limited to the morning or early afternoon. This allowed partial recovery from sedation before the nighttime drop in ambient temperature. Recovery time varied widely, and animals that appeared fully alert could still show poor coordination if returned to the forest prematurely. After processing, each animal was returned to a holding cage and monitored closely. Animals from the same group were housed together. The holding area was shaded at all times of day.

To ensure correct identification, a collar and tag were loosely attached around the animal's neck immediately on arrival in camp, and its tag number, group, and location of capture recorded on the Capture Data Sheet.

Next, the animal's temperature was recorded, using a rectal thermometer and disposable cover. Sedatives destabilized thermoregulation in some individuals, leading to unusually low (cool days) or high (hot days) body temperature. If body temperature fell below ~97°F, a member of the field team sat in the sun with the affected individual, its stomach exposed and eyes shielded. When its temperature rose above 97°F, the animal was returned to the processing table and kept in a curled-up position on its side to minimize heat loss. Body temperature was monitored every 15 minutes, and the warming procedure repeated as necessary. If body temperature rose above ~100.5°F, the animal was sprinkled with cold water with its stomach exposed. Its temperature was monitored every 15 minutes, and the cooling procedure repeated as necessary.

The body temperature of individuals captured in the afternoon was closely monitored through the evening as ambient temperatures fell. Animals still partially or completely sedated and whose body temperature fell below ~97°F were given hot water bottles in their holding cages, wrapped in space blankets, or held by one of the field team until their temperature was within the normal range.

### **II:3.3 Marking for individual identification**

#### ***Tags and collars***

Each individual was assigned a unique numbered, plastic tag. Tags initially had numbers engraved on only one side, but were subsequently engraved on both sides in order to facilitate censusing.

The tag was attached to a metal ring sewn by the manufacturer into a ½" nylon collar. From 1984 to 1997, two attachment mechanisms were used: S-hooks and key rings. Some tags were lost as S-hooks straightened out, others as key rings gradually rusted and broke. From 1998, tags were attached with a 2" length of multi-strand, stainless steel sailboat rigging wire. The ends of the wire were crimped together in a small lead sleeve using a swage. This attachment system is referred to as "Ned" or "Rich" on the Capture



Sheet. After adoption of the “Rich” system, the weakest link in the tagging procedure became the collar, which animals occasionally lost when the collar came undone or was attached too loosely.

The collar was cut to the appropriate length with a razor blade, and the cut end melted and sealed with a flame. The loose end of the collar was bound to the collar body with nylon filament, buckled tightly enough around the animal’s neck to ensure that it could not slip over the head and loosely enough to allow room for growth in young animals. Allowing sufficient space to groom under the collar was also important. In Jan 1999, two animals were recaptured and their collars loosened because of a build-up of parasites.

**Ear-notches.** Each animal’s ears were notched, using a binary system corresponding to the animal’s tag number. Each ear had three notch positions – top, middle, and bottom – with values of 1, 2, 4 (animal’s right ear), and 8, 16, and 32 (left ear), yielding a total of 63 unique combinations (Appendix 3). The sequence was re-started at #64, again at #127, and so on. Some animals had natural notches, probably as a result of fights. An effort was made to match the animal’s ID number to a notch pattern that incorporated natural notches. It sometimes became difficult or impossible to “read” notches if a notched ear was subsequently torn in a fight. The notcher used initially is no longer manufactured, but closely resembles #50 N Punch, #N12 Triangle Notch with a 1/8<sup>th</sup> wide slot, made today by MC Mieth Manufacturing.

**Tattoos.** Initially, each animal’s inner thigh was shaved and tattooed with its ID number. With black ink on black skin, the tattoos were impossible to read in the forest, and difficult to read even when animals were recaptured and sedated. The procedure was abandoned in 1987.

### **II:3.4 Information collected on capture sheet**

A Capture Sheet was used to record all data collected on a captured individual. It was modified over the years (Appendix 4), the most significant change being the addition of further morphometric measurements in 1992.

Four types of information were recorded:

**Capture and capture context:** date and time of capture, capture location, dosage, rectal temperature at time of arrival in camp (and thereafter, as appropriate).

**Individual identification:** sex and visually assessed age class, assigned ID number, collar color, tag shape and color (see Appendix 6), tag attachment type, and ear notch combination

**Weight, physical description, and morphometrics.** Weight was recorded in kg, to two decimal points, using a spring balance in early years, and a digital scale more recently. For the physical description, any distinctive features were noted first. Otherwise, a descriptive “scoring system” was developed and used with increasing consistency as follows:

**General condition:** scored as “Good” or particular feature(s) noted (e.g. loss of fur, blindness, scar tissue, fresh wound, emaciated appearance).

**Throat gland:** not visible; barely visible/light brown; dark brown; dark brown & sticky; dark brown, sticky secretions extending to chest

**Nipples:** barely visible; present, not elongate; elongate

**Vulva:** small, pale pink; large, swollen, bright or dirty pink; moderate sized

**Testes:** not descended; tiny, furry; small, furry; medium-sized, some fur; big, black testes

*Teeth:* broken or chipped teeth were noted, and juveniles' incisor and canine sizes were assessed qualitatively; wear was noted for (upper and lower) incisors, canines and molars as none; light; moderate; heavy; very heavy

Most morphometric measurements were taken using a plasticized cloth tape measure; calipers were used for the head and testes. Limb measurements were taken on the animal's left side. Different terms were initially used for some measurements, although the landmarks were the same. The possibility of systematic differences between measurers has not been explored. In addition, certain measurements were difficult to take consistently and it is likely that sedation state affected some measurements. Notes about this are recorded on the capture sheet.

Skinfold thickness was measured with calipers on the biceps, abdomen and nape of some individuals from 1984 – 1995. This measurement was abandoned when its consistency proved to be low.

### ***Samples taken***

*Ear-notch tissue.* Notched tissue is transferred with tweezers to a marked vial containing EDTA. The vial was sealed and kept at ambient temperature in the field, and stored in a refrigerator after the capture season.

*Dental impression.* The upper dentition was cleaned with a toothbrush and dried with pressurized air before an impression was taken using Xantoprin (@ 1 tube=5 animals). The amount of hardener needed varied with ambient temperature (16-19 drops). From 1984 - 1999, impressions were taken of all individuals, and since then only of animals 2 years old or older.

*Hair.* A tuft of 20-50 hairs was pulled from the top of each individual's head using pliers. Samples were initially stored in small paper envelopes and subsequently in plastic bags, which improved their preservation.

## **II:4 NAMING GROUPS**

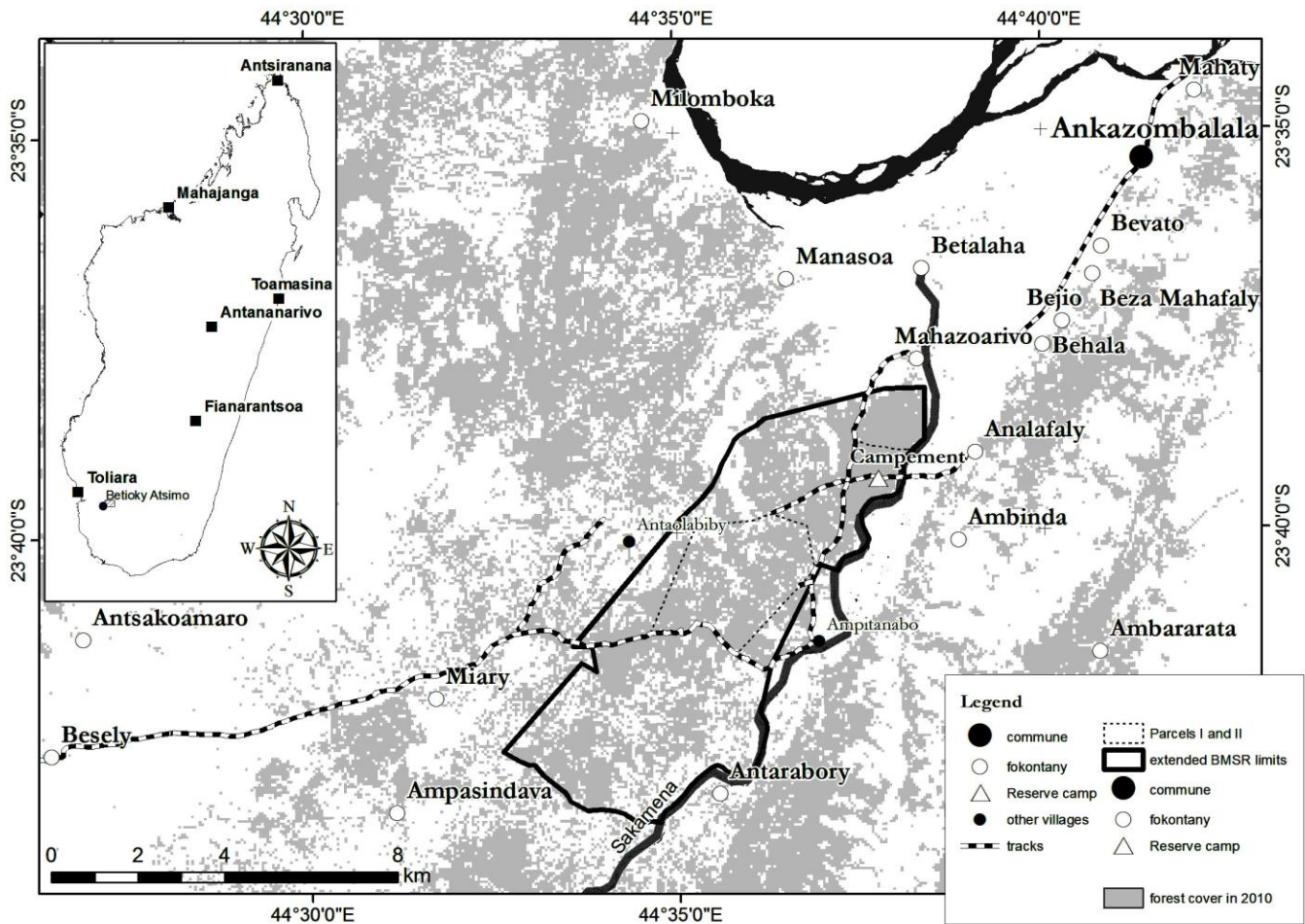
A group was given a name if it contained at least one male and one female in a stable association (i.e., if they were together on repeated sightings), and if at least one individual was clearly recognizable (or tagged). In practice, this meant that most groups were partially or completely habituated by the time they were named.

The identification of a newly-encountered association of animals evolved over time. A group was given the name "Mpivady" in 1984. After it disappeared in 1989, that name (or Mpivady-Vao) was applied to any newly encountered pair, as in Mpivady II, III, IV etc. Newly encountered associations with >2 adults were immediately given names. But there were many associations of varying size and they were often ephemeral, making it hard to keep track of the Mpivady numbering system and giving rise to a proliferation of names. Starting in 1995, every new group regardless of size was identified as NWGP 1,2,3.... until observers were confident of its stability, at which point it was named. This too became problematic as the number of NWGPs proliferated. From 2007-08, a NWGP was identified by the month and year it was first seen, e.g. NWGPAug07. In practice, that proved hard to keep straight too.

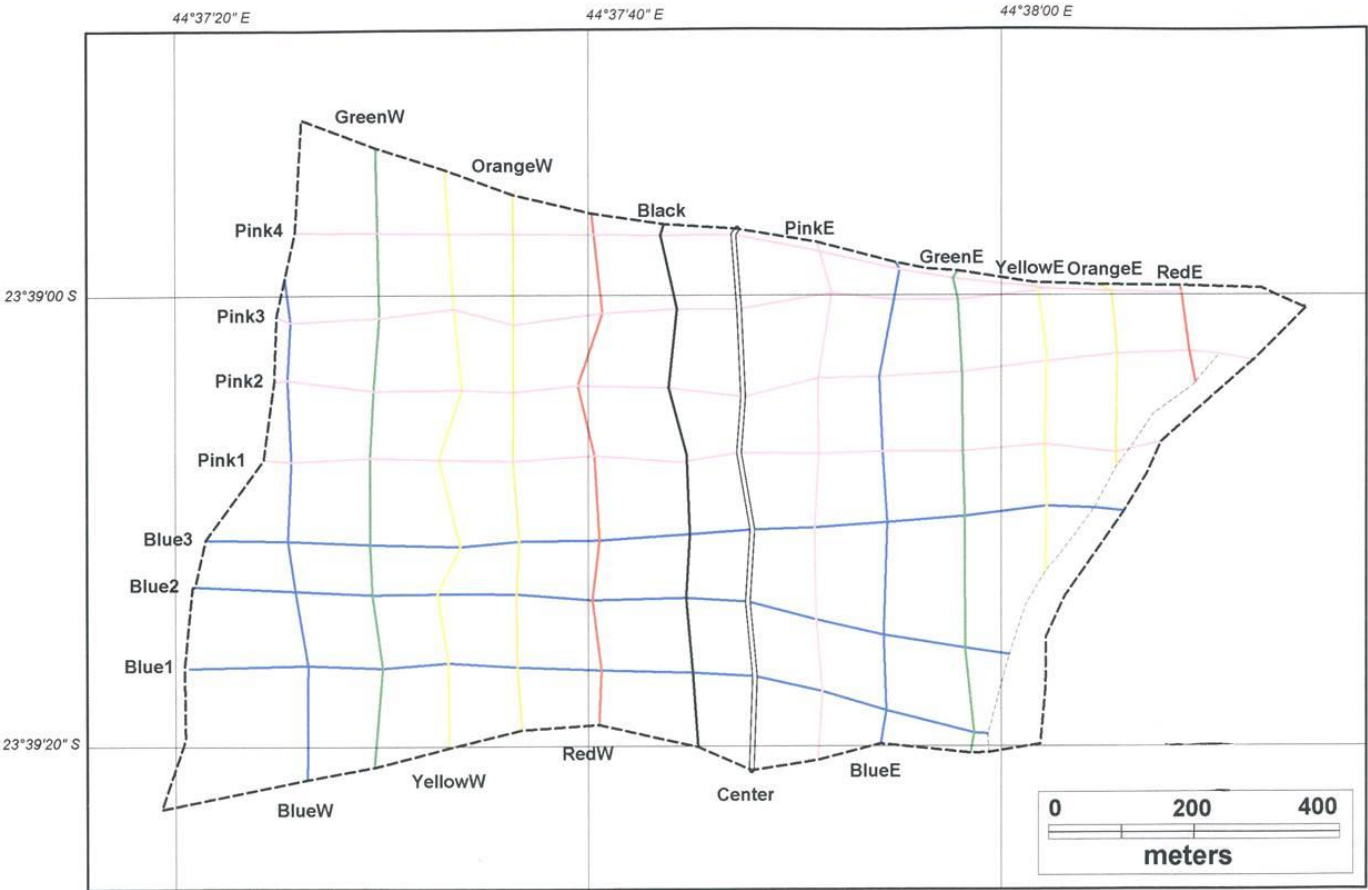
Groups were sometimes given an existing name with the suffix "2". This happened when the group (1) contained a collared female from the already-named group, (2) contained an individual with a similar distinctive feature (e.g. blindness) or (3) was first identified within the home range of the already-named group, or in the interstices between that group and another group.

Most group names are in the Malagasy language, and associated with particular people, places, or events. Names were shortened into Code IDs for the Database, and these came to be used in the field too (see Appendix 5 for standardized group names and abbreviations, and Appendix 7 for history of group names).

From 1984-1992, every individual captured was given a name on its Capture Sheet, and some were subjects of focal studies. The practice of naming individuals was abandoned as the size of the study population increased, and individual names are not included in the Database.

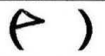
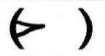
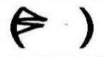


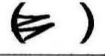

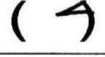

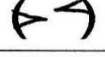
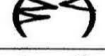
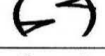
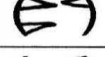
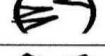
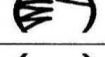
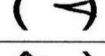
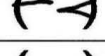


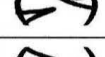
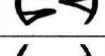
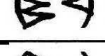



**Appendix 2: Map of the grid system of Parcel I in Bezà Mahafaly Special Reserve**























### Appendix 3: Ear-notch system of captured individuals

Ear Notching Patterns for *Propithecus*

	1	64	127	190	253	316	379	442	505	568	631	694	757	820
	2	65	128	191	254	317	380	443	506	569	632	695	758	821
	3	66	129	192	255	318	381	444	507	570	633	696	759	822
	4	67	130	193	256	319	382	445	508	571	634	697	760	823
	5	68	131	194	257	320	383	446	509	572	635	698	761	824
	6	69	132	195	258	321	384	447	510	573	636	699	762	825
	7	70	133	196	259	322	385	448	511	574	637	700	763	826
	8	71	134	197	260	323	386	449	512	575	638	701	764	827
	9	72	135	198	261	324	387	450	513	576	639	702	765	828
	10	73	136	199	262	325	388	451	514	577	640	703	766	829
	11	74	137	200	263	326	389	452	515	578	641	704	767	830
	12	75	138	201	264	327	390	453	516	579	642	705	768	831
	13	76	139	202	265	328	391	454	517	580	643	706	769	832
	14	77	140	203	266	329	392	455	518	581	644	707	770	833
	15	78	141	204	267	330	393	456	519	582	645	708	771	834
	16	79	142	205	268	331	394	457	520	583	646	709	772	835
	17	80	143	206	269	332	395	458	521	584	647	710	773	836
	18	81	144	207	270	333	396	459	522	585	648	711	774	837
	19	82	145	208	271	334	397	460	523	586	649	712	775	838
	20	83	146	209	272	335	398	461	524	587	650	713	776	839
	21	84	147	210	273	336	399	462	525	588	651	714	777	840
	22	85	148	211	274	337	400	463	526	589	652	715	778	841
	23	86	149	212	275	338	401	464	527	590	653	716	779	842

Ear Notching Patterns for *Propithecus*

	24	87	150	213	276	339	402	465	528	591	654	717	780	843
	25	88	151	214	277	340	403	466	529	592	655	718	781	844
	26	89	152	215	278	341	404	467	530	593	656	719	782	845
	27	90	153	216	279	342	405	468	531	594	657	720	783	846
	28	91	154	217	280	343	406	469	532	595	658	721	784	847
	29	92	155	218	281	344	407	470	533	596	659	722	785	848
	30	93	156	219	282	345	408	471	534	597	660	723	786	849
	31	94	157	220	283	346	409	472	535	598	661	724	787	850
	32	95	158	221	284	347	410	473	536	599	662	725	788	851
	33	96	159	222	285	348	411	474	537	600	663	726	789	852
	34	97	160	223	286	349	412	475	538	601	664	727	790	853
	35	98	161	224	287	350	413	476	539	602	665	728	791	854
	36	99	162	225	288	351	414	477	540	603	666	729	792	855
	37	100	163	226	289	352	415	478	541	604	667	730	793	856
	38	101	164	227	290	353	416	479	542	605	668	731	794	857
	39	102	165	228	291	354	417	480	543	606	669	732	795	858
	40	103	166	229	292	355	418	481	544	607	670	733	796	859
	41	104	167	230	293	356	419	482	545	608	671	734	797	860
	42	105	168	231	294	357	420	483	546	609	672	735	798	861
	43	106	169	232	295	358	421	484	547	610	673	736	799	862





## Appendix 4: Capture sheets used since outset of research program

Example 1: 1985 – only 3 morphometrics measurements recorded

**10** No morphometrics **10**

"Fangaraka John"

DEMOGRAPHIC DATA SHEET



I.D. #: 10      Date of capture: 6 Feb. 85      Social group: Vaovao  
 Tattoo #: 10      Age class: A ♂      Weight: 3.05 kg.  
 Collar and tag: B1en / noir carter  
 Hair sample: ✓      Dental cast: ✓

Measurements

Head-rump length: 38  
 Tail length: 47  
 Chest circumference: 43.5  
 Skinfold thickness  
   Biceps: 2, 2, 2  
   Abdomen: 3, 2, 2  
   Nape: 3, 3, 3

Notes on teeth: RI broken off at base  
 Moderate wear on M's.  
 V. long C's - "mature" adult.

General physical condition: Good. Dark throat. Tick on upper eyelid of both eyes

Ears:   Intact.

Other identifying marks: None. Large testicles.

fell with to knock  
↓ out further

Vetelan • Dose 2cc. + 1cc.  
 • Onset ~ 2min.  
 • Duration

Capture time • 1630h.  
 Release 1830h.  
 Location • E Rose  
 NBI,

Example 2: 1992 – with morphometrics on page 2

DEMOGRAPHIC DATA SHEET

Name: ELONGANA

Date: 25<sup>th</sup> July '92 Weight: 1.950 kg

Social Group: Emelia

Collar and Tag: red collar  
red rectangle tag Notes on Teeth: intact, no wear

Hair Sample: ✓

Dental Cast: ✓

Skinfold thickness:

Age Class: Young ♂ - small testicles 7

Biceps:

Abdomen:

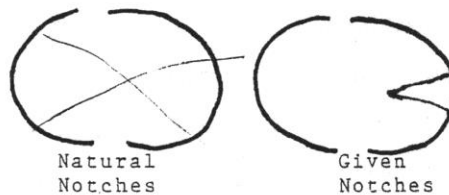
General Physical Condition: Good

Nape:

Temperature: 95.0

Identifying Marks:

No sign of thr. gland  
activity



Ketamine:

Telazol

Dose: 0.5 ml @ 75 mg.

Onset: Went down fine

Duration:

Capture Time: 1030 h.

Capture Location: WJ2 BI

Release Time:

Processed by: Munson

205  
189  
16

- 206 206
- 1.) scapula (vertebral border to acromion process) 5.9 cm
  - 2.) bi-acromial width 9.9 cm
  - 3.) upper arm (acromion pro. to lat. epicondyle of humerus) 9.9 cm
  - 4.) circumference of midpoint of upper forelimb 7.4 cm
  - 5.) lower forelimb (lat. epicondyle to radial styloid) 9.3 cm
  - 6.) circumference of midpoint of lower forelimb 6.9 cm
  - 7.) radial styloid to tip of longest digit 9.5 cm
  - 8.) radial styloid to crease under longest digit 5.4 cm
  - 9.) palm and longest digit 8.6 cm
  - 10.) upper hindlimb (gr. trochanter to lat. epicondyle of tibia) 15.1 cm
  - 11.) circumference of midpoint of upper hindlimb 13.0 cm
  - 12.) lower hindlimb (lat. epi. tibia to lat. malleolus of fibula) 14.1 cm
  - 13.) circumference of midpoint of lower hindlimb 7.7 cm
  - 14.) calcaneus to crease under longest digit 8.4 cm
  - 15.) circumference of chest at the nipple 29.9 cm
  - 16.) dorsal basion to base of tail 32.7 cm
  - 19.) tail length 49.6 cm
  - 20.) outside hip (greater trochanter to gr. trochanter) 6.7 cm
  - 22.) testes width 1.0 cm
  - 23.) testes breadth .53 cm
  - 24.) furthest projection in back of skull to end of snout 7.92 cm
  - 25.) maximum cranial width at level of the ear 5.73 cm

## Example 3: 1995 – with morphometrics

## DEMOGRAPHIC DATA SHEET

1/95

293

Social Group: G0BERA

Date: 8 Jan '98

Sex/Age Class/Name: A 5<sup>th</sup>

Capture Time: 10:35

Location: PINK IV, W. Fence W.

Collar and Tag: BEIGE &amp; BLUE

Dose: 0.5ml.

Processed by: AFR, RL et al.

Ned's system

(Rectangle)  
triangleTemperature: > 105, cooled him with  
some downHair Sample: ☒

Weight: 3.1

Dental Cast: ☒

Tissue Vial:

## Identifying marks and general physical condition:

A. Ears:    
Natural GivenB. Teeth: Intact, big C's, not much wear  
Moderate →

C. Genitalia: Big, furry

D. Throat gland/nipples: light brown, not sticky

E. Parasites: None evident

F. Eyes: fine

G. Other (nose blaze, etc.): Fine-looking male

1. Outside hip (greater trochanter to gr. Trochanter) 11.1
2. Bi-acromial width 9.6
3. Scapula (vertebral border to acromion process) 3.6
4. Dorsal basion to base of tail 32.3
5. Tail length 43.0
6. Circumference of chest at the nipple 25.9
7. Upper arm (acromion proc. to lat. Epicondyle of humerus) 8.4
8. Circumference of midpoint of upper forelimb 10.3
9. Lower forelimb (lat.epicondyle to radial styloid) 9.2
10. Circumference of midpoint of lower forelimb 7.8
11. Radial styloid to tip of longest digit 9.1
12. Radial styloid to crease under longest digit 4.8
13. Palm and longest digit 8.8
14. Upper hindlimb (gr. trochanter to lat. epi. of tibia) 14.8
15. Circumference of midpoint of upper hindlimb 16.2
16. Lower hindlimb (lat. epi.tibia to lat. malleolus of tibia) 14.7
17. Circumference of midpoint of lower hindlimb 9.1
18. Calcaneous to tip of longest digit 11.6
19. Calcaneous to crease under longest digit 7.9
20. Furthest projection in back of skull to end of snout 8.8
21. Maximum cranial width at level of the ear 5.4
22. Testes width R = 1.5      L = 1.4
23. Testes length R = 1.8      L = 1.8

Example 4: 2006 --present: addition of big toe to morphometric measurements

# DEMOGRAPHIC DATA SHEET

720

Social group: VAVMAS

Date: 9 Aug. '11

Sex/Age class/Name:

A ♀

Capture time: 10:55

Collar and Tag:

BU, RO, RO

Location: N. Bl III, Yellow E.

Dose: 0.4 ml

Who attached the collar?

RUSHNA

Processed by: Rich

Temperature: 95.9°F  
94.8°F  
94.6°F

Hair sample: ☒ Yes ☐ No

Tissue vial: ☒ Yes ☐ No

Weight: 2.60

Dental cast: ☒ Yes ☐ No

## Identifying marks and general physical condition:

NOTHING  
NATURAL  
ON (2)

A. Ears



B. Teeth: LIGHT TO MODERATE WEAR, BLUNTED LAMINAE

C. Genitalia: PINK VULVA

D. Throat gland/nipples: ELEVATED NIPPLES

E. Parasites: 15-20 IN FRONT/ARMPIT

F. Eyes: CLEAR, FINE

G. Others (nose blaze, etc.):

DIRTY TAIL  
TAIL, EVIDENCE OF DIARRHEA

1. Outside hip (greater trochanter to greater trochanter) 10.9
2. Bi-acromial width 5.7
3. Scapula (vertebral border to acromion process) 4.0
4. Dorsal basion to base of tail 35.2
5. Tail length 52.1
6. Circumference of chest at nipple 24.9
7. Upper arm (acromion process to lateral epicondyle of humerus) 9.6
8. Circumference of midpoint of upper forelimb 8.6
9. Lower forelimb (lateral epicondyle to radial styloid) 10.4
10. Circumference of midpoint of lower forelimb 7.5
11. Radial styloid to tip of longest digit 10.3
12. Radial styloid to crease under longest digit 5.5
13. Palm and longest digit 9.5
14. Upper hindlimb (greater trochanter to lateral epicondyle of tibia) 18.1
15. Circumference of midpoint of upper hindlimb 13.6
16. Lower hindlimb (lateral epicondyle of tibia to lateral malleolus of fibula) 15.1
17. Circumference of midpoint of lower hindlimb 7.4
18. Calcaneous to tip of longest digit 12.9
19. Calcaneous to crease under longest digit 8.9
20. Furthest projection in back of skull to end of snout 85.6
21. Maximum cranial width at level of ear 57.1
22. Testes width R: \_\_\_\_\_ L: \_\_\_\_\_
23. Testes length R: \_\_\_\_\_ L: \_\_\_\_\_
24. Big toe length (base of foot pad to tip) 11.2 8.4

## Appendix 5: Standardized group names and abbreviations

Final group abbrev.	Final group name	Final group abbrev.	Final group name
A	Alone	MB	Masiaka Be
AD	Andafy	ME	Merrill
AF	Andrefana	MH	Mahagaga
AF2	Andrefana2	MI	Miandry
AND	Andry	MK	Maka
AV	Avaratra	MN	Manga Kely
BB	Boribory	MP	Mpivady Vaovao3
BT	Borety	MPV	Mpivady Vaovao
CH	Chocolat	MPVA	Mpivady Vaovao1
CP	Campement	MPX	Mpivady Vaovao2
CS	Celeste	MVX	Mpivady Vaovao4
DA	Doara	MT	Mitady
DD	Didy	NB	Nenibe
DI	Diane	NB2	Nenibe2
DI2	Diane2	NG	New Group
DO	Domoina	NH	Neck Hurters
DR	Disoraty	NI	Nify
DS	Diso	PA	Papozy
EF	Efitiria	PL	Perline
EL	Elyse	PP	Pap-D
EM	Emelia	RA	Rarich
EM2	Emelia2	RB	Rabingy
EN	Enafa	RG	Rengoraka
EN2	Enafa2	RO	Roshna
EN3	Enafa3	RV	Rivotso
ES	Esambeto	SA	Sary
EV	Elahavelo	SA2	Sary2
FE	Fety	SB	Saba
FO	Fotaka	SN	Sibien
FV	Fanondro Very	SO	Sotrohazo
FX	Felix	SS	Sakamena Sud
FX2	Felix2	SV	Sarivady
G2/2PA	Gobera II (2eme P)	SV2	Sarivady2
GO	Gobera	SYL	Sylvia
GO1	Gobera1	TA	Tatiana
GO2	Gobera2	TE	Tsyemelia
HA	Hanitra	TF	Tafaramanana
HE	Heriniaina	TG	Tsygoa
HF2	Hafa2	TH	Tahina



HN	Honore	TR	Trano
JK	Jacky	VA	Vahiny
KK	Kashka	VB	Vamba
KT	Koto	VD	Vasa Diso
LA	Lanto	VG	Vavy Goa
LAHY	Lahy	VG2	Vavy Goa2
LE	Leslie	VM	Vavy Masiaka
LG	Lahygoa	VM2	Vavy Masiaka2
LL	Lolo	VV	Vaovao
LL2	Lolo2	ZM	Zavamaniry Madamo
LO	Lalao	ZM2	Zavamaniry Madamo2
LV	Lavaka	ZM3	Zavamaniry Madamo3

## Appendix 6: Standardized collar/tag abbreviations

### Collar color abbreviations

BC	BLEU_CLAIR (light blue)
BE	BEIGE
BR	MARRON (brown)
BU	BLEU (blue)
JA	JAUNE (yellow)
NO	NOIR (black)
OR	ORANGE
PI	ROSE (pink)
RC	ROUGE_CLAIR (light red)
RO	ROUGE (red)
UNK	UNKNOWN
VC	VERT_CLAIR (light green)
VE	VERT (green)
VI	VIOLET

### Tag form abbreviations

CA	CARRE (square)
CL	CLOCHE ( bell)
DI	DIAMANT (diamond)
FL	FLEUR (flower)
HX	HEXAGONE (hexagon)
OV	OVAL
RE	RECTANGLE
RO	ROND (round)
TR	TRIANGLE
UNK	UNKNOWN

### Tag color abbreviations

BL	BLANC (white)
BU	BLEU (blue)
DO	DORE (gold)
GR	GRIS (gray)
JA	JAUNE (yellow)
MA	MARRON (brown)
NO	NOIR (black)
RO	ROUGE (red)
UNK	UNKNOWN
VE	VERT (green)

## Appendix 7: History of Group Names

The rationale for naming groups is given below, by year:

### 1984-85:

*Andafy* (=overseas): a group with a range largely outside the Reserve.

*Diso* (=mistake): a lot of early confusion about this group's location and composition; probably same as group subsequently called *Tsy Emelia*.

*Domoïna* (=dove): dove cooing nearby when first individual in group was darted.

*Emelia*: named for Emelia Oleson, visiting from New York.

*Fanondro Very* (=missing finger): one of animals had a missing digit.

*Felix*: named for Felix Rakotondraparany, tenrec specialist at Parc de Tsimbazaza at the time, who came to Bezà with Martin Nicoll to inventory small mammals.

*Fety* (=festival): animals darted and group named on a day marked as Fety in the calendar.

*Fotaka* (=mud): range included one of the mud holes on the road along the southern perimeter of Parcel I

*Lahy Goa* (=blind male): contained a male blind in one eye; in early records, referred to as *Very*(=lost) and *Lahy Goa Diso*.

*Lalao*: named for someone working at Bezà at the time.

*Lavaka* (=cave, hole): one of animals had a hole in his ear; called *Dytra* in early records (the name JR's Promotion/Class Year gave themselves as ESSA students) and eventually renamed *Papozy*.

*Leslie*: named for Leslie Blay, wife of the head of UNDP (Paul Blay), who visited and helped capture.

*Lolo* (=ghost): there was initial confusion about whether this group actually existed – perhaps they were ghosts?

*Nenibe* (=old lady): named for markedly old female in the group.

*Sakamena Sud*: group's range was on bank of Sakamena River in SE corner of Parcel I.

*Tafara's group*: named for Tafaramanana, one of the original BMSR staff.

*Trano* (=house): group's range was on the edge of camp.

*Vaovao* (=new): last of the four groups habituated for AR's focal studies in '84-85, when the wider monitoring program was initiated; the other three were *Sakamena Sud*, *Vavy Goa*, and *Vavy Masiaka*.

*Vavy Goa* (=blind female): contained a female blind in one eye.

*Vavy Masiaka* (=fierce females): very aggressive females repeatedly chased us.

*Zavamaniry Madamo* (=vegetation lady): named for Sheila O'Connor, who came to Bezà to teach plant ecology in the field school.

### 1986:

*Andrefana* (=west): group's range was in the NW of Parcel I; this name appears only on individual capture sheets and rarely in the Database, where it is mostly referred to as *Kashka*.

*Sary* (=picture, photo): someone had a camera when members of this group were darted.

### 1989:

*Disoraty* (= a bad mistake): a group firmly identified after much confusion.

*Enafa*: named for Enafa; initially called *Andrefatimo*(=southwest), for range in SW corner of Parcel I.

*Masiaka Be* (=very fierce): another very aggressive group.

*Nify* (=teeth): named for Marion Schwartz, "the tooth lady".

**1990:**

*Tsy Goa* (=not blind): referred to as *Lahy Goa-Vao* (=new blind male) in early records, reflecting confusion about whether this was actually *Lahy Goa*, or a different group with a blind animal. It turned out to be the latter.

*Vahiny* (=visitor): named for the group's home range, which extended considerably north of Parcel I's boundary as well as inside.

**1991:**

*Papozy*: named for a female in *Sary* who established her own group. Called *Dytra*, then *Lavaka*, before becoming *Papozy*.

**1992:**

*Celeste*: named for Celeste Peterson, a US school student helping AR and her husband with childcare; the group was unstable in early years and was given several successive names.

*Chocolat*: named for an individual with a particularly dark and extensive head-cap.

*Mangakely* (=little blue): named for the short wheel-base, right-hand drive Toyota used by the project from 1984-1996, now being slowly absorbed by forest south of the camp.

**1993:**

*Avaratra* (=north): group ranged in NW corner of Parcel I.

*Boribory* (=round): reason for this name forgotten.

*Didy*: named for Edidy Ellis, a member of the monitoring team at the time; briefly referred to as *Raikipitia*, for reasons forgotten.

*Maka*: named for Maka Cyrille, one of the original BMSR staff.

*Pothin*: named for Pothin Rakotomanga; in Database as *Rivotse*.

*Saba*: reason for this name forgotten.

*Tsy Emelia* (=not Emelia): named after being mistakenly identified as *Emelia*; briefly referred to as *Diso* (=mistake).

*Vasa Diso* (=perhaps a mistake): a name given to an ephemeral group about whose identity there was confusion.

*Vamba*: named for the local word meaning when a male is seen with a different female.

**1994:**

*Esambeto*: named for a village leader working closely with the BMSR manager at the time.

*Gobera*: named for Jean Emady Rigobert, a founding member of the BMSR monitoring team.

*PapCel*: named when Papozy and Celeste coalesced briefly.

**1995:**

*Honoré*: named for the driver Honoré working for BMSR at the time.

*Kashka*: named for Kashka Kubzdela, doing her PhD research at Bezà at the time. Called *Andrefana* in early capture data.

*Rivotse* (=wind): named on a windy day; initially referred to as *Pothin*.

*Tatiana*: named for a visiting researcher.

**1996:**

*Elysé*: named for Elysé Razanajaonarivalona, who was working at Bezà at the time

*Lanto*: named for Lanto (surname unknown), who was working at Bezà at the time.  
*Sarivady* (=female from Sary): named for the group's founding female, who came from *Sary*.

**1997:**

*Diane*: named for Diane Brockman, who was doing her PhD research at Bezà at the time.  
*Rengoroka*: named for Ralaivao (his nickname), a MNP staff member at the time

**1998:**

*Koto*: named for Koto Bernard the head of the Zombitse National Park, who was visiting Bezà.  
*Pap-D*: named during extended period of confusing instability in two neighboring groups referred to as *Papozy* and *Celeste* in the Database.  
*Perline*: named for the cook at camp at the time.  
*Rabingy*: named for Helian Ratsirarson, who was working at Bezà at the time.

**1999:**

*Borety* (=wheelbarrow): a trader from Antsirabe was selling much-appreciated wheelbarrows in the nearby village of Besely at the time.

**2000:**

*Mahagaga* (=very surprising): a surprising assembly of individuals not seen for a long time.

**2001:**

*Merrill*: named for Merrill Baker, an undergraduate at Smith College in the US, who did a project at Bezà.  
*Martin, Evorisoa, Bakoly, Jean Paul, Mary, Neck Hurters*: names given to groups south of Parcel 1 being studied by Jeannicq Randrianasoa at the time. One female was marked in each group to facilitate identification. There are capture sheets for these females, but they were not monitored as part of the study population.

**2003:**

*Miandry* (=to wait): named for Miandry, one of the MNP staff helping with captures.  
*Rarich*: named for Rich Lawler, doing his PhD research at Bezà at the time.

**2004:**

*Jacky*: named for Jacky Youssouf, BMSR monitoring team coordinator at the time.

**2008:**

*Tahina*: the name of Jeannin Ranaivonasy's eldest son.

**2009:**

*Andry*: named for Andry Andrianandrasana, Madagascar National Parks Director of the Reserve at the time.

**2010:**

*Efitiria*: named for Efitiria, a member of the BMSR monitoring team.

**2011:**

*Heriniaina*: named for Joel Ratsirarson's eldest son, who helped with the capturing program that year.

*Sibien*: named for Sibien Mahereza, head of the BMSR monitoring team from 2015-2020.

*Roshna*: named for Roshna Wunderlich, a researcher from James Madison University.

*Doara*: named for Edouard Razafimahatratra, a member of the BMSR monitoring team.

**2016:**

*Elahavelo*: named for Efitroarany with nickname Elahavelo, a member of the BMSR monitoring team.

*Hanitra*: named for Hanitra Ihariliva, a field assistant at BMSR in 2016 who helped habituate the group.

*Mitady* (=to search): named for the long day of searching it took to find this group in the northwest sustainable use zone.

*Sotro hazo* (=wooden spoon): the first group habituated in the northwest sustainable use zone, named "sotro hazo" because on the first day of work with this group the team forgot their spoons with which to eat their packed lunch and BMSR guide Efitiria fashioned everyone wooden spoons.