

Husbandry Guidelines for **White Fronted Capuchin Monkey**



Mammalia: Primates: Cebidae
Cebus albifrons

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DISCLAIMER

These husbandry guidelines were produced by the compiler/author at TAFE NSW – Western Sydney Institute, Richmond College, N.S.W. Australia as part assessment for completion of Certificate III in Captive Animals, Course number 1068. Since the husbandry guidelines are the result of student project work, care should be taken in the interpretation of information therein, - in effect, all care taken but no responsibility is assumed for any loss or damage that may result from the use of these guidelines. It is offered to the ASZK Husbandry Manuals Register for the benefit of animal welfare and care. Husbandry guidelines are utility documents and are ‘works in progress’, so enhancements to these guidelines are invited.

OCCUPATIONAL HEALTH AND SAFETY RISKS

Caution should always be taken when dealing with any member of the genus *Cebus*. They are classed as hazardous and therefore have the potential to severely injure humans. Please take note of the following risks;

Cebus possess powerful jaws in comparison to their size, very strong, sharp teeth and can cause severe injuries through their bite. Those living in developed social groups can present an ever larger risk to humans if they attack as a troupe, which in large numbers has the potential to cause serious injuries including multiple lacerations and fractures.

Always be cautious when working below capuchins as they often pick up objects and drop or throw them deliberately at someone or something.

The previous hazards can be avoided by; Always wearing strong protective gloves when handling (elbow length); only allowing experienced staff to handle capuchins; minimise contact with animals by using ergonomically designed enclosures and trap cages; Avoid standing below animals with access to loose objects.

Capuchins are recorded to carry a number of very serious zoonotic diseases such as rabies, Hepatitis B and some less serious zoonosis including but not limited to fungal diseases (e.g. ringworm, candida), parasitic diseases (e.g. nematodes, giardia, lice, mites, mange, fleas etc.) and they are also at risk of infection from malaria and yellow fever which can be passed on to humans via vectors. It is advised to quarantine all capuchins prior to introduction to other monkeys and humans so as to detect any readily apparent health conditions before infecting others. There are also a few different types of preventative medications and vaccinations that can be administered to both animals and humans to reduce the likeliness of contracting viruses and disease. Hands should be washed and disinfected post handling capuchins or working in close proximity and all wounds be promptly and thoroughly cleaned.

Enclosures should be designed ergonomically to minimize contact with the animals and to allow safe hazard free operations.

An air-lock gate system and strong materials are imperative as these highly intelligent animals have the potential to escape from points of weakness in enclosures and once free, pose threats to bystanders.

When keeping capuchins for exhibit purposes, it is quite common to condition the animal to respond and cooperate with keepers, vets and staff. Although this can be beneficial, it does not mean that you can predict the behaviour and actions of the animal in all circumstances. Each individual is different and possesses different levels of risk which should never be underestimated.

Cebus are **wild animals** and should be treated with the respect they deserve. Many hazards surround keeping such species in captivity and these should be assessed prior to acquisition and reviewed regularly to maintain safe practices.

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(MURRAY, 1995) - MURRAY E. FOWLER (1995) - RESTRAINT AND HANDLING OF WILD AND DOMESTIC ANIMALS PG 236-245

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ALLONURSING: THE BEHAVIOUR OF FEMALES NURSING OFFSPRING THAT ARE NOT THEIR OWN.77

ARBOREAL: ADAPTED TO AND SPENDING MOST OF ONES LIFE IN THE TREES.77

CORNEAL REFLEX: THE CORNEAL REFLEX, ALSO KNOWN AS THE BLINK REFLEX, IS AN INVOLUNTARY BLINKING OF THE EYELIDS ELICITED BY STIMULATION (SUCH AS TOUCHING OR A FOREIGN BODY) OF THE CORNEA, OR BRIGHT LIGHT, THOUGH COULD RESULT FROM ANY PERIPHERAL STIMULUS.77

DIMORPHIC: OCCURRING OR EXISTING IN TWO FORMS.....77

DIURNAL: ACTIVE DURING THE DAY.....77

DORSAL: WITH RESPECT TO, OR CONCERNING THE SIDE IN WHICH THE BACKBONE IS LOCATED.77

HOLOTYPE: THE ORIGINAL SPECIMEN FROM WHICH THE DESCRIPTION OF A NEW SPECIES IS MADE.77

HYPOTHERMIA: A DECREASE IN THE CORE BODY TEMPERATURE TO A LEVEL AT WHICH NORMAL MUSCULAR AND CEREBRAL FUNCTIONS ARE IMPAIRED.77

INFANTICIDE: THE KILLING OF YOUNG OFFSPRING BY A MATURE ANIMAL OF ITS OWN SPECIES.77

NEONATE: A NEWBORN INFANT UP TO 4 WEEKS OF AGE.77

OLFACTORY: REFERRING TO THE SENSE OF SMELL.77

OMNIVOROUS: HAVING THE ABILITY TO EAT BOTH PLANT AND ANIMAL MATTER....77

POLYGAMOUS: HAVING MORE THAN ONE MATE AT A TIME.77

POSTNATALLY: OCCURRING IMMEDIATELY AFTER BIRTH.....77

PREHENSILE: ABLE TO TAKE HOLD OF AND CLASP OBJECTS. SOME MONKEYS HAVE PREHENSILE TAILS.77

PROCEPTIVITY: BEHAVIOUR THAT LEADS TO COPULATION AND THUS CONCEPTION.
.....77

VECTOR: ANY AGENT THAT CARRIES AND TRANSMITS A DISEASE.....77

**ZOONOSIS: ANY INFECTIOUS DISEASE THAT IS TRANSMITTED FROM OTHER ANIMALS
TO HUMANS OR FROM HUMANS TO ANIMALS.77**

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1 Introduction

Capuchins are New World primates and are one of the most widely distributed genera of primates in Central and South America. They are fascinating animals with highly developed social character, excellent dexterity, extremely variable behaviour and problem solving skills. It is because of these qualities that capuchins have been used for centuries in laboratory studies, medical research, in entertainment, kept as pets, in zoos and more recently used as helpers to aid the disabled. (www.monkeyhelpers.org)

Capuchins are especially noted for their tool use. (E.g. Using selected stones to crack open nuts.) They are one of only a few primate species, other than apes who have been noted utilizing tools.

The word capuchin derives from a group of friars named the Order of Friars Minor Capuchin, an offshoot from the Franciscans, who wore brown robes with large hoods covering their heads. When explorers reached the Americas in the 15th century they found small monkeys who resembled these monks and named them capuchins.

These small to medium size monkeys are diurnal, omnivorous and arboreal. They live in large groups with a complex hierarchy system. With similarities between all capuchin species, husbandry information can be helpful from other species and vice versa.

Their main threats include deforestation and fragmentation along with hunting for bush meat and the illegal pet trade. Although *C. albifrons* are classed as Least Concern (LC) under the IUCN redlist, their numbers are decreasing. The implementation of further programs to research and monitor the wild population, as well as to protect their natural habitat and educate their human co-inhabitants is essential.

1.1 ASMP Category

- Primate Taxon Advisory Group (TAG)
- Population Management Plan level 3 (RC&P 2008)
- Phase out species to make places for Black-capped Capuchin *Cebus apella*.

1.2 IUCN Category

- Redlist category – Least Concern (LC). However, population trend is decreasing.
- CITES listed Appendix 2

1.3 Wild Population Management

The major threat to this species across its range is hunting combined with forest loss and fragmentation. This species occurs in a number of protected areas across its range.

1.4 Species Coordinator

- ARAZPA Species contact; Martina Ter Steeg, Perth Zoological Gardens, martina.tersteeg@perthzoo.wa.gov.au

2 Taxonomy

2.1 Nomenclature

Class – Mammalia

Order – Primates

Family – Cebidae

Genus – *Cebus*

Species – *albifrons*

2.2 Subspecies

C. a. albifrons, *C. a. hypoleucus*, *C. a. malitiosus*, *C. a. cesarae*, *C. a. pleei*, *C. a. versicolor*, *C. a. leucocephalus*, *C. a. adustus*, *C. a. unicolor*, *C. a. yuracus*, *C. a. cuscinus*, *C. a. aequaorialis*, *C. a. trinitatis*

This species and its subspecies have problems with name, description and type locality. A holotype does not exist and they were originally described by Alexander von Humboldt (1812). Some variations in descriptions occur.

(Bryan Lens)

2.3 Recent Synonyms

Cebus was originally described under the genus *Simia*.

(IUCN)

2.4 Other Common Names

White fronted capuchin, brown pale-fronted capuchin, pale-fronted capuchin.

3 Natural History

3.1 Morphometrics

3.1.1 Mass And Basic Body Measurements

Cebus albifrons is one of the smaller species of the capuchin group. Males weighing on average 3.2kg – 3.3kg and females 2.3kg-2.5kg. Adults living in captivity are likely to weigh more than wild specimens.

Head and body length – 35cm – 46cm.

Tail length – 40.1cm – 47.5cm.

(Fragaszy, Visalberghi and Fedigan 2004)

(Answers.com)

3.1.2 Sexual Dimorphism

Sexual dimorphism occurs in the species with the males being larger than the females. The tail of the male may also be lighter at the tip although the markings vary a lot in individuals and this isn't always accurate. The most obvious difference in adult specimens is genitalia. Males have a relatively long mushroom-like penis and females have a prominent external clitoris. These reproductive organs are visible from birth although it is common for female infants to be wrongly identified as males for several months after birth. The fleshy part of the clitoris becomes thicker and shorter with age and therefore becomes much more easily distinguished from the male.

(Fragaszy, Visalberghi and Fedigan 2004)

3.1.3 Distinguishing Features

The head is relatively small in comparison to the body and the torso is slender with long limbs. *C. albifrons* has a complex colour pattern. Overall they are varying shades of light brown on the back with a lighter ventral side, often in shades of red or yellow. Dorsal fur is long and soft, which contrasts to the short and coarser fur of the venter. There is a round darker patch on the crown of the head. Females may have a tuft of hair anterior to this patch. The face is covered by sparse, pale coloured hair under which the peach coloured flesh is visible. The face is surrounded by a thin border of almost white fur. A stripe, slightly darker than the body colour, runs parallel to the spine. The limbs are a range of yellows and red browns.

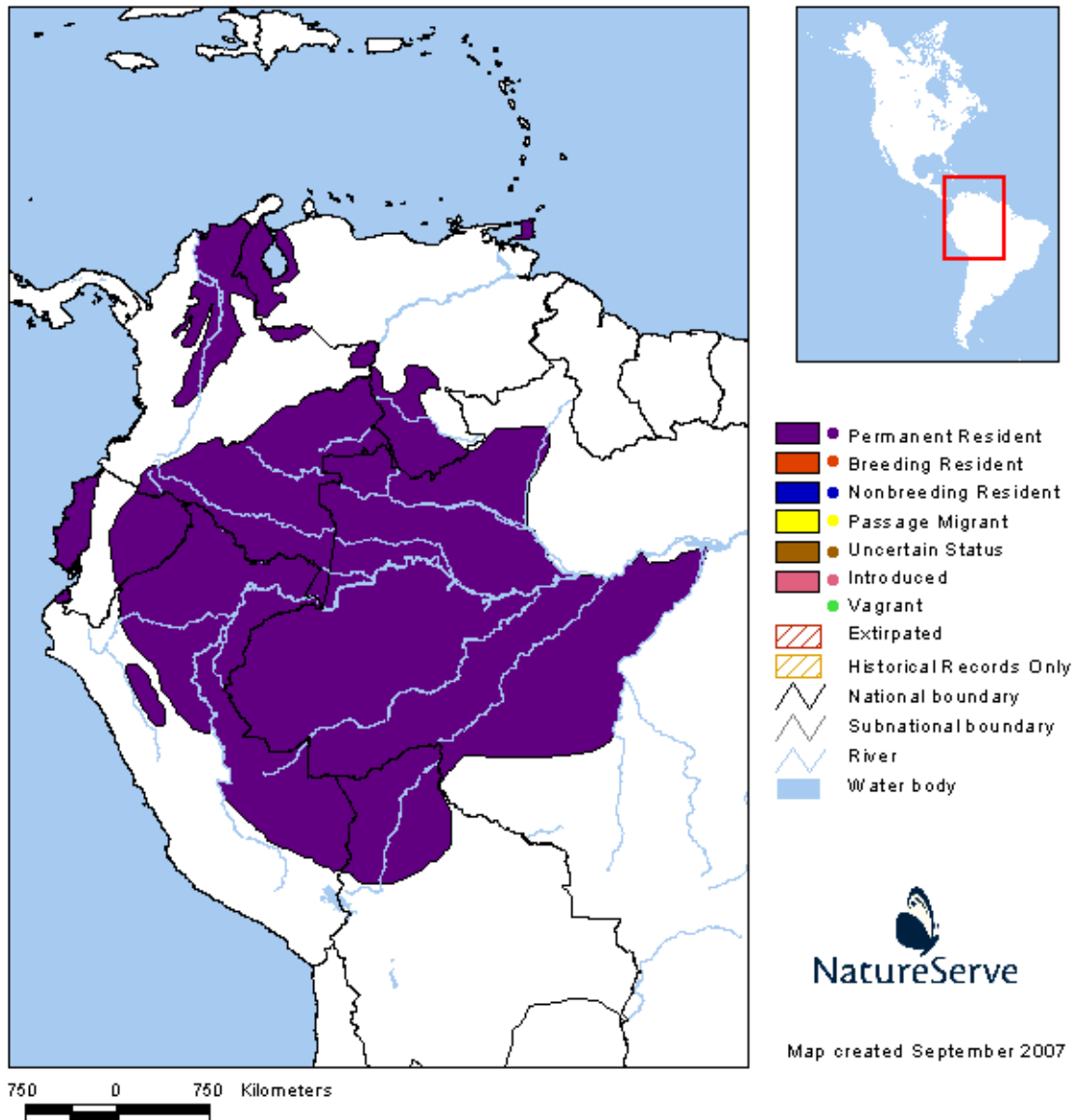
There are many different species in the *Cebus* family whom are all similar in size and shape but are distinguished primarily by their colourings and markings. Within the

species, individuals show distinct characteristics and are quite often easily recognised from other specimens.

(Animal Diversity Web)

3.2 Distribution and Habitat

C. albifrons are found in westerly parts of the South American continent, from Colombia, Ecuador (both east and west of the Andes) to western and southern Venezuela, south through Peru into Bolivia and western and central Amazon in Brazil. The limit in the east of the range is the Rio Tapajós, south of the Rio Amazonas.



(Info Natura) Image and Info.

Habitat;

C. albifrons are well adapted and found in primary and advanced secondary forests. They prefer high canopy trees of up to 30m. They are found in a very varied forest types including tropical forests, dry tropical forests, flooded forests, forests growing over white sand and high altitude cloud forests up to 2000m above sea level.

3.3 Conservation Status

C. albifrons are currently listed as LC (Least Concern) according to the UICN Red List Category. This was last assessed in 2003 by Defler, T. D. & Rodriguez-M, J. V. and evaluated by Rylands, A. B. & Mittermeier, R. A. (Primate Red List Authority).

(IUCN)

CITES – Appendix 2

These highly intelligent primates are adaptable and widely distributed. They have adjusted to living in secondary forests and in close proximity to humans. A major threat that they face is poachers whom hunt them extensively for their meat and more commonly for the illegal pet trade and for use in research facilities. Their numbers and distribution are deteriorating with the deforestation and urbanization of the Amazon Rainforest. Without prompt conservation of their habitat, the future may be uncertain for all capuchin species.

3.4 Longevity**3.4.1 In the Wild**

Data on longevity for capuchin monkeys in the wild is hard to come by. This requires good record keeping over many decades which unfortunately has not been consistently recorded or documented. For the genus *Cebus*, this information is often only estimated from studies of captive specimens.

3.4.2 In Captivity

Again the data on longevity for captive specimens is sparse and varies greatly between sources. An average maximum age of approximately 35 - 41 years is recorded, with one specimen of unknown sex living for a reported 44 years.

(Human Ageing Genomic Resources)

3.4.3 Techniques Used to Determine Age in Adults

Not much had been recorded for determining age in adult specimens. By studying the bone growth and brain size of a deceased specimen we can get quite an accurate age. Another option is to examine dentistry (under anaesthetic).

(Fragaszy, Visalberghi and Fedigan 2004)

Although not documented, I have noticed a few characteristics of elderly capuchins. On first observation, an older specimen may show signs of ageing through hair thinning, wrinkles and patches in skin – especially noticeable on the face, pale and dull fur colour and reduced movement and agility.

4 Housing Requirements

4.1 Exhibit/Enclosure Design

As with most primates, capuchins require a lot of stimulation and enrichment in captivity. This should begin with an adequate enclosure. Being primarily arboreal, enclosures should be tall allowing plenty of space up above the ground. They are very active and are almost constantly on the move – climbing, swinging and jumping. Naturally they live in forests and their enclosure should imitate as best as possible this environment. This can be achieved by the use of large trees, logs, ropes, suspended items and other appropriate materials hung at different levels throughout.

As these monkeys are so agile, it is difficult to keep them in open roof environments. It is recommended that the exhibit be fully enclosed or a suitable moat design be used.

I have learnt from my experience that capuchins are extremely intelligent and any weakness in the enclosure is a potential escape route. Locks, latches, material joints, entry/exit points and general construction need to be strong, reinforced and tamper proof. Do not underestimate these animals, they learn very quickly and can imitate keepers behaviour.

They are messy animals and an easy to clean floor is necessary.

4.2 Holding Area Design

Holding areas should be kept at a suitable temperature between 18 – 30 degrees Celsius. There should be ample fresh air changes to prevent a build up of odour or gasses. Lighting must mimic the natural environment and be adequate for keepers to conduct cleaning processes and health checks etc. as required.

4.3 Spatial Requirements

Minimum floor space- 40sqm

Minimum height – 2.5m

Group size – 4 adults

These sizes are for a basic group (or less) of adult capuchins.

Enclosure size should be increased by 25% for each additional adult animal above basic group number.

(Code of Practice for the public display and exhibition of animals, (2001) Bureau of Animal Welfare, Victorian Department of Primary Industries)

4.4 Position of Enclosures

Capuchins prefer outdoor enclosures with access to enclosed areas. Enclosure needs to be positioned for warmth but shade must be provided from direct sunlight.

4.5 Weather Protection

Sufficient shelter must be provided to allow protection from wind, rain and extremes in temperature. Access to both shade and sunlight must be provided.

(EAPA Primates Part 2.2.3)

4.6 Temperature Requirements

Native to the tropical rainforests in South America, capuchins require a warm, humid environment. Temperature should be kept between 18 and 30 degrees Celsius at all times. Where necessary, heating should be incorporated into the exhibit in both on display areas and holding areas. Where possible, humidifiers can be used.

(EAPA Primates Part 2)

4.7 Substrate

As *C. albifrons* are messy animals, substrate needs to be changed or cleaned regularly to avoid a build-up of faecal matter and old food and harbouring of parasites. Floor should be well draining and easy to clean. Recommendations include cement, dirt, mulch, sawdust, straw, gravel, leaf litter, grass, etc. or a combination of these. Any natural non toxic substrate would be suitable. Food stuffs can be hidden amongst the substrate for enrichment but bear in mind that substrate is often ingested.

4.8 Nestboxes and/or Bedding Material

Bedding material is not necessary for capuchin monkeys. In the wild capuchins live high in trees merely nestled on a branch. In captive specimens it has been observed that they prefer the safety and security of smaller protected sleeping quarters. This could include nestboxes or warm night holding areas. As far as size is concerned, bear in mind that capuchins often sleep together with other members of the group. Ensure any sleeping areas are easy to clean as they are regularly soiled.

If preferred, bedding of straw or similar can be added to night boxes for warmth but would need to be changed daily.

4.9 Enclosure Furnishings

Capuchins enjoy a complex network of branches, platforms and activities suspended in the enclosure at varying heights. Regular changes in furniture are recommended.

Minimum requirements are as follows;

Sitting or sleeping perches at least 2.0 metres above ground. There should be at least one per adult monkey and also have enough space to allow for more than one animal to sit for mutual grooming and socialising.

At least 4 horizontal pathways in upper half of the exhibit. These can be a mixture of flexible and rigid materials and should be sized appropriately for capuchins to utilise.

At least 4 vertical pathways in upper half of exhibit. These too can be a mixture of flexible and rigid materials. Some examples are ropes, bamboo, branches or planks.

Feeding platforms should be elevated and there should be at least one platform per adult capuchin.

Access to water for swimming, bathing, drinking etc.

All exhibits must provide living or fresh vegetation.

(EAPA Primates Schedule 3)

5 General Husbandry

5.1 Hygiene and Cleaning

- Soil and soft substrate should be spot cleaned daily to remove faeces and food debris.
- Hard-surfaced platforms, shelves and night den floors should be cleaned daily with water and disinfected monthly or as needed. Pay particular attention to where the animals sit regularly.
- Water bowls should be scoured daily to prevent bacterial build-up.
- Food bowls and feeding equipment should be washed daily with detergent and bleached monthly. Rinse thoroughly after cleaning.
- Anti-rust should be applied to mesh when necessary to eliminate rusting.
- Animals should be locked off if at all possible when mowing or operating loud maintenance equipment. If this is not possible, animal behaviour needs to be monitored to prevent stress build up during this time.
- Animals must have access to dry areas during and after the cleaning process.
- Neutra-san Animal House by Glason is recommended to use as a disinfectant. Dilute 1 part solution to 10 parts water. Available from www.glason.com. See Appendix 6 for details.

Table 1 - Annual Cycle of Maintenance Tasks. Please also see table to follow.

Daily

Heat lamps	Check if working properly, replace bulb if required
Floor	Sweep up food scraps and faeces from floor Wash all surfaces with a scourer and water, ensure no food or faecal residue remains
Surfaces	
Plants	Clean food scraps and faeces off leaves
Night box	Shake out bedding to remove faecal matter, wash when necessary. Wash floor and surfaces with water, scrub with brush and squeegee excess water away.
Night den	
Enclosure walls	Check all surrounds of enclosure for possible escape routes
Food/Water Bowls	Check for holes or cracks

Weekly

Plants	Ensure plants are kept watered. Depending on weather, this could mean a lot more regularly
Night den	Disinfect surfaces
Padlocks	Use graphite or oil to maintain all padlocks
Weeding	Pull out weeds inside enclosure and in surrounding areas
Pest control	Baits/traps replaced when necessary
Substrate	Replace soiled substrate
Exhibit furniture	Replace, add or rearrange furniture
Maintenance	When needed
Browse	Replace browse

Monthly

Horticulture maintenance	Prune dead or overhanging tree branches
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Water bowls
 Hard surfaces in enclosure
 Health

Re-pot plants as necessary
 Disinfect bowls - rinse

 Disinfect and scrub - rinse
 Routine health checks

Annually

Veterinary
 Enclosure

Annual vet check / weigh in
 Consider renovation

Annual Cycle of Maintenance by Kate Littlefield

January

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

February

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28

March

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

April

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

May

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

June

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

July

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

August

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

September

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

October

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

November

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

December

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6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

5.2 Record Keeping

Establishments must keep a high standard of current, accurate records on each individual specimen. Information must be in a clear format to allow ease of comparison, examination and analysis of the same species within other establishments.

As EAPA states; The records should provide the following information:

- identification number, common name, scientific name, any personal name and any distinctive markings;
- origin (details of parents and their origin and of any previous locations);
- dates of acquisition and disposal, with details of circumstances and addresses;
- date of birth;
- veterinary records, including results of physical examinations, details and dates of any treatments, results of routine health examinations;
- breeding (including mating, reproductive and behavioural cycles, parenting ability) and details of any offspring;
- date of death and cause including results of post mortem reports;
- normal diet;
- any other specific details pertaining to the individual such as changes in behaviour or diet.

Where a studbook exists for white-fronted capuchins held by an exhibitor, records must be submitted at least annually to the studbook keeper or as required by the studbook.

All documentation and records must be kept for the life of the individual plus 5 years.

(EAPA Primates Part 6)

5.3 Methods of Identification

Each capuchin monkey needs to be individually identified by an appropriate method of permanent identification. Some appropriate methods include;

- Microchip
- Ear tagging
- Tattooing

ID methods should be non-intrusive and relatively painless. Importantly they need to be unalterable.

(EAPA Primates Part 6)

(Vic DPI 2001)

5.4 Routine Data Collection

Data collection is extremely important for all captive specimens. This includes monitoring location, health, behaviour and breeding for all specimens held. Records are to be transferred with the animal if changing institution and therefore need to be clear and generally uniformed for ease of comparison and analysis with other existing records.

Recorded data is also very important for captive studies. With not much known about the full life span of *C. albifrons*, any information obtained could be useful to research being conducted.

Here is a condensed list of suitable codes that can be used;

ACQ: ACQUISITION

Any importation from outside the collection, public donation, or capture from grounds or from the wild

B/H: BIRTH/HATCHING

Birds: generally recorded as hatch date. If date of leaving the nest is used it must be noted as such under Information column

Marsupials: The day on which the animal is permanently out of the pouch or the day a juvenile is thrown from the pouch

Placentals: The day on which they are born

D/30: DEATH WITHIN 30 DAYS

Death/Euthanasia within 30days of birth hatching or acquisition

D/E: DEATHS ESTABLISHED

Death/Euthanasia of any animal which has been resident in the collection for longer than 30 days

DIS: DISPOSITION

Includes exports from the collection, releases, sales, escapes

BRD: BREEDING

Reproductive details/observations: Any nesting, laying of eggs, oestrus, menstruations, matings, courtship, pouch checks, sexing of previously unsexed individuals or any other reproductive matter

INT: INTERNAL MOVEMENT/TRANSFER

Any movement of an animal from its residing enclosure, be it within a section or to a different section. Transfers/exports out of the collection NOT included

TAG: TAGGING

Animal identification by banding, tagging, notching, tattooing, naming or any other method of identification

W/L: WEIGHT/LENGTH

Weight or length measurement

Rx/Tx: TREATMENT

Any medical treatment administered to animals, either by Vets, or continuing treatment administered by animals care staff. Include observations of anything related to treatment. Flag if veterinary examination is required using VET code.

VET: VET EXAMINATION REQUIRED

Note if veterinary treatments/examination require

OTH: OTHER

Any notable observations made in reference to daily routine or animals, e.g. behaviour, change to routine etc. Also anything else of interest e.g. animal management procedures, diet change, maintenance etc

(Graeme Phipps)

6 Feeding Requirements

6.1 Diet in the Wild

Capuchins are opportunistic omnivores or frugivores-insectivores and (as some researches have suggested) generally speaking will attempt to eat almost anything remotely edible. Their dietary intake varies with location, season, availability of food and also merely between groups. They prefer fruits when they are in season however they will also consume insects, small vertebrates including birds and young/small mammals, fish, nuts, figs, leaves, nectar and other foodstuffs.

The diet of capuchin monkeys, *Cebus apella*, in a 250 ha semi deciduous forest in south-east Brazil was studied for 44 consecutive months. Based on 367 feeding bouts the diet of capuchins was 53.9% fruit pulp, 16.0% seeds, 11.1% flowers, 6.3% leaves and new shoots, 1.5% roots and 13.9% corn from plantations surrounding the forest. (Galleti & Pedroni 2004) Although this study was not conducted on *Cebus albifrons*, the diet composition will be of a similar nature throughout the genus.

Please see appendix 2 – Showing a comprehensive list of plant foods eaten by capuchins in the wild.

(Terborgh, J. 1992)
(Perth Zoo Feeding Manual)
(Fragaszy, Visalberghi and Fedigan 2004)

6.2 Captive Diet

A complete and varied diet is extremely important for the health and wellbeing of captive capuchins. According to the NSW Policy on Exhibiting Primates, in captivity, *C. albifrons* should receive a commercial primate diet, fresh fruits and vegetables, insects (mealworms and crickets), meat, chicks, eggs, nuts, seeds and browse.

Cebus albifrons are highly active animals and therefore require regular feeding throughout the day. A minimum of two feeds should be conducted daily and additional activity feeds, enrichment and/or browse should also be provided on a daily basis.

Food preparation and feeding should be planned and monitored to ensure each animal receives adequate quantities of food and therefore all the necessary nutritional requirements. The entire troupe must have access including subordinates, young animals and lactating females. This should be monitored daily by keepers. Aggression and monopolization by individuals can be prevented in group housing situations by offering food in multiple locations.

There is such an extensive variety of foods that are suitable to give to capuchins that it is almost impossible to list them all. A majority of their diet is made up of ripe fruits. Season and location will all affect which fruits are available.

Daily fruit feedings can include but are in no way limited to banana, apple, papaya, pears, kiwi fruit, melon, watermelon, orange, mango, berries, grape, pineapple (small amounts) etc. Avocado should be given on occasion, great oils for healthy skin and fur condition.

Daily vegetables again vary according to availability and can include carrot, sweet potato, broccoli, lettuces, green beans, turnip, peas, corn, celery, greens, egg plant, zucchini, cauliflower, etc. Garlic cloves given a few times a week help build up immune system.

Nuts and seeds are also necessary to fulfil nutritional requirements. Seeds and nuts can be given in their shells as *Cebus albifrons* are highly dexterous and can manipulate objects like rocks to assist in cracking nuts. This is a great form of enrichment. Examples include peanuts, almonds, macadamias, palm nuts, coconuts, sunflower seeds etc.

Other protein sources can include

- Insects – mealworms, crickets, butterflies, beetles, moths, caterpillars etc.
- Fish varieties
- Vertebrates – cooked chicken, turkey, beef, other meats (including bones)
- Eggs hard boiled

Extra foods that can be given on occasion include;

- Wheat items such as bread, whole wheat cereals
- Popcorn
- Rice/Pasta
- Dried fruit treats
- Low joule jams, spreads etc
- Low joule juices/cordials

Suggested Capuchin Diet Composition (as used at Perth Zoo, WA)

250g per animal per main feeding.

2 x main feedings per day.

- A variety of fruit in the morning,
- A variety of vegetables in the afternoon along with cheese, eggs, cooked chicken (bones and flesh) and chicks.
- Cooked garlic cloves 3x weekly to help build up immune system.
- Afternoon scatter feeds of primate pellets, nuts, and seeds.
- Fresh browse daily if available. Browse can include acalapha, nasturtium, mulberry, hibiscus species, bamboo, dandelion greens and a variety of figs.
- Daily activity feeds.

It is recommended that celery be cut into 5cm pieces to prevent choking (Mootnick, 1996).

Cook hard root vegetables such as carrots and sweet potatoes occasionally for variety.

Dietary supplements: primate pellets (See Appendix 3 for nutrient content).

(Perth Zoo Feeding Manual)

(Twycross Zoo Diet Sheet)

(Pet Monkey Info)

(Primate Info. Net diet)

6.3 Supplements

It is recommended to provide commercially produced ‘primate pellets’. These generally have high nutritional values and although they are a good way to add extra required nutrients to the diet, they should in no means be the sole food source for captive primates.

Available from www.specialtyfeeds.com

Please see appendix 3 for nutrient content and supplier details of Primate Pellets.

6.4 Presentation of Food

There are many problems that can arise with keeping primates in captivity- this includes psychological stress, unnatural and repetitive behaviour, appetite loss and malnutrition to name a few. To combat these problems it is our duty to substantially enrich the lives of our animals through enrichment programs. To promote psychological well-being it is not sufficient to merely provide a nutritionally adequate diet. It is important to (1) increase processing time, (2) stimulate the senses by providing foods other than the typical pre-formulated pellets, and (3) periodically change the availability of food in time and space. Foraging programs should require primates to “work” for food items, spend more time processing foods, and increase their exposure to novel foods. In the wild, “working for food” is one of the most frequently found and time-consuming behaviours, yet many

captive primates are deprived of this stimulation. Mental stimuli may be provided to animals by requiring them to complete cognitive tasks to obtain their food.

(Phoenix Zoo Enrichment)

The following are just a few ideas for using food as a behavioural enrichment tool;

- An outdoor environment allows primates to forage in a natural way if food is placed on the ground or in trees as it would be found in nature. This environment should be imitated by scattering food in a foraging substrate (such as wood chips, shavings, straw, hay, leaf litter or shredded paper)
- Foraging devices are ranging from feeder boxes, puzzles, acrylic food puzzles, to various shaker boxes, toys and peg boards placed outside enclosures where food has to be manipulated with “tools” to pull it through the peg maze. Foraging devices can be made more complex by suspending them from the ceiling.
- Live prey also causes capuchins to work for their food. Live prey allows the capuchin to stalk, grab, poke, and pry for their food. Live prey can include beetles, caterpillars, moths, grasshoppers, locusts, ants, crickets, mealworms, butterflies, centipedes, millipedes, spiders, slugs, snails, frogs, and fishes. Insects can be provided in either passive (allow slow dispersal of the live prey) or active (require the primate to “work” to obtain live prey) dispensers.
- Fresh browse is great source of natural enrichment. Herb gardens can be grown in wooden boxes covered with wire mesh, protecting the roots. The veterinarian can offer plants with medicinal value. Caution should always be taken so as not to offer any species of toxic plant as browse. See Figure 4 – List of plants toxic to animals as presented by the university of Illinois.
- Low Joule jam smears can be placed around enclosure
- Ice blocks are a great source of enrichment. They can be made with low joule cordials or juices, fruit and nut pieces and hung in enclosure. They can keep the monkeys working at it for long periods and are perfect for hot weather.

This is a suggested enrichment program for *Cebus albifrons* as Perth Zoo, WA

Day	Behavioural enrichment
Monday	Live mealworms
Tuesday	Jam/honey smear
Wednesday	Novel devices e.g. bamboo shakers, boxes
Thursday	Coconuts or jam/honey smear Prepare rice/vegetable mix: cook 1kg rice and variety of root vegetables until soft. Mix together and store in refrigerator.

Friday	Rice/vegetable smear (spread on branches etc.)
Saturday	Live mealworms, scent trail
Sunday	Ice/jelly blocks

Always ensure that the amount of food given via activity feeds is taken into consideration when planning total daily nutrient requirements.

Please note - EAPA Primate Policy states that food should not be left out over night where rodents can gain access, due to the risks of disease, such as Encephalomyocarditis (EMC) virus (a virus which causes heart failure and is spread in the urine of feral rodents) being transmitted. To minimise contamination, over-ripe, liquid and semi-liquid foods should be offered in feeding trays or handed out individually to each primate.

(Perth Zoo Feeding Manual)
(Hilda Tresz 2003)
(EAPA Primates Part 4)
(Youngen, 2005)
(Young, 2003)

7 Handling and Transport

The EAPA primate protocol states the following important information regarding handling primates;

Handling, new environments, separation from the group, noise, unfamiliar personnel and routines are all stressful, the effects of which may be cumulative and not readily apparent. Acute or chronic distress can result in death from shock (in the case of acute distress), decreased resistance to disease or parasites, abnormal behaviours or reduced levels of activity. The decision to capture and handle any primate must take into account the likely disruption to the group and the animal's position in the dominance hierarchy as well as the likely stress to the individual. The removal of any individual for more than a few days means that, when reintroduced to the group, the animal may not be able to re-establish itself or may be totally rejected.

(EAPA Primates Part 7)

7.1 Timing of Capture and Handling

Timing of capture is of no great importance to capuchin monkeys although it is advised to avoid stressing the specimens in extremely hot, cold or violent weather whenever practical. Always keep in mind exactly why and how long the individual will be restrained.

In Santa Martha Rescue Centre in Ecuador, South America we always transported capuchins overnight when temperatures were cooler. Capturing was done after 5pm.

7.2 Capture and Restraint Techniques

There are a number of different ways to approach the capture and restraint of captive non-human primates. Capuchins are highly unpredictable in their reaction to handling, especially with unknown or inexperienced attendants. In all circumstances one should never underestimate the dangers posed by the strength, tenacity, and viciousness of the capuchin monkey. Not only do they pose zoonotic risks, but their long canines and powerful jaws can inflict serious injuries as can their ability to throw loose objects.

Operant conditioning is a behavioural training technique used by zoos and institutions working with wild animals in captivity. The focus of the training is to get animals to willingly cooperate with routine examinations, handling, transport and basic procedures without stress or resistance and to acclimatize it to their environmental conditions. It is usually reinforced with positive rewards. For example, capuchins can be trained to hold out their arm for a veterinarian to withdraw blood in return for a few peanuts or it can be

conditioned to willingly enter holding areas ready for transportation to other institutions. There are almost unlimited circumstances that conditioning can have positive impacts. The idea of using these techniques to condition animals has been a breakthrough which is making drastic improvements to animal welfare and the wellbeing of wild animals in captivity.



This is a photo of a monkey conditioned to give regular blood samples in a lab situation. Without having to physically restrain the animal, it reduces stress and dangers to both animal and handler. http://www.awionline.org/Lab_animals/biblio/at55.htm

It is advised that all primate exhibits incorporate a separate holding area or squeeze box to be used for isolating individuals. This could be the use of a night den, nest box or raceway. An area which is used often by the troupe is recommended. For example the regularly used raceways between enclosures provide a perfect space for minimal stress restraint. The idea is that the individual can willingly enter or be lured into the area and by mechanical means; they can be trapped in the confined space. Once trapped, this then allows for easier close examination and/or administration of injectable medications or sedatives/tranquilisers if further restraining is required. It is possible for individuals to exhibit signs of distress when confined like this and there is also the risk of self inflicted injury if struggling and/or attempting to escape. It is here that the use of operant conditioning can have such a positive impact on the animal's wellbeing. If the individual was conditioned to accept the motion of the squeeze box and to comfortably remain confined on several occasions where only positive rewards were administered, it would have no reason to feel stress or anxiety.

Another physical capture technique involves the use of a net on a long pole. The net should be of strong construction with a diameter of approximately 50-70cm. The holes should be woven small enough so as not to allow the head or any limbs to pass through. A solid fabric is a very good option to avoid any tangling. This technique is often used in

larger exhibits which house multiple monkeys. It is important here to be cautious yet quick in the capture. Capuchins are very fast moving, agile primates and are often difficult to catch and this should only be attempted by experienced attendants. Drawn out captures can cause much stress to the targeted individual and also any others in the troupe. If using the net technique, it is often useful to have one attendant providing a distraction such as food and another to protect the capturer from attack from the other members of the troupe. Capuchins are well known to show aggression when feeling threatened and as a group can pose a serious threat. Once caught in the net, different procedures can be conducted. For example, it is possible to administer injections through the net and in some circumstances administer isoflurane gas or other anaesthetic agents if immobilization is required. Please see the following if physical restraint is required.

When restraining *Cebus albifrons* there are conflicting arguments as to the use of gloves. To avoid the possibility of a bite injury, thick, elbow length gloves for example welding gloves (as shown below) can be worn. This provides a barrier between yourself and the animal. Or on the other hand, EAPA states that heavier gloves are not recommended because of the loss of sensitivity and dexterity, increasing the risk of injury to small animals and to the handler with larger ones. Gloves give a false sense of security. Surgical gloves are the bare minimum that should be worn to avoid contraction of zoonosis.



I believe the experience and preference of the attendant will assist in making the decision of when and when not to use gloves.

Please see image for the correct restraint practices.



By holding the capuchin underneath the arm pits with the arms held together behind its back, it restricts the movement of the head and prevents the chance of the keeper being bitten. One finger should be kept between the arms when being held. The legs can also be held for stronger restraint. When in this position, the specimen is rendered almost helpless. Although, you should always bears in mind the significant strength of these small creatures.

According to ANZCAART's publication on restraint, using blow darts on animals below 15kg mass is not recommended There is a high risk of injury (impact trauma, damage to an eye, the face, body cavity or internal organ) and the animals are too fast and small to be good targets.

(Tribe, Spielman 1996)

7.3 Release

When releasing *Cebus albifrons* that have been restrained it is important to do so within the exhibit holding area and then into the main exhibit. It is advisable not to enter an area with other monkeys whilst restraining an individual due to safety precautions.

Always be aware that *Cebus albifrons* may show signs of retaliation once released. A safe escape route should be prepared for the keeper.

The specimen must be observed once back amongst the troupe as the others may react with aggression, dominance and bullying to individuals that have been a way from the group for a long period on time. This can disrupt social hierarchy and even lead to death. Because of this, the time individuals are restrained should be kept to the bare minimum.

7.4 Transport Requirements

7.4.1 Box Design

Transport containers must be well constructed and be able to withstand other freight damaging it or causing the structure to bend. It must be strong enough to prevent the animal escaping through weak points e.g. gaps at the seams or joints and also secure enough to avoid accidental opening from either the outside or inside. The materials must be non toxic.

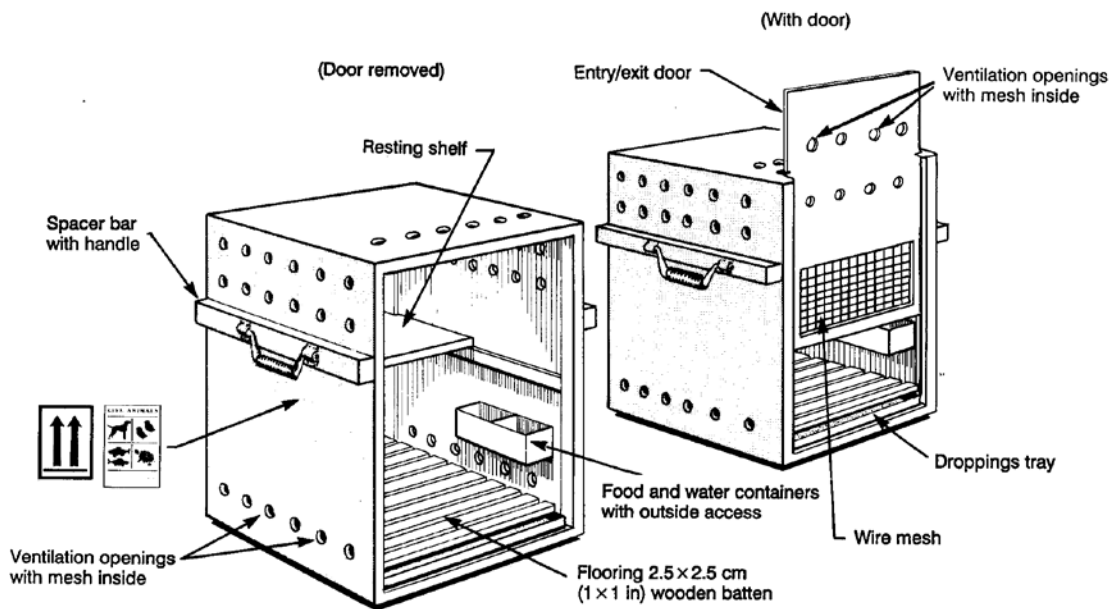
When in transit, the monkey should be able to stand up, turn around and lay down according to current IATA regulations.

Adequate ventilation is important and air vents must be located at least three sides of box to eliminate the risk of blocking ventilation when stacking boxes along side each other. The use of spacers on the sides of the box also help with avoiding blockages in ventilation.

There must be no sharp edges, such as nails on the inside of the box which could cause injury to the animal.

'Live Animal' signage must be clearly displayed on box along with 'right way up' arrows. All relevant animal records and identification must also be displayed, along with any quarantine permits or special requirements.

The image below shows an example of an adequate transport box as shown in EAPA guidelines.



(EAPA Primates Schedule 4)

7.4.2 Furnishings

Inside the box a resting shelf is recommended. This allows the animal space to sit if the floor becomes soiled. As capuchins are messy animals, a grate style flooring with droppings tray is useful. This can allow excess waste to fall through the gaps and minimize build up of matter. An absorbent bedding material must also be used. If container does not have a droppings tray, the ends must be sealed to avoid spillage of faecal matter.

7.4.3 Water and Food

Food and water containers must be provided with external access. Except in the case of long journeys or delays, additional food and watering is generally not required during transport. If water is offered, it should be removed again before recommencing transportation. If food is offered, generally monkey pellets or non-citrus fruits are best. Be careful not to overfeed.

7.4.4 Animals per Box

EAPA Policy on Exhibiting Primates states that animals (primates) of the same species and size may be shipped together in the same container *only* if they have previously been contained together. Otherwise, they must be carried completely separately.

7.4.5 Timing of Transportation

Transportation is best done in temperate parts of the day or night. Avoid excess heat or cold. In the case of high temperatures, extra ventilation and cooling methods are required. Always avoid placing box in drafty or chilly areas as extremes in temperatures can cause illness, distress and possibly death.

7.4.6 Release from Box

When opening the box, the keeper should not stand in front of the door; they should stand behind the box to allow to animal a clear exit route into holding area. Always observe the released animal for any signs of illness or injury that may have developed during transit. See also section 1.3.

(EAPA Primates Part 7)
(Tribe, Spielman 1996)
(Gibbon Centre)
(Murray, 1995)
(CCAC)
(IACUC)

8 Health Requirements

8.1 Daily Health Checks

The first step in making an assessment on the physical health of the capuchin is to simply observe it in its enclosure and evaluate its appearance, behaviour and general demeanour. Records should be kept daily which should assist in noticing any changes.

- First thing to note would be its reaction to your presence – whether it is inquisitive, scared, showing no response at all, or anything out of the ordinary.
- Here it is important also to check the monkey's posture. If in pain or distress *cebus* often huddle over, drooping their head and crossing their arms, when excited they are active and expressive. You should also notice their facial expressions which can denote many different emotions.
- Generally the skin and fur condition can be observed from a distance. Hair loss can indicate underlying skin infections (bacterial/parasitic) or behavioural hair pulling issues caused by over grooming, self infliction, bullying, stress or boredom etc.
- Depending on the enclosure and the individual, it could be possible to observe the eyes, nose and front teeth of each monkey. Record any discharge or swelling or signs of irritation.
- Check for the presence and condition of the faeces. Diarrhoea or constipation can usually be easily noted. Check for excessive or minimal urine.
- Watch the ability of the animal to run, jump, balance, walk and play. Check if they are favouring a limb or off balance at all.
- Check the monkey has been eating and drinking.
- Assess enclosure – has the monkey used the toys/enrichment activities provided? (Difficult to tell in large groups)
- Check for traces of blood anywhere in enclosure.

All this information should be recorded in keeper diary or on an assessment sheet and anything notable or out of the ordinary should be transferred into the Daily Diary and reported for further investigation.

According to EAPA Primate Policy, In order to observe their physical condition and behaviour, a person familiar with the animals must spend sufficient time each day observing the animals.



This is an image of a *cebus apella* expressing negative emotions. Photo taken by Kate Littlefield at Flor de la Amazonia Rescue Centre, Ecuador.

EAPA Primate Policy states that basic health evaluations of the animals within a primate colony must be carried out at frequent and regular intervals, and at least quarterly, by a qualified veterinarian with primate experience or by a veterinarian in consultation with a recognised captive primate expert.

8.2 Detailed Physical Examination

8.2.1 Chemical Restraint

In order to carry out a full examination it is often necessary to use drugs to sedate or anaesthetise the individual to reduce injury risks to the handler, minimize stress to the animal and to allow for a more thorough examination. The first step in administering immobilizing drugs is to physically restrain the monkey enough so that the medication can be administered safely and effectively. Techniques regarding manual restraint were outlined in chapter 7.

All chemical restraining of primates should be conducted by a veterinarian. Outlined below are some of the techniques, considerations and observations to be aware of.

There are many ways to administer drugs – this includes orally, by hand, by injection or by inhalation of anaesthetic gases (dart use is not recommended in capuchins). The most effective ways to administer anaesthesia would be via injection, either intravenous or intramuscular or with the use of anaesthetic gas.

If possible, it is advised to fast capuchin monkeys for 12 hours prior to administration of an anaesthetic.

For induction via injection please see image below for location of veins.

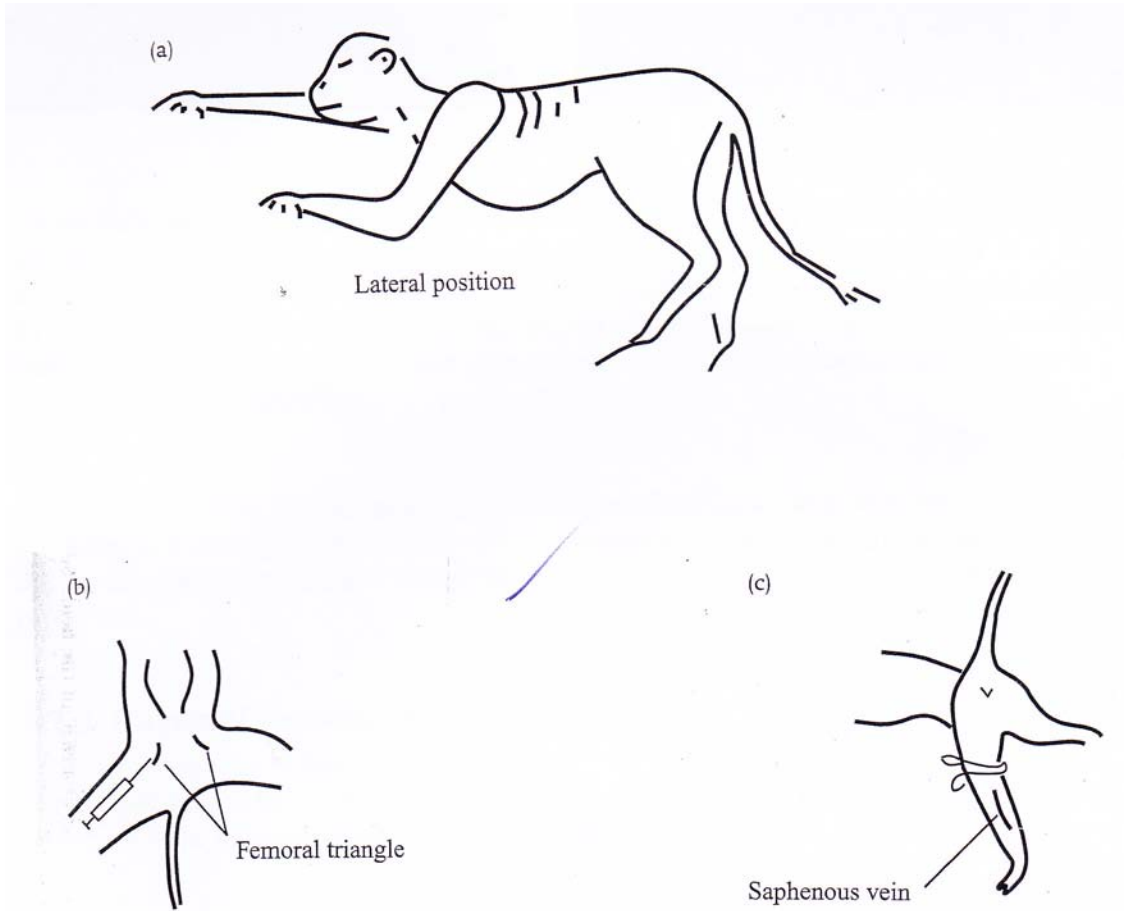
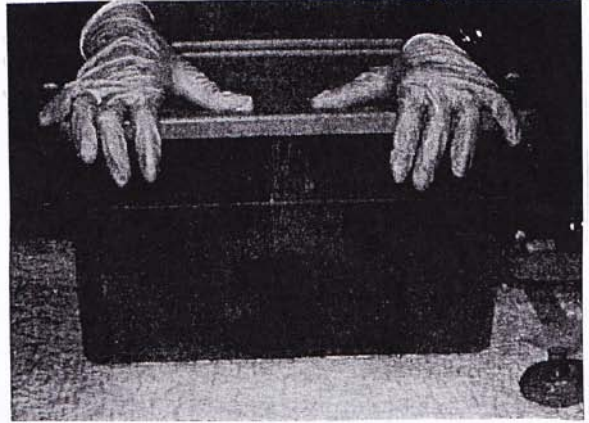
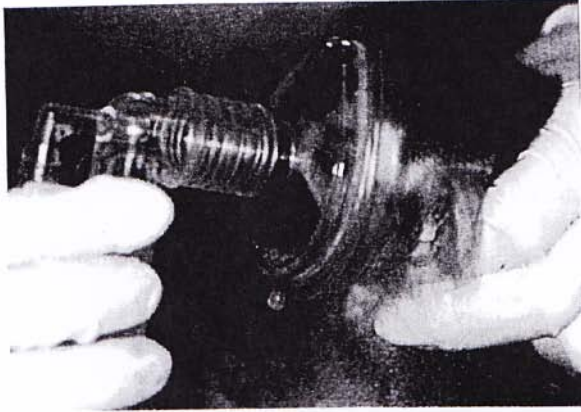


Image: (West, Heard, Caulket 2007)

For gas induction a mask can be placed on the monkey or they can be placed in an induction box. See images below.



Image; (West, Heard, Caulket 2007)

Once under anaesthetic, animals need to be closely monitored. This includes circulation, temperature, heart rate, pulse rate and respiratory rate. They lose the ability to thermo regulate their body temperature and often suffer hypothermia. Be prepared for this by having access to heating and cooling options. IV Fluids should also be used, if not, on hand. Check corneal, palpebral and pain reflexes regularly to ensure animal remains in the correct state of anaesthesia.

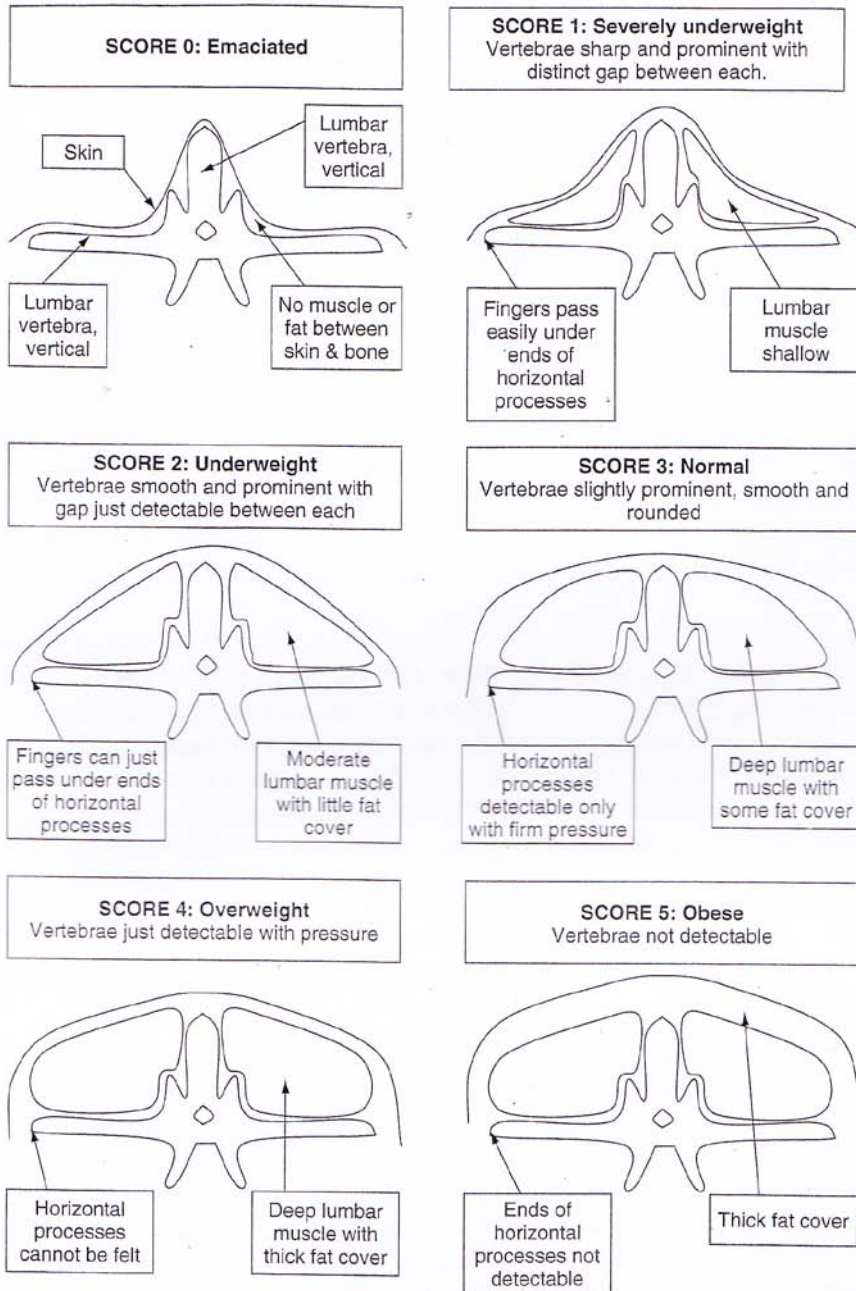
Recovery

Recovery should be performed in quiet, warm, confined space that does not allow for climbing as a drowsy capuchin may fall from a perch. Monitor the animal constantly during this time. The primate should not be reunited with its troupe until it has fully recovered.

8.2.2 Physical Examination

- Assessment of body condition

The weight should be recorded and the body condition noted. This is done by a scoring system. Please see image below showing condition scoring.



Once the body condition is noted, continue on with a full body examination. Here are a few things to check and record observations;

- Eyes – are they looking straight, are the pupils equal size, and discharge
- Ears – are they clean, any discharge or swelling
- Nose – are nostrils even in size, any discharge
- Mouth – lift up lip and note gum colour, check condition of front teeth. Open the mouth using an instrument and examine all teeth, the tongue and inside of the

- mouth. Note any swelling or abnormalities. (Do not place your fingers inside the mouth)
- Limbs – Run hands down each limb simultaneously checking for evenness in length and width. Note any swelling around joint etc.
 - Genitalia – Observe external genitalia and anus. Note any abnormalities.
 - Hands, feet and tail – look for wounds, lacerations, swelling.
 - Breathing – observe respiratory movements, monitor heart rate and pulse rate.
 - Extra tests or exams may be performed by the veterinarian.

It is at this point that vital samples can be taken for testing, e.g. Blood, skin swabs etc.

8.3 Routine Treatments

It is to accept routine treatments without any stress.

Routine treatments include;

- Regular worming (usually 3 monthly). Protects against all gastrointestinal worms and can be given as a tablet or liquid.
- Vaccinations for known diseases – please see section 8.4. These are administered via injection and may require repeat boosters. Please seek vet advice regarding vaccination protocols for non human primates.
- Vitamin supplements can be given on a regular basis to enhance the captive diet.

8.4 Known Health Problems

Due to the close genetic relationship between nonhuman primates and humans, disease causing organisms are easily exchanged between them. Non human primates and humans are prone almost countless numbers of diseases both in the wild and in captivity and it is almost impossible to list them all. Many of these diseases are zoonotic. Having at one stage taken these primates out of their natural environment and placed them into a captive environment where they are living in much closer confides with each other and also now living very closely with humans, this has greatly increased the number of diseases they are exposed too. Please find below some common health problems of non human primates in captivity.

It is not advised to work with non human primates if you are immuno-compromised.

Endoparasites

There are a number of different endoparasites that affect non human primates both in captivity and in the wild. These include many different types of protozoa, roundworm, hookworm and tapeworm. Some of these are zoonotic and most are infectious.

Signs – The detection of endoparasites is most commonly assessed by the observation and testing of faecal matter. Initially you might notice changes in gastrointestinal motions such as diarrhoea, constipation, strange colour or consistency of faeces. Also anorexia, loss of appetite, bloating, weight loss, lethargy, itching of anal area etc.

Treatment – Treatment is in most cases a simple administration of a worming tablet or solution e.g. Broad spectrum anthelmintics. Heavy parasite loads may require further treatment and possible isolation from the troupe. Seek veterinary advice.

Prevention - Regular (usually 3 monthly) treatments of worming should be instigated. Also precautionary testing of faeces should be carried out on a regular basis. To reduce the risks of contamination ensure good hygiene practices such as safe removal of faecal matter and cleaning of enclosure on a daily basis, clean fresh drinking water and fresh food supplied of clean surfaces. To avoid contracting parasites yourself, always wash hands thoroughly, wear appropriate PPE when cleaning, handling monkeys or handling faecal matter.

Ectoparasites

Again there are many types of ectoparasites that can affect non human primates such as fleas, lice, mites, ticks.

Signs – The most common signs are constant scratching or itchiness, scruffiness in fur, hair loss or thinning, chewing on self, rubbing of objects, rash, dermatitis etc. Some parasites are visible upon close inspection. In severe cases some monkeys may show lethargy, weakness, lack of appetite, dehydration or weight loss.

Treatment – There are many different treatments available for ectoparasites in mammals. These include sprays, rinses and spot-on treatments. Seek veterinary advice before choosing the most suitable method. Some examples are malathion, pyrethrin, ivermectin etc.

Prevention – Avoid breeding grounds for parasites such as open wounds, expressed bodily fluids, build up of faecal matter, stagnant water and unsanitary conditions. Parasite sprays are available to treat the environment which helps to kill adult parasites and sterilize the eggs to prevent reinfestation.

Rabies

Cause – Australia is currently a rabies-free country. Rabies is a usually fatal viral disease that causes acute inflammation of the brain in mammals. It is usually transmitted via bite or scratch from an infected animal. Animals prone to contraction and transmission of the disease include almost all warm blooded mammals including dogs, cats, foxes, bats, raccoons, cattle etc. Both humans and non human primates are capable of becoming infected if coming into contact with the virus. This disease is zoonotic.

Signs – The signs in capuchins include agitation, self mutilation, paralysis, erratic behaviour, abnormal aggression and overproduction of saliva giving the impression of ‘frothing at the mouth’.

Symptoms in man - Symptoms begin similar to the flu then progress rapidly to partial [paralysis](#), [cerebral dysfunction](#), violent movements, acute pain, [anxiety](#), [insomnia](#), [confusion](#), [agitation](#), abnormal behaviour, [paranoia](#), terror, [hallucinations](#), excessively dry throat and over production of saliva which can give the impression of ‘frothing at the mouth’. Infected individuals usually die within 2 – 10 days after the onset of symptoms.

Treatment – There is very limited treatment available for infected primates. Isolate individual to avoid passing on the virus. Euthanasia is a viable option.

Prevention – In order to prevent an outbreak of rabies, strict quarantine procedures must be carried out when introducing a new individual. If the monkey is coming from a rabies present country, it is important to follow AQIS guidelines for quarantine care and monitoring. Always bear in mind that an infected monkey poses a serious threat to both humans and other animals. Correct precautions and PPE must be used to eliminate risk. It is possible for both humans and non human primates to be immunized against the rabies virus. This is a series of injections requiring regular boosters and should be considered if working within a rabies present country or when regularly acquiring new specimens from such places.

Herpes virus (Herpes B)

There are more than 35 herpes virus’ of non human primates, most of which are not zoonotic and occurring asymptotically in primates, this particular strand Herpes B being the most significant zoonotically and of most concern. It is a virus that is transferred by direct contact of saliva, blood, urine, faeces and tissue.

Signs – The animal may be completely asymptomatic. Some specimens show mild cold-sore like lesions on the tongue, lips and face similar to that caused by herpes simplex in humans. These usually heal in a week or two. Other signs include nasal discharge and conjunctivitis. Some animals express severe discomfort and neurological signs. The virus can remain latent and reactivate throughout the lifespan usually in times of stress. **Once a monkey is infected, it is infected for life.** Even when the animal is showing no signs, it still poses a threat to humans.

Symptoms in man – Skin lesions, neurological symptoms, paralysis and encephalitis (swelling of the brain). Death usually occurs 3 to 21 days after the appearance of clinical signs.

Treatment – Humans have been treated successfully on a few occasions when detected early by acyclovir. A vaccine is currently unavailable. Primates can live a healthy life carrying the disease.

Prevention – Monkeys can be tested via swabs from the genitalia and mouth. If infected do not allow monkey to enter a healthy disease free troupe. Here again, quarantine is highly important in stopping the spread of disease.



Image of a monkey infected with Herpes B Virus.

Measles

Measles is a viral infection of the respiratory system. It is highly contagious. It can spread from man to monkey, man to man and monkey to man. *Cebus* only contract the virus in a captive situation where an infected human comes into close contact with the animal. Therefore cautious zoo keeping is crucial.

Signs – Signs include rash, fever, facial oedema, conjunctivitis, nasal discharge.

Symptoms in man - fever, cough, runny nose, red eyes, conjunctivitis and a generalized, erythematous (redness of the skin caused by capillary congestion) rash.

Treatment – There is no specific treatment for measles other than supportive care and treatment of secondary infection. There is a high mortality rate in New World Primates.

Prevention – There is a measles vaccination that can be administered to non human primates from 6 months of age. There is also an equivalent vaccination for humans (MMR). Minimising contact with humans is the best way to avoid an outbreak. **If you are unwell do not work in close proximity to non human primates. You are putting them at risk.**

Tuberculosis

Tuberculosis is a highly infectious, often fatal mycobacteria. The primary route of transmission of tuberculosis is through inhaled aerosols from infected animals/humans. Animals with tuberculosis of the gastrointestinal tract can shed the organism in their faeces.

Signs - coughing, laboured breathing, and exercise intolerance. Because tuberculosis can involve a multitude of organ systems, signs vary depending on the system affected.

Treatment - Due to the risk a nonhuman primate infected with tuberculosis poses to the rest of the troupe and the staff, euthanasia is often carried out on the infected individual.

For valuable animals or special circumstances, tuberculosis-positive primates can be successfully treated with a regimen of isoniazid, ethambutol, and rifampin. A 90 day quarantine with at least 3 tuberculin tests is method of choice where possible.

Prevention - Tuberculosis in a troupe can be prevented/minimized by establishing a preventive health program that includes suitable quarantine periods, tuberculin skin testing animals in quarantine and current collection, annual tuberculin skin testing of staff that come in contact with nonhuman primates, and limiting nonessential human access to the animals. Vaccinations are also available. (Handbook of Primate Husbandry and Welfare)

Encephalomyocarditis (EMC)

EMC is a virus that affects many vertebrate species including pigs, rodents, cattle, elephants, raccoons, marsupials, and primates such as baboons, monkeys, chimpanzees, and humans. The virus is most commonly passed on via rodent populations and is shed in their faeces.

Signs – Usually not detected until sudden death occurs. Other signs include anorexia, fever and progressive paralysis.

Treatment – There is no real treatment for infected primates.

Prevention – The most effective way to control the spread of the disease is by controlling rodent infestation as it is spread by rats.

Husbandry Related Disease

Fighting injuries – Capuchins live according to strict social hierarchy and inevitably there will be some fights to prove and enforce dominance amongst the troupe. Some individuals will get injured and some may even be killed. Subordinates are often targeted and bullied. Keeper observations and plans are important to reduce harm.

Signs – Lacerations, puncture wounds, bruising, abrasion, avoiding use of limbs, holding of limbs, licking or picking at specific areas, reduced activity, deterioration in general condition, depression and withdrawal.

Treatment – All injured monkeys should be examined and treated as soon as possible after being wounded to reduce the risk of infection. If conditioned, it is possible to examine the individual before the use of sedatives and decide what specific treatment is required (if any). For animals that aren't conditioned it may be necessary to use chemical restraint and then perform an exam. Pay particular attention to hands and feet, ears, eyes and tail base. Always seek veterinary advice before any treatment.

For minor lacerations only – With the capuchin sedated, clip and clean around the wounds with sterile saline or dilute chlorohexidine solution. Apply an antiseptic cream and if required, a course of antibiotics.

For puncture wounds – It is necessary for the veterinarian to assume there is hidden damage beneath the skin and the wound needs to be opened up for further investigation. Torn muscles and tissue often require suturing. This is to be performed under anaesthetic.

If the primate shows signs of lethargy or depression post injury, veterinary advice should be sought immediately.

Prevention – There are a number of things to do to minimise the risks of fighting injuries. They include ensuring there is adequate space for the troupe, ensure they are fed in multiple locations, and there is a balance of male/female specimens. Keepers pay close attention to behaviour, dominance and bullying. It is occasionally necessary to remove social misfits for their own safety or for the benefit of the rest of the group.

Behavioural Problems

Primates in captivity can develop many different behaviour problems caused by inadequate conditions. A few examples are self mutilation including chewing on self and hair pulling, pacing or repetitive movements, lethargy or withdrawal, aggressive tendencies, human dependency, stress, depression, destruction etc.

Treatment and Prevention - A lot of these problems are associated with inadequate conditions – boredom, lack of space, isolation, over nurturing, bullying, lack of enrichment. The best way to combat such abnormal destructive behaviour is to provide suitable enclosures, adequate enrichment programs, companion specimens, clean enclosures, excellent keeping and veterinary care. It is much easier to prevent such behaviour rather than trying to reverse these habits once formed.

8.5 Quarantine Requirements

As you can see, quarantine is an extremely important aspect of keeping primates in captivity safely and responsibly. The length of time each specimen is kept in quarantine varies depending on a number of things – origin – was it imported from outside Australia, transferred from institution within Australia, captive bred, wild caught, individually housed, group housed, medical concerns, disease incubation periods etc. AQIS is the government organization that is responsible for setting quarantine times. All AQIS policies must be adhered to at all times. These can be accessed via www.aqis.gov.au.

The following criteria for quarantine are outlined in the EAPA policy on exhibiting primates;

- Newly received primates must remain quarantined from resident primates until their

health status has been established, in accordance with acceptable veterinary practice and any importation requirements. Any disease in a newly acquired primate must be successfully treated before it is placed with other residents.

- Primates which have been acquired in compatible groups must be retained in those groups during quarantine. Introductions to a new group must be undertaken slowly and with care.
- The quarantine area and its drainage system must be totally separate from regular holding areas. Staffing and feeding regimes must ensure that there is no contamination of the quarantine area from outside and vice versa. The physical and psychological needs of the animals whilst in quarantine must be provided for.
- Newly received primates must be vaccinated in accordance with the vaccination program of the resident animals.
- While primates are in quarantine, examination and, where indicated, treatment for internal and external parasites and any other tests or treatments prescribed by the veterinarian must be undertaken.
- Keepers' protective outer clothing that has been heavily soiled whilst caring for primates which are in quarantine must be soaked in an appropriate disinfectant prior to being sent for washing.
- A footbath containing an effective disinfectant must be used prior to entering all primate quarantine enclosures, or areas containing quarantine enclosures and its use strictly adhered to by all personnel.

(WRAI 1998)

(Lees & Wilcken, 2002)

(Fragaszy, Visalberghi and Fedigan 2004)

(Wolfensohn and Honess, 2005)

(Setchell and Curtis 2003)

(CITES)

(ARAZPA)

(Non human Primates – Research Animal Resources Website)

(Rand, 2007)

(Virginia Department of Health – Zoonosis of Non Human Primates)

9 Behaviour

9.1 Activity

Capuchins are diurnal species. The main components of an activity budget are travel, feed/forage, rest and socialize. Capuchins are an active species, if not locomoting, they are generally busy manipulating objects.

Time period	Activity
Dawn	Capuchins rise and begin feeding on the nearby fruiting trees.
Morning	Entire group forages through the forest feeding on fruits.
Mid-morning	Pace of foraging slows down and capuchins begin to forage for insects.
Noon	During the hottest part of the day is a period of rest. Juveniles will engage in play whilst adults will conduct a grooming session. During the dry season capuchins will visit the nearby waterhole to drink.
Afternoon	Foraging for fruits begins again when heat subsides, this will continue into the late afternoon.
Dusk	Capuchins will look for a good sleeping tree near their most recent fruiting tree; here they will rest until the following morning.

(Honeysett, 2006)

9.2 Social Behaviour

The optimal social grouping for captive Capuchins is undoubtedly one that would be encountered under natural conditions in terms of age and sex classes (see table for age/sex composition). This is often impossible in a captive situation but effort should be made to emulate natural group composition as closely as possible. Capuchin monkeys should be kept socially, as social companions are excellent sources of interactive and ever-changing stimulation (Visalberghi and Anderson 1993).



Social bonding. - Photo taken by Kate Littlefield at Flor de la Amazonia Rescue Centre, Ecuador.

9.2.1 Social Structure and Relationships

All capuchin species live in social groups. According to the recorded field data – (see table) *Cebus albifrons* have an average group size of 19.83 individuals. Depending on location, groups have been sighted with anywhere between 8 and 35 individuals.

The age ratio for *Cebus albifrons* (as seen in table below) has been averaged to 33 % adult males, 30 % adult females, 22 % juveniles and 16 % infants. However, this data appears to vary considerably across sources.

Species name	Group Size	Proportion adult males	Proportion adult females	Prop. Juveniles	Prop. infants	Adult M:F ratio	Immature: adult female	Infant: adult female
<i>Cebus Capucinus</i>	16.36	0.21	0.31	0.34	0.14	0.71	1.45	0.47
<i>Cebus olivaceus</i>	21	0.17	0.33	0.41	0.09	0.53	1.56	0.28
<i>Cebus apella</i>	17.17	0.33	0.31	0.23	0.12	1.08	1.06	0.43
<i>Cebus albifrons</i>	19.83	0.33	0.30	0.22	0.13	1.08	1.20	0.57

(Fragaszy, Visalberghi and Fedigan 2004)

Cebus albifrons have social systems in which more than one adult male is socially and reproductively active in each group. These two species (*C.albifrons* and *C .capuchinus*)

have easily recognized alpha males in each group, but they are not the object of exclusive female choice and they do form cooperative alliances with other males to defend their groups. Thus, it is fair to say that *C.albifrons* and *C.apella* live in multi-male groups in which all adults have access to oestrous females (whether this is equal access is not yet clear), and in which they cooperate actively in group defence, they look for and retrieve lost males, and they sometimes transfer groups together. (Fragaszy, Visalberghi and Fedigan 2004)

Female *C. albifrons* form strong bonds with other females in their groups, develop dominance hierarchies, and powerfully influence the direction and timing of group movement. (Fragaszy, Visalberghi and Fedigan 2004)

Males are usually dominant over females and they are generally less affiliated with one another. Resident males will band together readily to resist the immigration of new males. Although there is not sufficient documented data, it is believed that females seldom participate in encounters between groups.

9.2.2 Communication

Social interactions usually occur through communication ‘signals’. These signals may take many forms and may be expressed through the visual, vocal, tactile and olfactory modes. The behavioural interactions amongst all non-human primate species are complicated as it is with humans. Primate behaviour is constantly being studied in attempts to understand the complexity of such interactions. This section provides some examples of how we interpret capuchin behaviour and communication; however there is a lot more research to be conducted before we can attempt to fully understand. (Fragaszy, Visalberghi and Fedigan 2004)

Capuchins have well-developed mobility of the facial musculature which allows them to exhibit a rich repertoire of facial expressions. Below are some diagrams showing examples of facial expressions and also an explanatory table with a brief description of common expressions. Please note that both the diagrams and table are for *C. apella* as such data has not yet been recorded for *C. albifrons*. However, Weigel (1978) concluded that all four capuchin species are quite similar in their visual repertoire of signals.

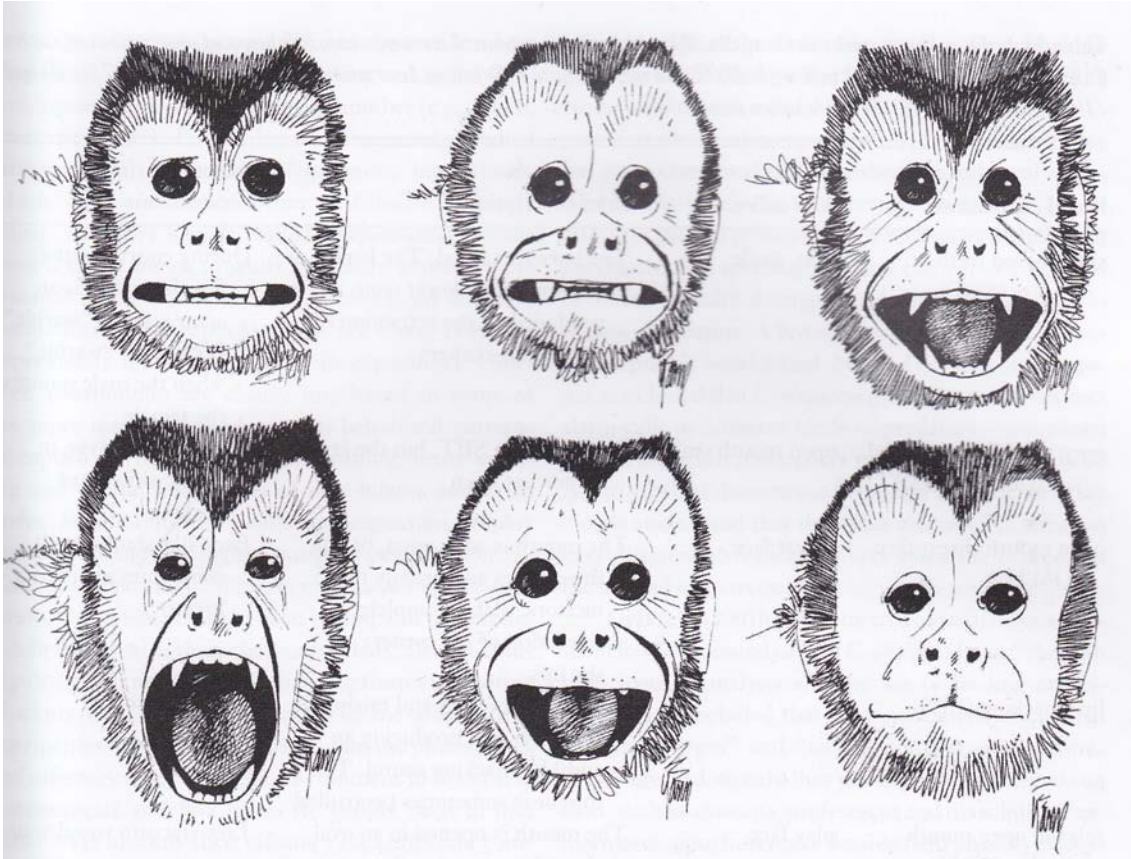


Table 1- Facial expressions in *C.apella*. The descriptions are based on more than 200 hours of observations of captive *C. apella* (Valenzano and Visalberghi 2002 and unpub. Data). Previous descriptions by Oppenheimer (1973), Weigel (1978) and Weaver (1999) are taken into account. (Fragaszy, Visalberghi and Fedigan 2004)

Facial expression	Also called	Brief description	Accompanying vocalizations
Silent bared teeth display (SBT)	Grin, smile	The jaws are closed. The baring of the upper and lower teeth row is produced by the retraction of the mouth-corners.	During courtship the female performs an acute squeal (“warble”). Both sexes “warble” when the male mounts the female.
Open mouth silent bared teeth display (OSBT)	Open mouth smile	Similar to the SBT but the jaw is somewhat open	A pulsed call given in bouts while head cocking
Open mouth threat face (OMTF)	Threat face	The mouth is wide open, baring the canines and usually the incisors, with a complete retraction of the corners of the lips	Bark-like staccato call, sometimes a pulsed breath
Lip smacking (LPS)		Rhythmic lowering and raising of the lower jaw, producing an audible smacking sound. The tongue is sometimes	Smacking sound

Relaxed open mouth display (ROM)	Play face	protruded The mouth is opened in an oval shape by retracting the corners of the lips and opening the mouth; teeth largely remain covered by the lips	Low staccato vowel sound
Scalp lift (SCL)		Eyebrows and forehead are raised, no change in the configuration of the mouth	
Head cock (HCK)	Head tilting	The head is rhythmically tilted from one shoulder to the other while gazing at recipient	
Protruded lip face (PLF)	Duck face	Lower jaw protrudes anteriorly, lips are tensed together and protruded	

Capuchins also communicate in the tactile mode: they touch, sit in contact with, groom and inflict varying degrees of pain on one another (e.g. pinch, push, pull, bite). Grooming is not only a method of removing parasites and general hygiene, the act of grooming expresses strong social bonding, hierarchies, kin relations, sexual relations and many more social patterns that are not totally understood.

Playful interactions are another easily recognized form of affiliative expression in monkeys. Capuchin play is exhibited mainly but not exclusively by juveniles and can take the form of solitary and social play. Juveniles often engage in social play while the adults are resting from their foraging activities.



Image – capuchins grooming. Photo taken by Kate Littlefield in Ecuador, South America.

Olfactory signal (called pheromones) are the most difficult for us to study and there is not yet any research focused directly and exclusively on olfactory communication in capuchins. However, pheromones are clearly implicated in some of the more interesting and unusual behavioural patterns of capuchins, for example, hand sniffing, urine washing, and genital inspections of new infants and adult males.

Capuchins have a rich repertoire of signals in the vocal-auditory mode. This makes good sense in a monkey that spends much of its day in leafy trees out of direct sight of its fellow group members. Through their call, capuchins constantly maintain contact with one another and appear to transmit information about their internal status (fearful, contented, aggressive etc.) as well as information about the environment (e.g. food locations, directional movement cues and predator sightings). (Fragaszy, Visalberghi and Fedigan 2004)

Captive observations help us to further understand the way capuchins interact with each other. It is important to document such data.

9.2.3 Home Range

Capuchins are distributed across a large variety of habitat types. The home ranges of different species of capuchin monkey have been studied in various locations. Below is some documented information.

(In Manu National Park in Peru) *C. albifrons* groups shift the focus of their activity from one spot to another in a large home range of about 150 hectares. (1.5 km²; Tergorgh 1983)

(In El Tuparro National Park in Colombia) *C. apella* show extensive home range overlap and peaceful interactions between groups where as *C. albifrons* defend nearly exclusive territories in large home ranges of 120 hectares (1.2 km²; Defler 1982)

9.3 Reproductive Behaviour

9.4 Bathing

Capuchins do not sand or dust bathe. If provided with a water source, such as a moat around the exhibit they will play by the waters edge and often dip their arms in the water during hot weather, although they will not willingly enter the water as Capuchins cannot swim.

Capuchins will also rub pungent smelling materials into their fur. In the wild Capuchins will often rub plant materials and tissues of insects into their fur. This behaviour was referred to as “peat-bathing” by Ludes and Anderson (1995); this is thought to deter

insects such as Mosquitoes. In captivity, if Capuchins are provided with onions, spring onions, Citrus fruits, peat and even tobacco or garlic they will carry out this activity. (Honeysett, 2006)

9.5 Behavioural Problems

When keeping capuchins in captivity, a number of behavioural problems can arise.

Some abnormal behavioural patterns that may be seen in captive capuchins include;

Excessive grooming

Hair pulling

Repetitive pacing, jumping or rocking

Social withdrawal

Self mutilation

Unwarranted aggression

If a captive capuchin is displaying any of these undesirable behaviours, it is important to assess the conditions under which the animal is being kept and make changes to rectify the problem. See Section 9.7 Behavioural Enrichment.

Hand reared capuchins often have behavioural problems, particularly in a social group setting. Hand reared capuchins regularly lack social skills to allow them to be successfully integrated into a social group. Some of these animals will crave human attention and will gain this by imitating people; the humoured response by uneducated audiences encourages this undesirable behaviour. It is undesirable for capuchins to imitate human behaviour.

There are certain precautions a keeper should take to avoid aggressive encounters with Capuchins. When entering the exhibit to feed, acknowledge the dominant male first. In the wild, the dominant male would have the choice of feed first and if subordinates are fed before him he may get jealous and become aggressive. The dominant male controls the troupe so it is important to familiarize with him and “become friends”.

(Honeysett, 2006)

As capuchins are housed confined living quarters much smaller than their natural home range, there is the potential for aggression amongst individuals (especially if there is nowhere for individuals to avoid one another). To avoid this, separate areas or simply divided or screened off areas should be provided so individuals can get out of site of one another.

If two capuchins are agonistically interacting or fighting, keepers should avoid these animals or the Capuchins will quite possibly turn their aggression to the keeper. If a capuchin is threatening or flaring up at a keeper it is important to avoid eye contact and

attempt to ignore the animal, do not run or show fear as the monkey would then have achieved its outcome by this undesirable behaviour and could possibly attack.

A gentle tone of voice should be used to talk to subordinate Capuchins even when reprimanding especially if they are family members of the dominant male. The dominant male can be very protective of his troop and may perceive an angry or raised tone of voice as a threat. (Honeysett, 2006)

9.6 Signs of Stress

Some signs of stress in captive capuchins include:

Pacing

Excessive grooming

Self mutilation

Head tossing

Weight loss

Irritability

Unwarranted aggression

Appetite loss

9.7 Behavioural Enrichment

Environmental enrichment is the provision of stimuli which promote the expression of species-appropriate behavioural and mental activities in an under stimulating environment. (Reinhardt, 1999)

In order to keep capuchins in captivity it is important to incorporate an enrichment program into the daily activities. The main aim is to encourage and provide the stimulation necessary for the capuchin to exhibit natural behaviours and to reduce or ideally eliminate abnormal or undesirable behaviour. There are many different ways to do this.

Capuchins are primarily arboreal species, they move around their home range and their environment is constantly changing. Their captive enclosure should mimic this as best as possible. Therefore a complex network of fixtures should be incorporated. These can include branches, logs, ropes, toys, ladders, pipes, tubes, nest boxes, platforms etc. The furnishings should be changed regularly to replicate an ever changing habitat. This encourages the monkeys to explore. The introduction of a simple new ladder or extra branches can provide hours of entertainment. Places for hiding foodstuffs should also be incorporated.



Image – Enclosure Flor de la Amazonia, Ecuador. Photo taken by Kate Littlefield.



Image – Monkey Island, Wellington Zoo, NZ

In the wild, capuchins spend a majority of their day foraging for food. To avoid stereotypical behaviour caused from boredom, it is important to try and simulate normal activities such as foraging. The enrichment ideas in this section are only limited to your imagination and in no way could one list them all. So provided are just a few examples of different feeding strategies which help stimulate captive primates:

- Scattered throughout grasses, amongst substrate
- Hidden in trees, hollows, activity balls etc
- Placed on nails in trees
- Chopped into various sized pieces
- Frozen ice blocks with juices/fruits etc.
- Whole fruits and vegetables for them to open themselves
- Whole nuts for them to crack e.g. macadamias, coconuts

- Cooked fruits or vegetables
- Mashed and smeared on logs, e.g. Sweet potato smears
- Insects in tube feeders
- Small nuts and raisins hidden in holes drilled into logs
- Spreads such as peanut butter/vegemite/jams smeared throughout enclosure
- Bottles filled with treats
- Items wrapped in newspaper parcels

The ideas are only limited to your imagination. Just be sure to only use safe, non toxic items that cannot cut, splinter or injure the capuchins in any way. Be aware that substrate is often ingested.

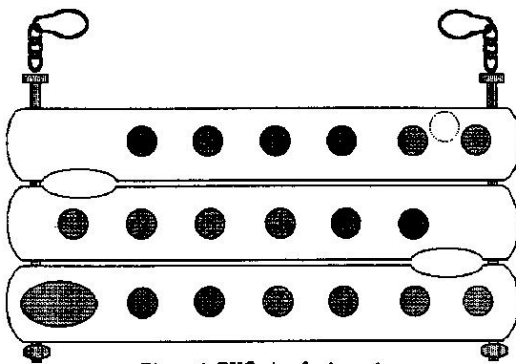


Figure 1. PVC pipe food puzzle.



Images – some examples of specially designed primate toys. www.hellofelix.com

Enrichment programs should try to stimulate the species through a number of ways. A good way to get a broad scope of ideas is to focus on each sense and provide some

stimulation for each of them. Obviously some senses are more prolific than others and would require more enrichment but here are a few ideas for the capuchin monkey.

Smell – The use of scent trails throughout enclosure provide good stimulation. These can involve a huge range of smells. Some examples include perfumes, herbs, and liquid food items e.g. (Fish oils, gravies etc). Scents can be just randomly sprayed throughout the enclosure or can be a trail leading towards something (such as a food item or toy).

An alternate scent source that can be added is that of other species. For example urine or scat from either a known predator or prey. For example, a light spray of ocelot urine will spark much interest and will keep the troop alert and aware at the possibility of a threat nearby.

Almost any new, unusual, tasty or revolting smell will provide some stimulation for these curious creatures.

Sight – Visual stimulation is also another form of enrichment. This can be very simple to provide. By merely changing colours, layouts, backgrounds etc of the enclosure can spark interest, or by offering different viewing areas such as windows etc. It can also help by changing the view that is out the window on the outside of the enclosure.

Another form is to place statues, pictures, toys or objects around enclosure posing as threats or predators. These should only be used occasionally and for very brief periods as primates become accustomed to them quite quickly. Some examples include, silhouette birds of prey hovering above enclosure, a mechanism to rustle around in a nearby bush periodically, toy snakes or simply a person running by in a chicken suit. A lot of this so called ‘fear enrichment’ works very well to assist with group bonding and hierarchy as the dominant male should provide troop protection and the rest of the will work together to protect each other from the threat..

Mirrors can be introduced as well. It has not been proven that capuchins recognise their own reflection but they will still interact with the figure in the mirror.

Taste – Taste is probably the most commonly used avenue for enrichment. And it appears that most animals respond well to food items whether used for enrichment or training. Capuchins spend a vast majority of their day foraging for fruits, nuts, insects, leaves, small mammals etc. The way food is presented to them in captivity should attempt to mimic this behaviour. To place a big bowl of nicely chopped pieced of food stuffs in the same place everyday would not provide much stimulation at all. Daily diets could be spread around the enclosure in a number of ways. Capuchins should be fed a minimum of 2 times per day plus activity feeds. It is important to include the total number of treats/activity feeds into the daily dietary requirements to avoid over feeding.



Image – food treats hidden in activity ball for black capuchin.

Hearing – Some sounds that can be used to mimic their natural environment include wild jungle noises (on a compact disc). These create a good atmosphere for both animal and visitor.

Touch – The use of different substrates encourages the monkeys to dig/forage through it out of curiosity or in search of food. Some examples are leaf litter, sawdust, straw, bark, grasses, paper etc. Food items can be hidden amongst the substrate e.g. mealworms or nuts.

Appropriate kid's toys are another great enrichment tool. These can be rattles, teething rings etc.

Things to avoid with enrichment items:

- **parts that can be swallowed**
- **keepers should remove the lid rings from plastic bottles as a precaution**
- **When placing ropes in enclosures do not use slip knots and be careful not to create any loops in the rope that a monkey may get hung on.**
- **No sharp objects**
- **If plastic edges of enrichment toys are sharp they must be filed until deemed safe.**

No soft or beaded toys that may be torn open and ingested

9.8 Introduction and Removals

Introductions and removals in Capuchins can be difficult and pose many social problems but the risks of severe problems arising from introductions appear minimal to the disadvantages of solitary housing. In some groups the lowest ranking individual can become the target of repeated aggression, during which no other group member intervenes on its behalf. This is obviously a stressful situation for the victim, and in extreme cases removal of the unfortunate individual may be called for. However, unless serious injury or depression results from such bullying, removal can have considerable drawbacks: it results in isolation, altered immune functions (Kling *et al.* 1992) and possible problematic reintegration for a socially rejected individual, and does not preclude the possibility of another member of the group becoming a new scapegoat. In

such cases priority should be given to monitoring the psychological and physical health of the individual, providing temporary relief and food supplements during short separations, if necessary. No cases which an individual has been harassed to the point of death have been reported and not only physical wounds but social wounds heal with time.

If a Capuchin must be removed from the group the period of separation should be kept to a minimum, the longer the animal is separated, the higher the risks when it is returned. If possible the rejected individual should be housed where they have visual, auditory and olfactory contact with the group. Rejected individuals should be under daily, long term monitoring. Rejected animals can also be provided with a companion to prevent solitary confinement.

Introduction and reintroduction must be undertaken with caution. All efforts should be made to integrate an individually housed animal into the resident group or at another institution since solitary housing is undesirable. Introduction should occur in a step wise manner; increasing contact from sound and smell to sight and finally physical. This process may take several months. This process was successful for hand-reared and mother-reared infants when the full integration procedure was preceded by a period of visual contact, allowing mutual familiarization from a safe distance. Integration of a single adult female was achieved on two different occasions through a period of visual contact, followed by periods in which the female was together with the dominant adult male, and then together with him and each of the other group members. Finally she was housed permanently with the entire group (Anderson et al. 1991, Ludes and Anderson 1995b). A similar procedure has been found to be successful when introducing a fully adult male (more than 10 years old) into a group in which the dominant male was 4 years old. The procedure involved stages similar to those just described for the adult females, but was much quicker, and the last individual to be in contact with the newcomer was the dominant resident male. Strikingly, as soon as these two males were together in the cage they made contact and performed joints threats, directed towards no particular target. The two males had a positive relationship, with the newcomer being dominant over the resident, younger male. Although all such cases of introduction involve stress for all involved, in none of the cases described did the introduced animal have to be removed from the group because of aggression or stress related ill health.

Often the use of a neutral cage facilitates safer introductions/reintroductions. No foolproof recipe is yet available for group formation or introduction procedures, but the chance of success can be increased by having knowledge of the animals involved, careful monitoring of phases proceeding and following introduction, and by taking into account factors such as sex, age and the experience of newcomers (Visalberghi and Anderson 1993). It is anticipated that the introduction of a fully adult male into a group containing neonates may be risky. Also, the introduction of an adult female into a group containing more than one adult male may result in a violent challenge to the dominant male by a subordinate, especially if the former is old. Once given physical contact the group should be closely observed for 48 hours and monitored daily for at least 2 months. (Honeysett, 2006)

9.9 Intraspecific Compatibility

Capuchins live in social groups and are generally compatible. The group itself will work out the social hierarchy. Even though there is much dominance exhibited between individuals, subordinates will still be allowed access to food and can be in the presence of alpha male without conflict. Bullying can occur and needs to be monitored closely. Please see section '9.8 Introductions' on problems associated with introducing new members to the group.

Infanticide is not common in captivity however it is known to exist amongst capuchin species, usually by unrelated males in times of conflict or when a male is introduced to a new group and is fighting for dominance.

9.10 Interspecific Compatibility

Capuchins have been used in zoos in mixed species exhibits. They are most commonly housed together with squirrel monkeys (*samiri sp.*). In the wild these two species coexist peacefully and sometimes forage together, which is mainly beneficial to the squirrel monkey as the capuchins provide troupe protection. Reports of successful and unsuccessful instances of interspecific housing are reported below.

Cebus albifrons and *Aloutta caraya* (Howler monkey) were unsuccessfully exhibited at Omaha's Henry Doorly zoo. The Capuchins were removed after 3 months because the howlers attacked them, although the capuchins usually instigated confrontations with short, aggressive attacks on the howler monkeys.

Cebus apella and *Aloutta caraya* was also unsuccessful at Santa Ana Zoo. These animals were successful for about a year when the group composition changed. The female howler attacked one of the female Capuchins causing severe injury. This Capuchin had to be removed to heal and it became impossible to introduce any Capuchins after that.

Cebus apella were successfully exhibited together with black-handed spider monkey (*ateles geoffroyi*), Squirrel Monkey (*samiri sp.*), giant anteater (*myrmacophagia trydactylus*) and Brazilian Tapir (*tapirus terrestris*). The Capuchins rarely, if ever interact with the tapirs or the anteater. The adult male spider monkey was aggressive towards two of the adult male Capuchins and could not be exhibited together. The squirrel monkeys and Capuchins had a positive relationship and juveniles would often play together. Two of the female capuchins shared holding cages with the squirrel monkeys rather than enter the capuchins holding cages.

9.11 Suitability to Captivity

Non human primates have been held in captivity for thousands of years (if not more). Only recently have humans begun to realise the intense social, environmental, behavioural and dietary requirements of these animals.



Image: an inappropriately housed capuchin in Ecuador, South America. Photo taken by Kate Littlefield.

Throughout the world capuchins are being housed in inappropriate, appalling conditions where the monkeys are suffering their entire lives. It takes a lot of time, effort, money, supplies and knowledge to provide capuchin monkeys with a suitable environment for them to live contently. The basics that need to be provided are explained in the 'Five Freedoms' (Broom and Johnson 1993);

- 1) Freedom from hunger and thirst – by ready access to fresh water and a diet to maintain full health and vigour.
- 2) Freedom from discomfort – by providing an appropriate environment including shelter and a comfortable resting area.
- 3) Freedom from pain, injury and disease – by prevention or rapid diagnosis and treatment.
- 4) Freedom to express normal behaviour – by providing sufficient space, proper facilities and company of the animals own kind.
- 5) Freedom from fear and distress – by ensuring conditions and treatment which avoid mental suffering.

It is only once these requirements can be fulfilled, that it is possible for capuchins to be housed suitably in captivity.

References;

- (Honeysett 2006)
- (Wolfensohn and Honess, 2005)
- (Fragaszy, Visalberghi and Fedigan 2004)
- (Capuchins - Social Behaviour)
- (Reihardt, Viktor and Annie 2008)
- (Lelsey, 1994)

10 Breeding

10.1 Mating System

Capuchins are polygamous, and it is the females who do the courting. Females mate preferentially with the dominant male. Their methods of luring males include raising their eyebrows, gesturing, and making sounds. If the male is interested, he will mimic her gestures and sounds, follow her, and mate.

During the last 2 days of the female oestrus cycle, the dominant male is very protective and keeps females from mating with subordinate males. (Capuchins - Social Behaviour)

There is a complex social hierarchy within the capuchin grouping. See section 9 on Behaviour to further understand group relationships.

10.2 Ease of Breeding

There has been success in breeding capuchins in captivity. Care must be taken to ensure compatibility of paired monkeys as fights may take place causing injuries. Providing there is an adequate diet and suitable conditions, most compatible pairs will mate without to much human intervention.

Capuchins are excitable and generally do not readily cooperate for vaginal swabbing to chart menstrual cycles.

It is a more complicated task to inhibit breeding than to get them to breed.

10.3 Reproductive Condition

10.3.1 Females

Females show no signs of oestrus swelling.

It appears that males may be able to detect females in oestrus by chemical cues in her urine (Smuts et al., 1987).

Females exhibit remarkable prospective behaviour when in oestrus. This can consist of facial expressions, vocalizations, gestures and body postures. *Cebus apella* express this behaviour much more commonly than *Cebus albifrons* however this behaviour is still expressed to a lesser extent. When she is prospective, the female actively follows a target male (in most cases the dominant male of her group) until mutual sexual interest becomes evident and mating occurs. (Fragaszy, Visalberghi and Fedigan 2004)

10.3.2 Males

Although recorded data is limited, it is estimated that sexual maturity in male capuchins is approximately 5 - 7 years. It is usually the dominant male that is targeted by females of the group; however, the females may offer themselves to subordinates also (usually when the dominant male is not present). The males will respond to the female with similar gestures before copulation occurs.

10.4 Techniques Used to Control Breeding

There are a few methods used to control breeding in non-human primates. Some of these are similar to methods used in humans.

Contraceptive implant - This is the most common technique used as it is effective and long lasting. There are several different brands containing different active constituents. Their effectiveness lasts from 6 months to 3 years. The contraceptive pill can also be used but is not preferred as it requires daily dosage and there is the risk of missing a dose or of other monkeys receiving twice the dose. Also injections can be administered. A few suggestions are listed below.

(1) **GnRH Agonists** - Gonadotropin Releasing Hormone Agonists are considered the safest reversible contraceptives, but dosages and duration of efficacy are not well established for all species; males may require higher doses. Side effects are generally similar to those associated with gonadectomy, especially the potential for weight gain unless diet is controlled.

- **Suprelorin® (deslorelin) Implants (F or M)**
- **Lupron® Depot Injection (F or M)**

(2) **MGA implant (F)**

(3) **Depo-Provera® injection** - Depo-Provera injection can be used to prevent the post-partum oestrus until an MGA implant can be placed or as longer term contraception (20mg/kg body wt, effective for approximately 30 days). **(F)**
(AZA Wildlife Contraception)

For more information on these methods see appendix 5.

10.5 Occurrence of Hybrids

There is no known record of hybrids occurring.

10.6 Timing of Breeding

In nature, capuchins give birth about every 2 years and show some degree of birth seasonality, either a birth peak or an actual season of births when food is abundant. This

peak season varies with locality but usually coincides with dry season or high fruiting periods or influxes of insect populations. (Fragaszy, Visalberghi and Fedigan 2004) *Cebus* do not show seasonal breeding under controlled ambient conditions (i.e. in indoor colonies with lighting etc. that does not change seasonally) but are reasonably seasonal breeders both in the wild and in captivity when caged outdoors in seasonal climates. (Neagle and Denari 1982)

In captivity, capuchins can breed at almost any time of the year provided there is ample food and good climatic conditions. (Fragaszy, Visalberghi and Fedigan 2004)

10.7 Age at First Breeding and Last Breeding

There is very little data recorded regarding the ages of first and last breeding of *Cebus albifrons*. The following table includes some information on different species of the genus. (Fragaszy, Visalberghi and Fedigan 2004)

Table 4.1. *Life history parameters in Cebus*

Species	Gestation (days)	First birth	Interbirth interval (mos)	First siring	Max life span (years)
<i>C. albifrons</i> (nature)	–	–	–	–	–
<i>C. albifrons</i> (captive)	–	–	–	–	44 ⁶
<i>C. apella</i> (nature)	151–155 ¹ 149–158 ¹⁰	7 yr Mode ¹ 5 yr E ⁹	19.4 ¹ 22 ⁹	–	–
<i>C. apella</i> (captive)	160 ⁴	5 yr 7 mo ⁴ 5 yr 8 mo A ¹¹ 4 yr 7 mo E ⁴ 3 yr 10 mo E ¹¹	20.6 ⁴ 20.4 ⁸	4 yr 5 mo ⁴	45.1 ⁶
<i>C. capucinus</i> (nature)	157–167 ⁵	7 yr A ²	26.4 ³ 23.7 ⁷	6 yr (mate with ejac.) ²	–
<i>C. capucinus</i>	–	–	–	–	54.75 ⁶

10.8 Ability to Breed Every Year

Cebus albifrons gives birth to a single young every 1 to 2 years, with a gestation period of about 150 to 160 days. If the infant dies shortly after birth, the female mates in the next breeding season, but if the infant lives, the female postpones breeding an extra year in order to take care of the infant (Smuts et al., 1987).

There is no evidence for the existence of menopause in New World primates and they appear to continue breeding albeit with reduced frequency as they get older and into old age. In the interest of the animals health and welfare, it may be appropriate to embark upon a course of contraception for capuchins that are older and experience problems (e.g. frequent still-births), but it is also important for their welfare that they remain with their social group. (Wolfensohn ad Honess 2005)

10.9 Ability to Breed More than Once Per Year

Cebus albifrons gives birth to a single young every 1 to 2 years, with a gestation period of about 150 to 160 days. If the infant dies shortly after birth, the female mates in the next breeding season, but if the infant lives, the female postpones breeding an extra year in order to take care of the infant (Smuts et al., 1987). There is an average of 547 days interval between litters.

10.10 Nesting, Hollow or Other Requirements

When a female capuchin is showing indicators of a forthcoming birth, bedding such as straw or sawdust can be added to the den for extra comfort. She will birth wherever she is most comfortable. If the temperature in the den is artificially controlled it is advised to slightly increase the temperature, in particular if the den has two sections, giving the female the option of a warmer den or regular temperature. (Honeysett, 2006)

10.11 Breeding Diet

To encourage breeding, the female should be provided with extra food. High fat/energy foods and high protein foods such as mealworms help prevent weight loss when rearing an infant. This should be simply extra food on top of the balanced complex dietary requirements that are fed daily. See section 6 on Health and Diets.

10.12 Oestrous Cycle and Gestation Period

Gestation period is 150 - 160 days.

Capuchins reach sexual maturity at four to five years of age. Females have a menstrual cycle of 19 – 22 days. Gestation lasts from 150 to 160 days, followed by 22 weeks without menstruation during nursing if the mother rears the baby, or about seven to eight weeks without menstruation if she loses the baby. Infertility while nursing lasts months longer, even after menstrual cycling resumes.

10.13 Litter Size

One infant is born. Twins are very rare.

10.14 Age at Weaning

Average age at weaning for captive *Cebus albifrons* is 270 days. However using re-conception as a marker for completion of weaning, could be up to 416 days (Fragazy and Adam Curtis 1998). Capuchins are fed by their mother for several years after 'weaning' so it is difficult to record a specific age.

10.15 Age of Removal from Parents

Infants cling primarily to their mother but they also routinely ride on other individuals. Riding on individuals other than the mother is uncommon in infants under 4 weeks of age (although infants have been observed even on the day of their birth). Adults, juveniles and siblings will all assist in the carriage. Allonursing also occurs in the genus *Cebus*. After approximately 6 months capuchins are more often moving on their own than carried by others.

(Fragazy, Visalberghi and Fedigan 2004)

Female infants remain with the group generally for the entirety of their lifespan where as males will begin to disperse upon sexual maturity in search of a troupe of their own.

Mothers can assist the young with feeding up to and beyond 3 years of age. Juveniles continue to learn behaviour from parental figures and group members such as manipulating objects, cracking nuts, extracting food from crevices etc throughout the course of their life.

10.16 Growth and Development

Development of capuchins is complicated and lengthy. Their brain is relatively small at birth indicating a greater proportion of brain development occurs postnatally.

Infants are attractive to others from birth, although as newborns they are incapable of responding to others with vigorous or differentiated actions. They participate in social behaviours from 4 weeks of age by clinging to others (not their mother), nursing from others and playing with others. As they develop, they begin grooming others, participating in sexual encounters and other adult social activities.

Youngsters must become able to feed themselves before they can be fully weaned. To do so they must become strong enough and large enough and develop strong teeth and jaws. For capuchins, these aspects of growth are in progress when the youngsters enter weaning in their second year of life, but are not completed for several more years.

Capuchins must also become skilled at selecting places to forage, avoiding dangerous places and irritating prey, at opening hard surfaces and at extracting food from surfaces and crevices. Developing these skills begins whilst infants are still nursing.

In captivity juveniles are found to be more curious, playful and inquisitive. Sufficient enrichment should be supplied to encourage the youngsters to learn positive behaviours.

Table 6.1 shows Body and Brain Proportions for newborns. (Fragaszy, Visalberghi and Fedigan 2004)

Table 6.1. Body and brain proportions for newborn male (M) and female (F) infants in a variety of primate taxa. Sources are listed by number to the right of each column (in italics; see Note).

Species	Neonatal brain weight (kg)	Adult brain weight (kg)	Neonatal body weight (kg)	Adult body weight (kg)	Neonatal/adult brain weight (%)	Neonatal/adult body weight (%)	Age at weaning (days)
<i>Cebus albifrons</i>	0.0326 (F) 3 0.0344 (M) 3	0.0668 (F) 3	0.2277 (F) 3 0.2375 (M) 3	2.29 (F) 4 3.18 (M) 4 2.54 (F) 4	49 (F) 3	10 ^a 3, 8	270 6, 8, 9
<i>Cebus capucinus</i>	0.029 ^a 6	0.0792 (F) 6	0.23 ^a 2, 3	3.68 (M) 4 2.52 (F)	37 ^a 6	9 ^a 6, 8	365 5, 9
<i>Cebus apella</i>	NA	0.071 ^a 6	0.245 ^a 10	3.65 (M) 4	49 ^a 7	10.9 ^a 8	416 11
<i>Saimiri sciureus</i>	0.0146 (F) 3 0.0155 (M) 3	0.0233 (F) 3 0.0253 (M) 3	0.110 (F) 3 0.1129 (M) 3	0.67 (F) 4 0.78 (M) 4 9.15 (F) 4	63 (F) 3 61 (M) 3	16.5 (F) 3 11.4 (M) 3	330 1, 9
<i>Ateles fusciceps</i>	NA	0.1147 (F) 6	NA	8.89 (M) 4 7.29 (F) 4	NA	NA	365 6
<i>Ateles geoffroyi</i>	0.064 ^a 6	0.1109 ^a 6	0.426 ^a 6	7.78 (M) 4	58 (F) 6	6 (F) 6	870 6
<i>Cercopithecus talapoin</i>	NA	0.0377 ^a 6	0.18 ^a 2	1.12 (F) 4 1.38 (M) 4	NA	16 (F) 6	180 6
<i>Pan troglodytes</i>	0.128 ^a 6	0.4103 ^a 6	1.756 ^a 6	39.5 (F) 4 50.0 (M) 4	31 (F) 6	5.6 (F) 6	146 6

^a Sex unspecified or average of both sexes.

Sources: (1) Baldwin and Baldwin 1981; (2) Byrne and Suomi 1995; (3) Elias 1977; (4) Fleagle 1999; (5) Freese and Oppenheimer 1981; (6) Harvey and Clutton-Brock 1985; (7) Kirkwood and Stathatos 1992; (8) Ross 1991; (9) Rowe 1996; (10) Visalberghi and Anderson 1999; (11) Fragaszy and Bard 1997.

Capuchins gain weight at a rapid pace after birth. The weight increases by more than 100% from birth to 60 days. Thereafter the weight gain slows, but at the end of the first year of life, young capuchins weigh over 1kg.

Dentistry –

Capuchins are born with deciduous incisors already visible above the gums. A full set of deciduous teeth appear in the next several months (by 30 weeks) accompanied by much chewing activity. The first permanent tooth, the first pre-molar appears at 13.5 – 14 months. The permanent incisors appear soon after at 14 – 18 months. The second molars appear at 26 – 28 months. The third and fourth pre-molars appear by 3 years, and the third molars by 3.6 years. The last permanent teeth to emerge are the canines, which typically appear at the end of the fourth year or during the fifth year. Males get each of their permanent teeth 2 weeks to 2 month before the female.

(Fragaszy, Visalberghi and Fedigan 2004)

11 Artificial Rearing of Mammals

EAPA standards for exhibiting primates states the following;

Hand-rearing must only be undertaken in exceptional circumstances, in consultation with animal management staff and a veterinarian with primate experience. Hand-reared primates must have visual and olfactory contact with other members of the group at the earliest opportunity and be physically reintroduced to the group as early as possible. There must be minimal human contact and use of a surrogate mother is preferred.

11.1 Housing

Infants require a warm, stable environment. An incubator or heated box could be suitable for young infants. Infants do not require a lot of space in the first few months of their lives.

House infants together when available or when an individual needs housing alone, place with a warm soft toy for comfort.

11.2 Temperature Requirements

Most often infants are found on the cold, concrete floor, wet and covered with poop (faeces) or food. These infants are critically ill and at high risk.

Protocol – Slow warming with warm blankets, hair drier and incubator set at 32.2 degrees Celsius, and humidity of 75-85 %. Infants have poor thermo stability, and a constant ambient temperature is important. COLD KILLS. In the newborn it is usually the result of failure to provide a supportive environment

Do not attempt to feed formula until temperature is near normal (at least 36.1 degrees Celsius).

11.3 Diet and Feeding Routine

The following information was written by Cynthia Bickel, Zoo Vet Tech from Denver Zoological Gardens in reference to Hooded Capuchins *Cebus apella cay*. Although I haven't managed to find information directly relating to *C.albifrons*, I believe similar nursery practices would be applicable.

Formula of choice: PRIMILAC Milk supplement for infant non-human primates.
Available from Bio-Serv - Product # F0554SP (www.bio-serv.com)

PRIMILAC mixing directions: Directions for preparing one 6oz serving.

- 1) Measure 200ml. of warm water (temp approximately 110 degrees) add to bottle
- 2) Add one scoop (31.25 grams) of Primilac (product #F0554SP)
- 3) Shake approximately one minute or until dissolved

- 4) Fill feeding tubes or bottles
- 5) Refrigerate unused portion

For best results see instruction sheet for storage, refrigeration and mixing.

Formula Intake:

Caloric requirements of infant primates are 110-200 kilo calories per kilogram per day. Over feeding will cause diarrhoea and bloat. Infants must be held upright in a natural position for nursing, and they should be burped to prevent gas accumulation in the stomach, caused by gulping. Very small or weak infants should be fed smaller amounts at more frequent intervals.

Feeding Schedule:

Initially because of the dilute formula and low intake, the infant will want to be fed frequently, it will be necessary to feed ad lib. Once the formula concentration is at full strength and the infant's intake increases, feedings can be offered every two hours.

Feeding apparatus:

Blue Preemie Nipples. When formula is dilute, the cross cut should be small. As formula concentration increases it becomes thick so there should be a concomitant increase of the cross cut to facilitate flow. Use extreme caution as there is **danger of ASPIRATION** if the cross cut is too large.

(Bickel)

11.4 Specific Requirements

Body temperature should be taken before feeding.

Room/Box temp should be checked regularly.

Weigh infant before first morning feeding.

Clean animal as required. Ensure animal is dried completely.

Change bedding and clean incubator/ hot box as needed.

Rabies Vaccination is given at 144 days of age. (Bickel)

11.5 Data Recording

Record all the usual data for housing primates see 5.1 Record Keeping and 5.4 Data Collection.

Extra data that should be recorded includes;

- Daily body weight – take before first feed.
- Amount and composition of food intake.
- Times when food is taken.
- Faecal monitoring
- Teething information
- General demeanour
- Abnormalities to routine

11.6 Identification Methods

The same as in adults – Please see section 5.3

11.7 Hygiene

Bickels Nursery Reference states that because newborn animals do not always have a fully developed immune system, it is critical that those responsible for infant care maintain high standards of cleanliness and sanitation.

Restricting entry to only those persons assigned to infant care will help reduce the likelihood of exposing the infant to pathogens.

FAILURE TO WASH HANDS IS UNDOUBTEDLY THE PRINCIPLE MODE OF SPREAD OF INFECTION. NOTHING IS MORE FUNDAMENTAL TO PROPER NURSERY HYGIENE THAN HAND WASHING.

Nursery staff should be to those personnel who do not have young children at home which might increase the number of pathogens brought into the nursery. The keeper should use care in exposing the infants to human diseases by not entering the nursery when ill. Smocks should be worn when handling infant. (Bickel)

11.8 Behavioural Considerations

This important behavioural information is provided in EAPA standards for exhibiting primates.

The extended developmental period of juvenile primates requires older animals to associate with juveniles so that behaviour develops normally. The juvenile adults then learn to function as part of a social group, reproduce and care for young. Artificial rearing disrupts this natural process and often results in socially maladjusted animals which may be difficult to place in a group or lack the skills for normal breeding behaviour. This can be avoided by treating the youngster as a member of its species and not as a human baby. Behavioural enrichment should be maintained.

11.9 Use of Foster Species

I have not yet found any reputable information regarding this section.

11.10 Weaning

Denver Zoo started to wean their *Cebus apella* infant at 33 days of age by beginning to offer solids. She licked yogurt off a spoon and was offered leaf eater cubes to play with. (Bickel)

Introduction to adults – 104 days of age put in with adults for 1 hour per day
112 days of age no longer separated at night.

Teething –

3 days of age: Teething lower incisors, at 7 days of age lower deciduous incisors 1 + 2 erupting/cutting gums.

17 days of age: Teething upper deciduous incisors 1, 30 days of age erupted.

147 days of age: Deciduous incisors 2/2, canines 1/1, premolars 2/2 = 20

167 days of age: Deciduous incisors 2/2, canines 1/1, premolars 3/3 = 24

Always monitor infants closely when amongst adults. I have been unlucky enough to have seen a newly introduced infant killed overnight by a troupe of capuchins in Ecuador, South America. This is a very sad outcome and with good observational skills accidents like this can be avoided.

11.11 Rehabilitation and Release Procedures

This is a very difficult subject to approach. There are many Rescue, Rehabilitation and Release Centres throughout South and Central America, although there is no proven or recorded data showing the best practices for these topics.

Capuchins become habituated with humans very easily and it is difficult to break this. Please consider the welfare and destination of the individual animals carefully before attempting a release program.

12 Acknowledgements

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This has been an all-consuming piece of work and I hope it will be useful to someone, somewhere in preserving this fascinating species.

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14 Glossary

Agonistic: The range of activities associated with aggressive encounters between members of the same species, including threat, attack, appeasement, or retreat.

Allonursing: The behaviour of females nursing offspring that are not their own.

Arboreal: Adapted to and spending most of ones life in the trees.

Corneal Reflex: The corneal reflex, also known as the blink reflex, is an involuntary blinking of the eyelids elicited by stimulation (such as touching or a foreign body) of the cornea, or bright light, though could result from any peripheral stimulus.

Dimorphic: Occurring or existing in two forms.

Diurnal: Active during the day.

Dorsal: With respect to, or concerning the side in which the backbone is located.

Holotype: The original specimen from which the description of a new species is made.

Hypothermia: A decrease in the core body temperature to a level at which normal muscular and cerebral functions are impaired.

Infanticide: The killing of young offspring by a mature animal of its own species.

Neonate: A newborn infant up to 4 weeks of age.

Olfactory: Referring to the sense of smell.

Omnivorous: Having the ability to eat both plant and animal matter.

Polygamous: Having more than one mate at a time.

Postnatally: Occurring immediately after birth.

Prehensile: Able to take hold of and clasp objects. Some monkeys have prehensile tails.

Proceptivity: Behaviour that leads to copulation and thus conception.

Vector: Any agent that carries and transmits a disease.

Zoonosis: Any infectious disease that is transmitted from other animals to humans or from humans to animals.

15 Appendices

Appendix 1

White fronted capuchin diet, Perth Zoo Composition of diet

A suggested diet composition is described below:

- A variety of fruit in the morning, vegetables in the afternoon, cheese, eggs, cooked chicken (bones and flesh) and chicks (see Appendix 1 for Perth Zoo's diet).
- Cooked garlic cloves 3x weekly to help build up immune system.
- It is recommended that celery be cut into 5cm pieces to prevent choking (Mootnick, 1996).
- Cook hard root vegetables such as carrots and sweet potatoes occasionally for variety.
- Dietary supplements: primate pellets (See Appendix 2 for nutrient content).
- Fresh browse daily if available. Browse can include acalapha, nasturtium, mulberry, hibiscus species, bamboo, dandelion greens and a variety of figs.

5.2 Quantity of food

Food preparation and feeding of primates must be carefully planned so all group members receive the necessary nutritional requirements including growing and lactating animals. Capuchins should be fed in small portions at least twice daily with additional activity feeds offered on a daily basis. Their small size and high level of activity requires that they eat regularly. White fronted capuchins at Perth Zoo receive 250g per feed X2 daily. Keepers should observe the animals once they have been fed to check that subordinate animals are obtaining their allocation of food.

5.3 Presentation of food

Suggestions for the presentation of food for white fronted capuchins are as follows:

- At least two feeds should be given per day.
- Food should be hidden around the enclosure to allow the animals to search for it and also allow subordinate animals a better chance of obtaining enough food.
- Fruit should predominately be fed in the morning and vegetables in the afternoon.
- Browse and behavioural enrichment given at least once a day.
- Scatter feed of nuts, seeds and primate pellets in the early afternoon.

5.4 Behavioural enrichment

It is now well known that a captive environment can impose severe restrictions on an animal's ability to display its full repertoire of species typical behaviour (Cocks, 2000). If an animal does not have enough stimulation, its behaviour, psychological well being and health can all suffer and boredom related problems can arise. These can include increased lethargy or the development of abnormal behaviours such as rocking, stereotyped movements, coprophagy and regurgitation/reingestion (Leivers, 1998).

Behavioural enrichment is used to stimulate animals and promote natural behaviours in a captive environment. Many forms of behavioural enrichment can include food. The main concept behind giving food as behavioural enrichment is to make the animals work and search for the food, thus keeping them physically and mentally active. Some examples of behavioural enrichment given to white-fronted capuchins at Perth Zoo are:

- Food hidden around enclosure (e.g. in stumps with holes drilled in them).
- Food given in different sizes.
- Scatter feeds of nuts, seeds, sultanas and primate pellets.
- Low joule jam smears.
- Rice and vegetable smears.
- Ice blocks with low joule cordial and frozen fruit and nuts inside.
- Cardboard boxes with seeds and nuts hidden in straw.
- Bamboo toys with nuts and seeds hidden inside (have to shake out through drilled hole).

A suggested enrichment timetable for *C. albifrons* is shown in Table 2

Table 2. Suggested Behavioural Enrichment schedule for *C. albifrons* at Perth Zoo.

Day	Behavioural enrichment
Monday	Live mealworms
Tuesday	Jam/honey smear
Wednesday	Novel devices e.g. bamboo shakers, boxes
Thursday	Coconuts or jam/honey smear Prepare rice/vegetable mix: cook 1kg rice and variety of root

	vegetables until soft. Mix together and store in refrigerator.
Friday	Rice/vegetable smear (spread on branches etc.)
Saturday	Live mealworms, scent trail
Sunday	Ice/jelly blocks

Many zoos are starting to incorporate behavioural enrichment into the normal daily routine of caring for primates. All primates at Perth Zoo receive daily behavioural enrichment to improve their welfare and well being. Perth Zoo has a Behavioural Enrichment Policy which includes ideas on behavioural enrichment and items that have been approved for individual species (located at www.perthzoo.wa.gov.au). It is recommended that behavioural enrichment be given to white-fronted capuchins daily as they are an intelligent and active species that will get bored easily.

5.5 Water

Clean, fresh water must be available at all times. There must be enough watering stations in the exhibit to allow all animals to have access to water, although not necessarily at the same time.

Watering devices such as monkey-activated drinkers must be designed to minimise contamination of the water by primate excreta. They should be kept in good working order and checked daily in case of damage.

Species that wash food items or search for food in water should be given appropriate water points to allow this natural behaviour e.g. have pond in exhibit (NSW Agriculture, 2000). The white fronted capuchins at Perth Zoo have a fibre glass pool in their exhibit (1m x 0.6m). They have been observed to retrieve food that is hidden in the pool and also wash food in the water. Play has also been observed such as splashing and dropping stones into the water.

Appendix 2

Twycross Zoo Capuchin Diet Sheet

Species: BROWN CAPUCHIN *Cebus apella*
WHITE-FRONTED CAPUCHIN *Cebus albifrons*
MONK CAPUCHIN *Cebus apella xanthosternos*

Number: Two adults

BREAKFAST

2 apples	sunflower seeds (small handful)
2 bananas	N W pencils (handful)
½ - 1 carrot	broccoli (small amount)
¼ - ½ baked potato	
¼ soft lettuce	

small amounts (depending on how much they are eating and availability):
swede, parsnips, turnip, cabbage. Half a pepper. Alternate pencils.

TEA

2 apples	1-2 slices of bread
1 carrot	1 soft lettuce
1 orange	2 bananas
2-3 tomatoes	½ -1 pear

Can also have small amounts of the following (depending on how much they are eating and availability): aubergine, courgette, moolie, chicory, cauliflour, cucumber, celery, pepper, leek, fennel, Chinese leaf.
Handful of grapes.

Locusts and mealworms

EXTRAS

Pineapple, mango, melon, paw paw, avocado, nuts, seeds, beans,
peas, sweetcorn, berries.
Hardboiled egg twice a week
Chicken once a week

SUPPLEMENT

Sprinkle of Nutrabal once a week

Date: 25 September 2006

Appendix 3

**Specialty Feeds – www.specialtyfeeds.com
3150 Great Eastern Highway,
Glen Forrest, WA 6071**

OMNIVOROUS PRIMATE CUBES DIET

A primate diet specifically designed for omnivorous primates. This diet would suit a range of primates including *Macaca* sp. (Macaque) Although this diet has been designed to provide complete nutrition, it is recommended that it be fed along with fresh fruit.. Stabilised Vitamin C in the form of the Roche product *Stay C* has been added to the diet. While the Vitamin C activity should retain for the shelf life of the diet, we would recommend that an additional Vitamin C source be included in the complete diet. The diet contains a banana flavouring as standard. In the past we have found this improves diet palatability. To retain diet palatability the diet is vacuum packed in three layers of packaging, the first layer being a paper liner followed by two separate layers of low oxygen permeability plastic. This diet and packaging system is suitable for irradiation if required.

A supplementary diet to be fed in combination with fresh fruit.

FEEDING RECOMENDATIONS

8mm diameter cubes. Vacuum packed in 5Kg bags packed two per box.

DIET FORM

Vitamin B12 150 ug / Kg

(Cyanocobalamin)

Folic acid 5 mg / Kg

Biotin 300 ug / Kg

Calcium Pantothenate 50 mg / Kg

Vitamin B6 (Pyridoxine) 25 mg / Kg

Niacin (Nicotinic acid) 100 mg / Kg

Vitamin B2 (Riboflavin) 30 mg / Kg

Vitamin B1 (Thiamine) 80 mg / Kg

Vitamin E 100 mg / Kg

(α Tocopherol acetate)

Vitamin C 1,000 mg / Kg

(Ascorbic acid as STAY C)

Vitamin K (Menadione) 20 mg / Kg

Vitamin D3 (Cholecalciferol) > 2000 IU/Kg

Vitamin A (Retinol) 10,000 IU / Kg

Added Vitamins

Calculated total Vitamins

Phosphorous 0.7 %

Calcium 1.2 %
Digestible Energy 14.7 MJ / Kg
Acid Detergent Fibre 4.4 %
Crude Fibre 2 %
Total Fat 7.6 %
Protein 25 %

Calculated Nutritional parameters

A fixed formula ration using the following ingredients.

Dehulled Oat flour, Lupins, Soya meal, Skim milk, Yeast, Gluten, Molasses, Canola oil, Salt, Calcium carbonate, Dicalcium phosphate and a Vitamin and Mineral premix including stabilised Vitamin C (Stay C).

Ingredients

Selenium 0.1 mg / Kg
Molybdenum 0.5 mg / Kg
Zinc 60 mg / Kg
Manganese 70 mg / Kg
Iodine 0.5 mg / Kg
Copper 16 mg / Kg
Iron 70 mg / Kg
Magnesium 110 mg / Kg

Added Trace Minerals

Choline 1190 mg / Kg
Vitamin B12 150 ug / Kg
(Cyanocobalamin)
Inositol no data
Folic acid 5.5 mg / Kg
Biotin 480 ug / Kg
Pantothenic acid 65 mg / Kg
Vitamin B6 (Pyridoxine) 28 mg / Kg
Niacin (Nicotinic acid) 135 mg / Kg
Vitamin B2 (Riboflavin) 35 mg / Kg
Vitamin B1 (Thiamine) 83 mg / Kg
Vitamin C 1,000 mg / Kg
(Ascorbic acid)
Vitamin K (Menadione) 20 mg / Kg
Vitamin E (Tocopherol) 107 mg / Kg
Vitamin D3 (Cholecalciferol) 2,000 IU / Kg
Vitamin A (Retinol) 11,044 IU / Kg
Cholesterol trace
Total Phospholipid > 0.3 %
Total Carotenoid no data
DHA 22:6 n3 no data
EPA 20:5 n3 trace
Arachadonic Acid 20:4 n6 trace

a Linolenic Acid 18:3 n3 0.7 %
Linoleic Acid 18:2 n6 1.8 %
Gadoleic Acid 20:1 0.1 %
Oleic Acid 18:1 3.9 %
Palmitoleic Acid 16:1 trace
Stearic Acid 18:0 0.2 %
Palmitic Acid 16:0 0.6 %
Myristic Acid 14:0 trace

Calculated Fat Composition

Tryptophan 0.3 %
Tyrosine 1.0 %
Phenylalanine 1.2 %
Lysine 1.4 %
Cystine 0.3 %
Methionine 0.6 %
Threonine 0.9 %
Isoleucine 1.1 %
Leucine 2.0 %
Valine 1.2 %

Calculated Amino Acids

Chromium no data
Cadmium 0.02 mg / Kg
Selenium 0.3 mg / Kg
Molybdenum 0.5 mg / Kg
Zinc 95 mg / Kg
Cobalt 0.3 mg / Kg
Manganese 108 mg / Kg
Iodine 0.5 mg / Kg
Copper 24 mg / Kg
Iron 198 mg / Kg
Sulphur 0.2 %
Pottasium 1.1 %
Chloride 0.2 %
Sodium 0.3 %
Magnesium 0.2 %
Available Phosphorous 0.5 %
Phosphorous 0.7 %
Calcium 1.2 %

Calculated Total Minerals

Calculated data uses information from typical raw material composition. It could be expected that individual batches of diet will vary from this figure.

We are happy to provide full calculated nutritional information for all of our products, however we would like to emphasize that these diets have been specifically designed for manufacture by Specialty Feeds

Appendix 4

The University of Illinois presents the following list of plants toxic to animals,
Veterinary Medicine Library:

LIST OF TOXIC PLANTS BY COMMON NAME

Alfalfa (*Medicago sativa* L.)
American Coffee Berry Tree see Kentucky Coffee Tree
Bloodroot (*Sanguinaria canadensis* L.)
Bouncing Bet (*Saponaria officinalis* L.)
Bull Nettle (*Solanum carolinense* L.)
Bracken or Brake Fern (*Pteridium aquilinum* L.)
Burning Bush see Fireweed
Buttercup (*Ranunculus* spp.)
Carelessweed see Pigweed
Castor Bean (*Ricinus communis* L.)
Clover, Alsike & Other Clovers (*Trifolium hybridum* L. & other species)
Cocklebur (*Xanthium strumarium* L.)
Creeping Charlie see Ground Ivy
Crown of Thorns (*Euphorbia milii*)
Curly Dock (*Rumex crispus* L.)
Daffodil (*Narcissus* spp.)
Delphinium (*Delphinium* spp.)
Devil's Trumpet see Jimson Weed
Dogbane (*Apocynum* spp.)
Dutchman's Breeches (*Dicentra cucullaria* (L.) Bernh.)
Elderberry (*Sambucus canadensis* L.)
English Ivy (*Hedera helix* L.)
Ergot (*Claviceps purpurea* (Fr.) Tul.)
Fern, Bracken (*Pteridium aquilinum* L.)
Fireweed (*Kochia scoparia* L.)
Foxglove (*Digitalis purpurea* L.)
Ground Ivy (*Glechoma hederacea* L.)
Hemlock
Poison (*Conium maculatum* L.)
Water (*Cicuta maculata* L.)
Hemp (*Cannabis sativa* L.)
Horse Chestnut, Buckeyes (*Aesculus hippocastanum* L.)
Horse Nettle (*Solanum carolinense* L.)
Horsetails (*Equisetum arvense* L. & other species)
Hyacinth (*Hyacinth orientalis*)
Hydrangea (*Hydrangea* spp.)
Ivy
English (*Hedera helix* L.)
Ground (*Glechoma hederacea* L.)
Poison (*Toxicodendron radicans* (L.) Kuntze)
Jack-in-the-Pulpit (*Arisaema* spp.)

Jamestown Weed see Jimson Weed
 Japanese Yew (*Taxus cuspidata* Sieb. & Zucc.)
 Jerusalem Cherry (*Solanum pseudocapsicum* L.)
 Jimson Weed (*Datura stramonium* L.)
 Kentucky Coffee Tree (*Gymnocladus dioica* (L.) K. Koch)
 Kentucky Mahogany Tree see Kentucky Coffee Tree
 Klamath Weed see St. Johnswort
 Lamb's Quarters (*Chenopodium album* L.)
 Lantana (*Lantana camara* L.)
 Larkspur (*Delphinium* spp.)
 Lily-of-the-Valley (*Convallaria majalis*)
 Lupine (*Lupinus* spp.)
 Mad Apple see Jimson Weed
 Maple, Red (*Acer rubrum*)
 Mayapple (*Podophyllum peltatum* L.)
 Milkweed, Common (*Asclepias syriaca* L.)
 Mint, Purple (*Perilla frutescens*)
 Nicker Tree see Kentucky Coffee Tree
 Nightshade (*Solanum* spp.)
 Oleander (*Nerium oleander* L.)
 Ohio Buckeye (*Aesculus glabra* Willd.)
 Philodendron (*Philodendron* spp.)
 Pigweed (*Amaranthus* spp.)
 Poison Hemlock (*Conium maculatum* L.)
 Poison Ivy (*Toxicodendron radicans* (L.) Kuntze)
 Poke (*Phytolacca americana* L.)
 Purple Mint (*Perilla frutescens*)
 Redroot see Pigweed
 Rhododendron (*Rhododendron* spp.)
 Rhubarb (*Rheum rhaponticum* L.)
 Squirrelcorn (*Dicentra canadensis* (Goldie) Walp.) see Dutchman's Breeches
 Staggerweed (*Dicentra* spp.) see Dutchman's Breeches
 St. Johnswort (*Hypericum perforatum* L.)
 Stink Weed see Jimson Weed
 Stump Tree see Kentucky Coffee Tree
 Sudan Grass (*Sorghum vulgare* var. *sudanense* Hitchc.)
 Summer Cypress see Fireweed
 Thorn Apple see Jimson Weed
 Tulip (*Tulipa* spp.)
 Water Hemlock (*Cicuta maculata* L.)
 White Snakeroot (*Eupatorium rugosum* Hout.)
 Wild Onion (*Allium* spp.)
 Yellow Sage see Lantana

Appendix 5

NEW WORLD MONKEYS - PRIMATES

GENERAL

Recommendations

- (1) **GnRH Agonists** - Gonadotropin Releasing Hormone Agonists are considered the safest reversible contraceptives, but dosages and duration of efficacy are not well established for all species; males may require higher doses. Side effects are generally similar to those associated with gonadectomy, especially the potential for weight gain unless diet is controlled.
 - Suprelorin® (deslorelin) Implants (F or M)
 - Lupron® Depot Injection (F or M)
- (1) **MGA implant (F)**
- (2) **Depo-Provera® injection** - Depo-Provera injection can be used to prevent the post-partum oestrus until an MGA implant can be placed or as longer term contraception (20mg/kg body wt, effective for approximately 30 days). **(F)**

Research and Monitoring

- (1) Surveillance for deleterious effects
 - Contraception Survey
 - Tissue Submission Form – Pathology
 - Adverse Reactions Report

CALLIMICO

Recommendations

- (1) **GnRH Agonists** - Gonadotropin Releasing Hormone Agonists are considered the safest reversible contraceptives, but dosages and duration of efficacy are not well established for all species; males may require higher doses. Side effects are generally similar to those associated with gonadectomy, especially the potential for weight gain unless diet is controlled.
 - Suprelorin® (deslorelin) Implants (F or M)
 - Lupron® Depot Injection (F or M)
- (2) **Separation** of reproductive individuals.

Caution

- (1) **MGA was found to cause excessive decidualization of the uterine endometrium** in a study of callimicos; if this result proves to be generally true, permanent infertility may result, and other progestins would be expected to have the same effects.

Research and Monitoring

- (1) Evaluation of reversibility of uterine pathology
- (2) Surveillance for deleterious effects
 - Contraception Survey
 - Tissue Submission Form – Pathology

THE USE OF ANY CONTRACEPTIVE IN NON-DOMESTIC ANIMALS IS CONSIDERED EXPERIMENTAL
(M=MALE-DIRECTED, F=FEMALE-DIRECTED METHOD)

Appendix 5.2

SUPRELORIN® (deslorelin) IMPLANTS

Manufacturer – Peptech Animal Health, Australia

Product information – Suprelorin® (deslorelin), a GnRH agonist, effects contraception by temporarily suppressing the reproductive endocrine system and preventing production of pituitary (FSH and LH) and gonadal hormones (estradiol and progesterone in females and testosterone in males). The observed effects are similar to those following ovariectomy or castration, but are reversed after the hormone content of the implant is depleted. As an agonist, deslorelin first stimulates the reproductive system, which can result in oestrus and ovulation in females or temporary enhancement of testosterone and semen production in males. Then, down-regulation follows the initial period of stimulation. Although deslorelin can also be an effective contraceptive in males, we recommend its use primarily in females, since monitoring efficacy in females by suppression of estrous behaviour or gonadal steroids in feces is more straightforward than ensuring continued absence of sperm in males, since most institutions cannot perform regular semen collections. It can, however, be used to ameliorate aggression in males but higher dosages are usually needed.

Deslorelin implants are available in two formulations: 4.7-mg for a minimum of 6-month, and 9.4-mg for a minimum of 12-month contraception. Deslorelin has been tested primarily in domestic dogs and cats, which makes it most suitable for carnivores, and it has successfully reduced aggression in male lion-tailed macaques. However, it appears not to be effective in male bovids or marsupials. It is currently in use in a number of species but the primary taxonomic group treated has been carnivores.

Storage and Expiration – Implants should be stored at refrigeration temperatures (4°C). Expiration date is stamped on individual implant packages. If implant expires prior to placement, contact Sally Boutelle (contraception@stlzoo.org) for the actual longevity of the implant.

Insertion – The implant comes pre-loaded in an insertion device. The recommended site of implant placement is SQ between the shoulder blades. The area should be clipped and cleaned using standard surgical prep techniques. A fold of skin should be lifted and held between the thumb and fingers as the obturator (sent with the implant) is inserted. To prevent breakage of the implant during insertion, the barrel of the obturator should be slowly withdrawn as the implant is expelled. The implant should be held steady as the obturator is removed to insure release of the implant so that it remains in place under the skin.

Latency to effectiveness - Because the initial effect is to stimulate the reproductive system, it is important to either separate treated animals from opposite sex individuals during the period of enhanced fertility or use another form of contraception. Females treated with deslorelin should be considered fertile for 3 weeks following insertion. Males may remain fertile for 2 or more months, until residual sperm either degenerate or are passed (as following vasectomy). Lessening of aggression in some male primates treated with deslorelin or other GnRH agonists was not seen for 6-12 months, but the delay may have been due to an inadequate initial dose.

Suppression of initial oestrus/ovulation – The oestrus and ovulation that can occur within 2 weeks following implant insertion can be suppressed with supplemental progestin treatment for 15 days (7 days prior to and 8 days after implant insertion). Megestrol acetate tablets are the simplest form for short-term progestin administration, with the tablet offered as a treat to insure ingestion. Depo-Provera® should not be substituted for Megestrol acetate, because its initial high levels and sustained release can interfere with Suprelorin® efficacy. MGA implants can be left in place for 2-3 weeks following Suprelorin® implant insertion, but then should be removed to prevent interference with the down-regulation action. Leaving them in place longer may compromise Suprelorin® efficacy.

Estrous cycles during contraceptive treatment - Deslorelin first stimulates, then suppresses oestrus in females. Species with induced ovulation (e.g., felids, some mustelids, bears) may ovulate and become pseudo-pregnant (also canids) when first treated. In males, initial stimulation may be accompanied by increased aggression or sexual interest. Estrous behaviour or even copulation may occur during a transition phase near the end of the period of contraceptive efficacy.

Duration of efficacy and reversibility – A new 12-month formulation containing 9.4mg deslorelin should be effective for approximately twice as long as the smaller (4.7mg) implants that have been supplied in the past. However, the dose needed per-kg-body-weight with the new 9.4mg implants is about twice that of the existing 4.7mg implants. For animals effectively contracepted for 6 months with two 4.7mg implants, two 9.4mg implants will be necessary, but the period of efficacy will be double (12 months). For 6 months contraception, one 9.4mg implants will not substitute for two of the 4.7mg ones. These dose recommendations should only serve as general guidelines, because individual animals may respond differently. Stated durations of efficacy should be considered minimums. The smaller implants may actually be effective for more than 6 months, and the larger ones for more than 12 months, in some animals. Data from various species have shown, responses may vary widely between individuals, but that the response from one individual tends to be consistent and if an individual reverses earlier than expected it will consistently do so. If it is not possible to wait for signs of reversal to determine duration of efficacy for the animal, then for continuous contraception the small implants should be replaced at 5- to 6-month intervals and larger ones at 11- to 12-month intervals.

Use during pregnancy – GnRH agonists should not be used during pregnancy, as they may cause abortion.

Use during lactation - No known contraindications once lactation has been

established; however, treatment during pregnancy may impede proper mammary development.

Use in pre-pubertals or juveniles – Because deslorelin suppresses gonadal steroids, its use may delay epiphyseal closure of the long bones, resulting in taller individuals, similar to the effects of pre-pubertal spaying and neutering in domestic dogs and cats. GnRH agonist use in prepubertal domestic cats was followed by reproductive cycles after treatment ceased. However, species differences may occur.

Consideration for seasonal breeders – In females, GnRH agonists can induce oestrus and ovulation even during the non-breeding season in some taxa. In males, GnRH agonists can transiently stimulate testosterone production even during the non-breeding season. Treatment should begin more than two months prior to the anticipated breeding season to prevent initiation of spermatogenesis, because it appears that suppression of sperm production is more easily accomplished before it has commenced and time must be allowed for passage of residual sperm, as following vasectomy.

Precautions - In general, the effects on weight should be similar to those from ovariectomy or castration. Preliminary data indicate that increased appetite will result in weight gain, especially in females, unless food is restricted. In males, muscle loss may result in overall weight loss if not replaced by fat. In sexually dimorphic species, males may become the size (weight) of females. Animals may lose secondary sex characteristics (e.g. lions may lose the mane while being treated with deslorelin).

Reporting requirements - All institutions using deslorelin must submit a complete Contraception Center Survey to the AZA Wildlife Contraception Center. ***The product will no longer be sold to any institution that fails to submit the annual survey.***

Appendix 5.3

LUPRON® (leuprolide acetate) DEPOT INJECTION

Manufacturer – TAP Pharmaceuticals

Product information – Lupron®, approved by FDA, a GnRH agonist approved for treatment of prostate cancer, is very expensive if purchased, but can sometimes be acquired through donation from the manufacturer. In captive animals it has been used primarily in males to suppress testosterone and sperm production. It is probably not effective in male bovids or marsupials.

Latency to effectiveness - Because the initial effect is to stimulate the reproductive system, it is important to either separate treated animals from opposite sex individuals during the period of enhanced fertility or use another form of contraception. Females treated with a GnRH agonist should be considered fertile for 3 weeks following insertion. Males may remain fertile for 2 or more months, until residual sperm either degenerate or are passed (as following vasectomy).

Suppression of initial oestrus/ovulation – The oestrus and ovulation that can occur within 2 weeks following implant insertion can be suppressed with supplemental progestin treatment for 15 days (7 days prior- and 8 days post-implant insertion). Megestrol acetate tablets are the simplest form for short-term progestin administration, as the tablet can be offered as a treat to insure ingestion. If the

animal has an unexpired MGA implant in place (less than 2 years old), MGA removal could be delayed until 3 weeks post Lupron® injection. Similarly, Lupron® should not be injected while the animal is being contracepted with Depo-Provera® due to a possible interaction at the cellular level which may inhibit down regulation.

Estrous cycles during contraceptive treatment - Lupron® first stimulates, then suppresses oestrus in females. Species with induced ovulation (e.g., felids, some mustelids, bears) may ovulate and become pseudo-pregnant (also canids) when first treated. In males, initial stimulation may be accompanied by increased aggression or sexual interest.

Duration of efficacy and reversibility – Lupron® is available in various formulations lasting from 1 to 6 months, but because the release of hormone from the depot formulation varies by individual, actual duration of efficacy and time to reversal can vary considerably.

Use during pregnancy – GnRH agonists should not be used during pregnancy, as they may cause abortion.

Use during lactation – No available information specifically for Lupron®, but probably acts as other GnRH agonists. Therefore, no known contraindications once lactation has been established; however, treatment during pregnancy may impede proper mammary development.

Use in pre-pubertals or juveniles – Lupron® may prevent epiphyseal closure of the long bones, resulting in taller individuals. GnRH agonist use in prepubertal domestic cats was followed by reproductive cycles after treatment ceased. However, species differences may occur.

Consideration for seasonal breeders – In females, GnRH agonists can induce oestrus and ovulation even during the non-breeding season in some taxa. In males, GnRH agonists can transiently stimulate testosterone production even during the non-breeding season. Treatment should begin more than two months prior to anticipated breeding season to prevent initiation of spermatogenesis, because it appears that suppression of sperm production is more easily accomplished before it has commenced.

Precautions - In general, the effects on weight should be similar to those from ovariectomy or castration. Preliminary data indicate that increased appetite will result in weight gain, especially in females, unless food is restricted. In males, muscle loss may result in overall weight loss if not replaced by fat. In sexually dimorphic species, males may become the size (weight) of females.

Reporting requirements - All institutions using Lupron® are asked to submit a complete Contraception Center Survey to the AZA Wildlife Contraception Center.

Appendix 5.4

MGA (melengestrol acetate) Implants

Manufacturer - ZooPharm division of Wildlife Pharmaceuticals, Colorado, USA.

Product Information - MGA implants are the most frequently used and consequently the contraceptive method for which we have the most information in the Wildlife Contraception Center database. Melengestrol acetate is a synthetic progestin. MGA implants contain 20% melengestrol acetate by weight in a silastic matrix. ***Because different species require different dosages, implants are not***

interchangeable. Please check with the WCC regarding implants that are not being utilized. Although duration of MGA implant efficacy may vary by individual and species, the continued recommendation is to replace them at 2-year intervals.

Storage – Implants should be stored at refrigeration temperatures (4°C).

Sterilization – MGA implants should be inserted using sterile surgical technique. In addition, it is recommended that implants be **gas-sterilized** with ethylene oxide followed by **de-gassing** at room temperature for a minimum of **2 weeks** prior to use. Because the implants are porous, they must be de-gassed longer than metal instruments. Inadequate de-gassing may result in residual gas that may evoke a tissue reaction. If ethylene oxide sterilization is not available, the implant may be rinsed with alcohol and dried with sterile gauze prior to placement. Sterilization with a cold-soak solution is not recommended, because the chemicals can be absorbed and/or MGA may be leached from the implant. Low temperature hydrogen peroxide gas sterilization (STERRAD) is replacing the more dangerous EtO process in most hospitals. (More information can be found at www.sterrad.com). Our lab test found no difference in MGA release rates after implant sterilization with the STERRAD system, but long-term efficacy of these implants has not yet been evaluated. Because heat may change the structure of the MGA, **implants should not be autoclaved.**

Insertion - Implants should be inserted between the scapulae intra-muscularly if possible, but, if subcutaneous placement is necessary, place implant in a “tunnel” created by blunt dissection of fascia away from the incision. Migration may be controlled by suturing the implant in place at the time of insertion.

Implant loss can be reduced by properly sterilizing implants before insertion, using sterile insertion technique, and separating the animal from conspecifics during the period of healing. (NOTE: in some taxa such as the callitrichids and small prosimians, steel sutures have been successful in preventing over-grooming and implant removal by conspecifics, thereby avoiding the need to separate animals).

The implant’s presence and location should be confirmed whenever the animal is handled.

Monitoring implant placement - Identification transponder microchips inserted in MGA implants can be used to confirm presence and location. Implants cannot be supplied with transponders already in place; however, chips can be inserted in implants that are longer than the chip. Using sterile procedure, puncture implant longitudinally with needle containing transponder chip (it comes sterile) and insert into implant as you would under the skin. Insert implant into animal using standard surgical technique as outlined above. Secondly, stainless steel suture or comparable material may be incorporated into the implant to make it visible on radiographs prior to sterilization.

Implant disposal – used implants received from ZooPharm or Ed Plotka should be disposed of in proper waste containers after use.

Latency to effectiveness - Although individuals vary, threshold levels of the hormone should be reached in the blood within 1 to 3 days following IM insertion and within 1 week after SQ insertion. However, pre-ovulatory follicles are difficult to suppress, so, if cycle stage is not known, extra time must be allowed. Therefore, ***separation or alternative contraception should be used for at least 1 week (if IM) or 2 weeks (if SQ) following insertion.***

Estrous cycles during treatment - MGA may effect contraception by blocking ovulation, causing thickening of cervical mucus, slowing ovum transport, and/or interfering with fertilization or implantation. However, follicle growth may continue and sometimes be accompanied by estrogen production sufficient to cause estrous behaviour. Ovulation may occur even though pregnancy does not ensue. Higher progestin doses may be preferred, so that estrous behaviour is prevented, but may not be effective in completely suppressing follicle growth and some estradiol production.

Duration of efficacy and reversibility - Implants are considered effective for at least 2 years and possibly much longer, depending on species and individual differences, but in some cases have been found to be effective for as much as 5 years when left in place. This means that ***implants should be replaced every 2 years to insure contraception, but should be removed when pregnancy is desired***. For this reason too, old implants should be removed when a new one is placed to avoid administering a higher than intended dose. Once the implant is removed, the circulating MGA clears very rapidly, so that ovulation and conception may occur within days, although actual latency is usually longer and will depend on the individual.

Use during pregnancy - Synthetic progestins like MGA are not recommended in pregnant animals because of the possibility of prolonged gestation, stillbirth, abortion, etc. in some species, although the effect may depend on dose. Progestins in late pregnancy seem not to interfere with parturition in primates, but this may be a taxon-specific phenomenon.

Use during lactation - Progestins are sometimes prescribed for lactating women and are considered generally safe for nursing infants.

Use in pre-pubertals or juveniles – Future reproduction was not affected in calves of domestic cows on MGA-treated feed, but no studies of pre-pubertal treatment with MGA or other progestins have been conducted with other species, so possible long-term effects on fertility are not known.

Precautions – MGA can cause weight gain in all species. Possible deleterious effects on uterine and mammary tissues vary greatly by species; see cautions for each taxon.

Consideration for seasonal breeders - Treatment should begin at least one month before the anticipated onset of the breeding season. However, in canids, treatment should begin more than two months before the time of anticipated oestrus, because proestrus increases in estradiol can begin as much as two months before oestrus, and it is known that this endogenous estradiol can exacerbate deleterious effects of progestins on the uterus and mammary glands. This synergy of estradiol and progestins may also occur in other carnivores, such as mustelids and ursids.

Reporting Requirements - All institutions must submit a complete Contraception Center Survey to the AZA Wildlife Contraception Center. The product will no longer be sold to any institution that fails to submit the annual survey.

Appendix 5.5

DEPO-PROVERA® (medroxyprogesterone acetate) INJECTIONS

Manufacturer – Pfizer

Product information - With the second most numerous records in the Wildlife Contraception Center database, Depo-Provera® has been used most often in reproductively seasonal species (e.g., prosimians, bears, pinnipeds), species in which anesthesia for implant insertion is problematic (e.g., giraffes, hippos), and as an immediately available interim contraceptive (e.g., if an implant is found missing or has not been ordered). Medroxyprogesterone acetate is a synthetic derivative of progesterone administered as an acetate salt with anti-estrogenic activity.

Dose - Dosage studies have not been conducted for most species. Recommended doses and injection intervals vary according to species and experience. Current reports have indicated that 2-5 mg/kg body weight every 2-3 months has been effective (the higher dose for smaller species and the lower dose for larger ones). However, New World monkeys require as much as 20mg/kg monthly. For especially large species for which body weights may not be available, such as hippos, see Taxon-Specific Recommendations.

Latency to effectiveness - IM injection is roughly equivalent to implant insertion, i.e., separation or alternative contraception should be used, conservatively, for 2 weeks, but at least for 1 week.

Estrous cycles during contraceptive treatment - Synthetic progestins may effect contraception by blocking ovulation, causing thickening of cervical mucus, slowing ovum transport, and/or interfering with fertilization or implantation. However, follicle growth may continue and sometimes be accompanied by estrogen production sufficient to cause estrous behaviour. Ovulation may occur even though pregnancy does not ensue. Higher progestin doses may be preferred, so that estrous behaviour is prevented, but may not be effective in completely suppressing follicle growth and all estradiol production.

Duration of efficacy and reversibility - Duration of efficacy, and thus latency to conception following last injection, can be extremely variable and has been seen to vary from 4 weeks to 2 years in some individuals. In general, the recommended dose (2.5-5 mg/kg BW) is effective for at least 2 months in most species. Hippos and

giraffe have been treated at lower doses and appear to need re-treatment every 6 weeks. New World primates require higher doses at more frequent intervals.

Use during pregnancy - Progestins are not recommended in pregnant animals because of the possibility of prolonged gestation, stillbirth, abortion, etc. in some species, although the effect may depend on dose. Progestins in late pregnancy seem not to interfere with parturition in primates, but this is a taxon-specific phenomenon. Because of the variability in duration of efficacy for Depo-Provera, special caution should be used when treating females that might be pregnant.

Use during lactation - Progestins are sometimes prescribed for lactating women and are considered generally safe for nursing infants.

Use in pre-pubertals or juveniles - Future reproduction was not affected in calves of domestic cows on MGA-treated feed, but no studies of pre-pubertal treatment with MGA or other progestins have been conducted with other species, so possible long-term effects on fertility are not known.

Consideration for seasonal breeders - Treatment should begin at least one month before the anticipated onset of the breeding season. This does not include however canids or other carnivores due to the potential for progestin side effects addressed in the corresponding taxonomic sections below.

Precautions – Progestins likely cause weight gain in all species. Possible deleterious effects on uterine and mammary tissues vary greatly by species; see cautions for each taxon. In the human literature, Depo-Provera® has been linked to mood changes. Because it binds readily to androgen receptors and is anti-estrogenic, females may experience male-like qualities (increased aggression, development of male secondary sex characteristics, etc.)

Reporting requirements - All institutions using Depo-Provera® are asked to submit a complete Contraception Center Survey to the AZA Wildlife Contraception Center. It is essential that accurate records of doses and intervals be maintained and results reported to the Wildlife Contraception Center Database to contribute to dosage development.

Appendix 6

Product Name: Air Tech Neutra-san

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This revision

Material Safety Data Sheet

Section 1 - Identification of Chemical Product and Company

Glason Specialised Services Pty Ltd
Phone: 02 4323 7792

4/16-17 Merinee Road
Fax: 02 4325 7900

West Gosford NSW 2250

1300 138 385

Substance: Water solution of ingredients.

Trade Name: Air Tech Neutra-san

Product Use: Surface odour killer.

Creation Date: November, 2005

Revision Date: November, 2005

Section 2 - Hazards Identification

Statement of Hazardous Nature

This product is classified as: Not classified as hazardous according to the criteria of NOHSC Australia.

Not a Dangerous Good according to the Australian Dangerous Goods (ADG) Code.

Risk Phrases: Not Hazardous - No criteria found.

Safety Phrases: S25, S37. Avoid contact with eyes. Wear suitable gloves.

SUSDP Classification: None allocated.

ADG Classification: None allocated. Not a Dangerous Good under the ADG Code.

UN Number: None allocated

Emergency Overview

Physical Description & Colour: Blue coloured, slightly viscous liquid.

Odour: Eucalyptus odour/fragrance.

Major Health Hazards: no significant risk factors have been found for this product.

Potential Health Effects

Inhalation Short Term Exposure: Available data indicates that this product is not harmful.

In addition product is unlikely to cause any discomfort or irritation

Long Term Exposure: No data for health effects associated with long term inhalation.

Skin Contact:

Short Term Exposure: Available data indicates that this product is not harmful. It should present no hazards in

normal use. However product may be mildly irritating, but is unlikely to cause anything more than mild discomfort

which should disappear once contact ceases.

Long Term Exposure: No data for health effects associated with long term skin exposure.

Eye Contact:

Short Term Exposure: This product may be irritating to eyes, but is unlikely to cause anything more than mild

transient discomfort.

Long Term Exposure: No data for health effects associated with long term eye exposure.

Ingestion:

Short Term Exposure: Significant oral exposure is considered to be unlikely. However, this product may be

irritating to mucous membranes but is unlikely to cause anything more than transient discomfort.

Long Term Exposure: No data for health effects associated with long term ingestion.

Carcinogen Status:

NOHSC: No significant ingredient is classified as carcinogenic by NOHSC.

NTP: No significant ingredient is classified as carcinogenic by NTP.

IARC: No significant ingredient is classified as carcinogenic by IARC.

Poisons Information Centre: 13 1126 from anywhere in Australia, (0800 764 766 in New Zealand)

Issued by: Glason Specialised Services Pty Ltd Phone: 02 4323 7792

Poisons Information Centre: 13 1126 from anywhere in Australia, (0800 764 766 in New Zealand)

Name: Air Tech Neutra-san **Product**

Material Safety Data Sheet

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Section 3 - Composition/Information on Ingredients

Ingredients CAS No Conc,% TWA (mg/m³) STEL (mg/m³)

Polyethylene glycol 25322-68-3 10-30 not set not set

Other non hazardous ingredients secret to 100 not set not set

Water 7732-18-5 to 100 not set not set

This is a commercial product whose exact ratio of components may vary slightly. Minor quantities of other nonhazardous ingredients are also possible.

The TWA exposure value is the average airborne concentration of a particular substance when calculated over a normal 8 hour working day for a 5 day working week. The STEL (Short Term Exposure Limit) is an exposure value that should not be exceeded for more than 15 minutes and should not be repeated for more than 4 times per day. There should be at least 60 minutes between successive exposures at the STEL. The term "peak" is used when the TWA limit, because of the rapid action of the substance, should never be exceeded, even briefly.

Section 4 - First Aid Measures

General Information:

You should call The Poisons Information Centre if you feel that you may have been poisoned, burned or irritated by

this product. The number is 13 1126 from anywhere in Australia (0800 764 766 in New Zealand) and is available at all times. Have this MSDS with you when you call.

Inhalation: First aid is not generally required. If in doubt, contact a Poisons Information Centre or a doctor.

Skin Contact: Irritation is unlikely. However, if irritation does occur, flush with lukewarm, gently flowing water for 5 minutes or until chemical is removed.

Eye Contact: No effects expected. If irritation does occur, flush contaminated eye(s) with lukewarm, gently flowing

water for 5 minutes or until the product is removed. Obtain medical advice if irritation becomes painful or lasts more

than a few minutes. Take special care if exposed person is wearing contact lenses.

Ingestion: If product is swallowed or gets in mouth, wash mouth with water and give some water to drink. If

symptoms develop, or if in doubt contact a Poisons Information Centre or a doctor.

Section 5 - Fire Fighting Measures

Fire and Explosion Hazards: There is no risk of an explosion from this product under normal circumstances if it is

involved in a fire. Only small quantities of decomposition products are expected from this products at temperatures normally achieved in a fire. This will only occur after heating to dryness.

Fire decomposition products from this product are not expected to be hazardous or harmful.

Extinguishing Media: Not Combustible. Use extinguishing media suited to burning materials.

Fire Fighting: If a significant quantity of this product is involved in a fire, call the fire brigade.

Flash point: Does not burn.

Upper Flammability Limit: Does not burn.

Lower Flammability Limit: Does not burn.

Autoignition temperature: Not applicable - does not burn.

Flammability Class: Does not burn.

Section 6 - Accidental Release Measures

Accidental release: Minor spills do not normally need any special cleanup measures. In the event of a major spill, prevent spillage from entering drains or water courses. As a minimum, wear overalls, goggles and gloves. Suitable materials for protective clothing include rubber, PVC, butyl rubber. Eye/face protective equipment should comprise as a minimum, protective glasses and, preferably, goggles. If there is a significant chance that vapours or mists are likely to build up in the cleanup area, we recommend that you use a respirator. Usually, no respirator is necessary when using this product. However, if you have any doubts consult the Australian Standard mentioned below (section 8).

Stop leak if safe to do so, and contain spill. Absorb onto sand, vermiculite or other suitable absorbent material. If spill is too large or if absorbent material is not available, try to create a dike to stop material spreading or going into drains or waterways. Sweep up and shovel or collect recoverable product into labelled containers for recycling or salvage, and dispose of promptly. Can be slippery on floors, especially when wet. Recycle containers wherever possible after careful cleaning. After spills, wash area preventing runoff from entering drains. If a significant quantity of material enters drains, advise emergency services. This material may be suitable for approved landfill. Ensure legality of disposal by consulting regulations prior to disposal. Thoroughly launder protective clothing before storage or re-use. Advise laundry of nature of contamination when sending contaminated clothing to laundry.

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Section 7 - Handling and Storage

Handling: Keep exposure to this product to a minimum, and minimise the quantities kept in work areas. Check

Section 8 of this MSDS for details of personal protective measures, and make sure that those measures are followed.

The measures detailed below under "Storage" should be followed during handling in order to minimise risks to

persons using the product in the workplace. Also, avoid contact or contamination of product with incompatible

materials listed in Section 10.

Storage: Make sure that the product does not come into contact with substances listed under "Incompatibilities" in

Section 10. Some liquid preparations settle or separate on standing and may require stirring before use. Check

packaging - there may be further storage instructions on the label.

Section 8 - Exposure Controls and Personal Protection

The following Australian Standards will provide general advice regarding safety clothing and equipment:

Respiratory equipment: **AS/NZS 1715**, Protective Gloves: **AS 2161**, Industrial Clothing: **AS2919**, Industrial Eye

Protection: **AS1336** and **AS/NZS 1337**, Occupational Protective Footwear: **AS/NZS2210**.

Exposure Limits TWA (mg/m³) STEL (mg/m³)

Exposure limits have not been established by NOHSC for any of the significant ingredients in this product.

No special equipment is usually needed when occasionally handling small quantities. The following instructions are

for bulk handling or where regular exposure in an occupational setting occurs without proper containment systems.

Ventilation: No special ventilation requirements are normally necessary for this product. However make sure that

the work environment remains clean and that vapours and mists are minimised.

Eye Protection: Eye protection such as protective glasses or goggles is recommended when product is being used.

Skin Protection: The information at hand indicates that this product is not harmful and that normally no special skin

protection is necessary. However, we suggest that you routinely avoid contact with all chemical products and that you

wear suitable gloves (preferably elbow-length) when skin contact is likely.

Protective Material Types: We suggest that protective clothing be made from the following materials: rubber.

Respirator: Usually, no respirator is necessary when using this product. However, if you have any doubts consult

the Australian Standard mentioned above.

Section 9 - Physical and Chemical Properties:

Physical Description & colour: Blue coloured, slightly viscous liquid.

Odour: Eucalyptus odour/fragrance.

Boiling Point: Approximately 100°C at 100kPa.

Freezing/Melting Point: Below 0°C

Volatiles: Water component.

Vapour Pressure: 2.37 kPa at 20°C (water vapour pressure).

Vapour Density: No data.

Specific Gravity: No specific data.

Water Solubility: Completely soluble in water.

pH: Approx 5.5

Volatility: No data.

Odour Threshold: No data.

Evaporation Rate: No data.

Coeff Oil/water Distribution: No data

Autoignition temp: Not applicable - does not burn.

Poisons Information Centre: 13 1126 from anywhere in Australia, (0800 764 766 in New Zealand)

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Section 10 - Stability and Reactivity

Reactivity: This product is unlikely to react or decompose under normal storage conditions. However, if you have

any doubts, contact the supplier for advice on shelf life properties.

Conditions to Avoid: None known.

Incompatibilities: No particular Incompatibilities.

Fire Decomposition: Only small quantities of decomposition products are expected from this products at

temperatures normally achieved in a fire. This will only occur after heating to dryness. Carbon dioxide, and if

combustion is incomplete, carbon monoxide and smoke. Water. Carbon monoxide poisoning produces headache,

weakness, nausea, dizziness, confusion, dimness of vision, disturbance of judgment, and unconsciousness followed

by coma and death.

Polymerisation: This product will not undergo polymerisation reactions.

Section 11 - Toxicological Information

Local Effects:

Target Organs: none known

Classification of Hazardous Ingredients

Ingredient Risk Phrases

No ingredient mentioned in the List of Designated Hazardous Substances is present in this product at hazardous

concentrations.

Section 12 - Ecological Information

This product is biodegradable. It will not accumulate in the soil or water or cause long term problems.

Section 13 - Disposal Considerations

Disposal: There are many pieces of legislation covering waste disposal and they differ in each state and territory, so

each user must refer to laws operating in their area. In some areas, certain wastes must be tracked. The Hierarchy of

Controls seems to be common - the user should investigate: Reduce, Reuse, and Recycle and only if all else fails

should disposal be considered. Note that properties of a product may change in use, so that the following suggestions

may not always be appropriate. The following may help you in properly addressing this matter for this product. This

product may be recycled if unused, or if it has not been contaminated so as to make it unsuitable for its intended use.

If it has been contaminated, it may be possible to separate the contamination in some way. Only if neither of these

options is suitable, consider landfill.

Section 14 - Transport Information

ADG Code: This product is not classified as a Dangerous Good. No special transport conditions are necessary

unless required by other regulations.

Section 15 - Regulatory Information

AICS: All of the significant ingredients in this formulation are compliant with NICNAS regulations.

Section 16 - Other Information

This MSDS contains only safety-related information. For other data see product literature.

Acronyms:

ADG Code Australian Code for the Transport of Dangerous Goods by Road and Rail

AICS Australian Inventory of Chemical Substances

CAS Number Chemical Abstracts Service Registry Number

IARC International Agency for Research on Cancer

NOHSC National Occupational Health and Safety Commission

NTP National Toxicology Program (USA)

R-Phrase Risk Phrase

SUSDP Standard for the Uniform Scheduling of Drugs & Poisons

UN Number United Nations Number

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THIS MSDS SUMMARISES OUR BEST KNOWLEDGE OF THE HEALTH AND SAFETY HAZARD INFORMATION OF THE PRODUCT AND HOW TO SAFELY HANDLE AND USE THE PRODUCT IN THE WORKPLACE. EACH USER MUST REVIEW THIS MSDS IN THE CONTEXT OF HOW THE PRODUCT WILL BE HANDLED AND USED IN THE WORKPLACE.

IF CLARIFICATION OR FURTHER INFORMATION IS NEEDED TO ENSURE THAT AN APPROPRIATE RISK ASSESSMENT CAN BE MADE, THE USER SHOULD CONTACT THIS COMPANY SO WE CAN ATTEMPT TO OBTAIN ADDITIONAL INFORMATION FROM OUR SUPPLIERS OUR RESPONSIBILITY FOR PRODUCTS SOLD IS SUBJECT TO OUR STANDARD TERMS AND CONDITIONS, A COPY OF WHICH IS SENT

TO OUR CUSTOMERS AND IS ALSO AVAILABLE ON REQUEST.

Please read all labels carefully before using product.

**This MSDS is prepared in accord with the NOHSC document
“National Code of Practice for the**

**Preparation of Material Safety Data Sheets” 2nd Edition
[NOHSC:2011(2003)]**

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