REPORT ON THE HEALTH AND BREEDING SUCCESS IN CAPTIVE GILBERT'S POTOROOS (*POTOROUS GILBERTII*)

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Background

The captive colony of Gilbert's Potoroo was established in December 1994 after the discovery by Elizabeth Sinclair of a number of individuals at the Hakea Gully site. The animals initially brought into captivity between Dec 1st and 12th 1994 were Adult female #1, Adult female #4 (who was carrying an 80 mm pouch young - Male #7), Juvenile male #2 (released two months later), Subadult male #3, Subadult male #5 (released two days later) and Juvenile male #6 (still in the colony). The founding stock of the colony thus consisted of two adult females (one with male pouch young), a juvenile male and a subadult male. Animals subsequently added to the colony were Adult female #10 (with male young at heel #11), and Adult female #17 with female pouch young =27.

Breeding was not expected at least until the middle of the first year as all the males were subadult or juvenile. Expected ages at sexual maturity (ie 1 year since birth) were Male #3 - May 1995, Male #6 -October 1995, and Male #7 November/December 1995. Male #3 was first placed with a female (#10) in October 1995 and sired two young #19 and #28 in November 1995, Male #6 was first placed with a female (#1) in November 1995 and sired Female #18 immediately and Male #7 was placed with Female #18 (who was anticipated to be sexually mature around November 1996) in October 1996 but as yet no young have been produced. Breeding of Male #7 was delayed until he was almost 2 years old because all possible adult females were occupied with rearing pouch young and the young females were not yet mature.

Early reproductive success in the colony was thus delayed by the immaturity of all the males. Breeding has, however, slowed in the second half of 1996 and early 1997 and the following report addresses some possible reasons for this, as well as reporting on progress on general husbandry issues raised in the 1996 Discussion Paper.

POTENTIAL HEALTH ISSUES

(A) Penis Encrustation

On 30th December 1996 during routine handling of animals it was noted that the cloaca of Male #3 appeared to be inflamed and a small (pinprick) pustule was present on the outer edge. Examination of the animal in question by Dr

Kevin Ellard on January 16th revealed the presence of a thick sandy encrustation, with some inflammation and possible infection. The area was cleaned and washed with dilute Betadine. All other males were then checked to determine if the condition was widespread in the population or was unique to Male #3. All males have been checked routinely as part of normal handling procedures and swabs taken for culture. The results of these examinations are detailed in the following case histories.

Case Histories

Captive Males

Male #3 : Initially housed alone, then placed with Female #10

31.12.96	Small pustule near anal opening, local inflammation (vet not present so no treatment attempted)
16.1.97	Examined by vet (Kevin Ellard). Infection no longer present, pustule gone, still slight swelling. Penis found to have a significant accumulation of soil and dirt around the base leading to inflammation and possible infection. Area cleaned and washed with dilute Betadine
30.1.97	Examined by vet. Accumulation around base of penis cleaned, not as inflamed. Placed with Female #10 (risk of infection considered negligible by vet)
13.2.97	Examined again at regular handling (vet not present). A few grains of sand present but much cleaner. No swab taken because no obvious accumulation to swab.
19.4.97	Some fresh sand on penis, not crusty or adherent, no green accumulation

Male #6 : Housed with Female #1 throughout this period

31.1.97	Penis heavily crusted, possible pus present, cleaned and washed with Betadine
13.2.97	Penis quite clean. Culture swab and slide smear taken
26.2.97	Penis sandy but not particularly infected or crusty
27.3.97	Light sand coating on penis, no inflammation
19.4.97	Fresh sand coating, no inflammation or obvious active infection no green material, sand not adhering.

Male #7: Housed with Female #18 throughout this period

31.1.97	Penis slightly crusty - cleaned
13.2.97	Penis clean except for some yellow mucus and green accumulation in prepuce - swab taken
4.3.97	Penis only lightly encrusted, swab taken for smear, no inflammation noted.
27.3.97	A few grains of sand and mucous, no inflammation noted
19.4.97	Thin sand coating on bottom half of penis, no treatment.

Male #11 Housed alone throughout this period

31.1.97	Penis heavily encrusted, cleaned with saline and dilute Betadine
13.2.97	Thick green accumulation in prepuce, Swabs taken for culture and two slide smears made.
18.2.97	Penis thickly encrusted with sand, some green accumulation, cleaned and flushed with weak Betadine solution (Tony Start present at this handling).
4.3.97	Penis sand encrusted, cleaned with saline.
27.3.97	Penis very encrusted with fresh sand, cleaned with saline.
19.4.97	Thick fresh sand encrustation, green clumps in prepuce, some sand adhered to penis shaft. No obvious inflammation or active infection, cleaned with saline.

Male #28 Subadult male housed with Sister #19 then alone

30.1.97	Penis sandy - cleaned
13.2.97	Penis crusted, no pus or obvious mucous, tip appears inflamed, culture swab and smear taken
4.3.97	Moderate encrustation, smear taken
27.3.97	Penis heavily sandy but fresh, not cleaned.
19.4.97	Some sand adhered to penis shaft, thick green accumulation in prepuce, some inflammation on underside of penis. Cleaned with saline.

Females

Swabs for culture have been taken from Females #27 (4.3.97), #18 (27.3.97) and #4 (27.3.97), and smears have been prepared from females #19 (27.3.97), #1 (27.3.97), #10 (27.3.97).

Presence in the Wild

Following discovery of the extensive presence of the condition in the captive colony, trapping was carried out at the East Firebreak site to determine whether a similar condition was occurring in the wild population.
Three males were caught at East Firebreak and a further male was caught during later trapping efforts at Hakea Gully.

East Firebreak

Males

#16

9.2.97	Penis encrusted with sand, no treatment (vet not present)
2.4.97	Penis mildly sandy, no inflammation

#20

9.2.97	Penis clean, no sand except on one side at the base, thickly coated in mucous. No treatment
1.4.97	Penis not very sandy but a thick green accumulation was present which was swabbed for culture.

#26

9.2.97	Penis encrusted with sand, strong odour. No treatment (vet not present)
2.4.97	Penis thickly coated in green mucous, not particularly sandy except at base in prepuce, some vegetative material. Penis swab and smear taken.

Females

Swabs and smears have been taken from two females at the East Firebreak site - #23 who was carrying a small (3-3.5cm) pouch young and also feeding a

young at heel (evidenced by engorged mammary and elongated teat), and #30 who is a juvenile female.

Hakea

#31 This male was the only potoroo caught over 19 nights of trapping at Hakea and was an aged animal.

14.2.97.	The penis of this animal was found to be completely clean with little or no mucous accumulation and no sand or vegetative material

Results of the swabs are not available to be included with this report and will be sent separately.

Possible Causes

(1) Normal Condition

Detailed discussions with Dr. David Taggart from Monash University suggest that the presence of a thick sandy encrustation, mucus layer and odour are common on the penises of marsupial species which are low to the ground, dig and live on sandy substrates. Dr. Taggart is an expert on marsupial reproductive physiology and has been involved in studies of sperm motility, sperm counts and reproductive health in many species (including Dasyurids, *Potorous tridactylus*, *Bettongia penicillata*, Wombats and Numbats) involving the use of electro-ejaculation techniques. He commented that most species required some degree of "penis cleaning" prior to electro-ejaculation and that Wombats and Bilbies were particularly badly affected, exhibiting characteristics which were very similar to those described for the Gilbert's Potoroos. Dr Taggart also noted that the encrustation appeared to have no effect on breeding efficacy and sperm counts and morphology in affected males were found to be healthy and normal. Jim Phelan (Vet, Healesville Sanctuary) also recalled that a thick "cheesy" plug had been recovered from the urethra of a Long footed potoroo on one occasion, and that, anecdotally, other Potoroos appear to be "messy" in the penis area.

The exact cause of the encrustation in any of these species remains uncertain, and the fact that it varies between males requires further investigation. Some possible causes are:

(a) Scent Marking through dragging of cloaca on substrate

Dragging of the cloaca across the substrate as a form of scent marking behaviour is well documented in small macropods (Coulson 1989, Courtenay, 1993) and it is easy to imagine how such behaviour could result in the observed accumulations of sand in the penis prepuce. In a captive situation normal behaviours may be carried to pathological extremes through either boredom, over stimulation of agonistic responses (for example as a result of the presence in close proximity of other males) or through over stimulation of sexual responses (caused by the close presence of a number of cycling females to which the male is denied access).

(b) Sexual Frustration/Masturbation behaviour

Masturbation has been reported in a number of macropod species. Coulson's (1989) review notes that masturbation had been observed in 5 species of macropods, three of which were observed in the wild. These all tend to be of the medium to large species in the superfamily but Coulson (pers. comm) feels that this is most likely an artefact of a lack of behavioural work having been done on smaller macropods rather than an indication that the behaviour does not occur. Masturbation in these smaller species is likely to involve rubbing of the erect penis against the ground which again could be imagined to result in the observed accumulations of sand.

(c) Sexual Display behaviour

Display of an erect penis in agonistic interactions between adult males is also documented among Macropodoids (for example, Coulson, 1989:465). Dr. Taggart noted that frequent unsheathing of the penis in this situation could easily lead to the accumulation of sand etc, especially as the penis was not always resheathed immediately after the display. Presence of a number of males in close proximity in the captive colony could be increasing the frequency of such displays. Males have certainly been observed pacing backwards and forwards in front of the (closed) connecting door to the cage of another male

which may be a precursor to more active display activities which have not been observed. Whether the penis was sheathed or not during this pacing behaviour could not be determined.

The table of case histories (above) appears to indicate that the condition is worst in males that are housed alone without access to females (for example #11 and #28), although it occurs to some extent in all the captive males. This suggests that the condition is possibly related in some way to a lack of sexual opportunity, whether through masturbation, or excessive marking or display behaviour. Males that are housed with females may still exhibit the condition because the females would only be sexually receptive at certain times (and as the recent lack of new pouch young indicates, may not be co-operative even then).

In the wild population, the variability in occurrence or severity in the same individual at different captures (see especially Male #26) suggests that it may be a normal part of the display/mating cycle and thus may not be cause for undue concern. Monitoring of all animals (wild and captive), and swabbing for bacterial cultures if it appears necessary, will nevertheless be continued for the time being.

(2) Presence of an "itchy pathogen" resulting in dragging of cloaca.

The second and more sinister explanation for the condition is that the males have become infected with some pathogenic organism which is causing an itch in the genital area. The males may be responding to this by rubbing the cloaca against the ground and thus again accumulating the sandy material in the prepuce. Cultures taken from the worst affected captive males found about 25 different bacteria present although there was nothing present that could immediately be identified as likely to be responsible for itching (See attached veterinary report). There was, however, a spirochaete present which may be associated with the penis encrustation (a spirochaete has been shown to cause a similar condition in rabbits). It is also possible, however, that spirochaetes form part of the normal urogenital flora of the animals without being pathogenic. Jim Phelan (Vet, Healesville Sanctuary) recalled that a

spirochaete was observed in the ejaculate of a male *Potorous longipes* that was being tested for fertility. The matter was, however, never followed up (for example, no detailed identification of the spirochaete was undertaken).

The lack of information on the normal bacterial flora of Gilbert's Potoroos makes interpretation of this data difficult and further investigations are being carried out (for example obtaining swabs from both sandy and "clean" males in the wild for culture). If an "itchy" organism is found to be the problem, the presence of the condition in the wild population may be cause for concern if it is likely to interfere with breeding whether by inhibiting mating, or through possibly causing infection or sterility in females. Fortunately this appears not to be the case at present, as all females caught in the wild to date have been carrying pouch young. If a pathogen is found to be the cause in the captive colony, the availability of sufficient cage space to allow resting of cages before moving animals around is an urgent priority.

While Dr. Taggart was unable to completely rule out the possibility that the problem could be caused by a pathogen, and agreed that we should certainly pursue the veterinary pathology investigations thoroughly, he felt that the presence of the condition in so many other marsupial species suggested that a pathological origin was probably unlikely.

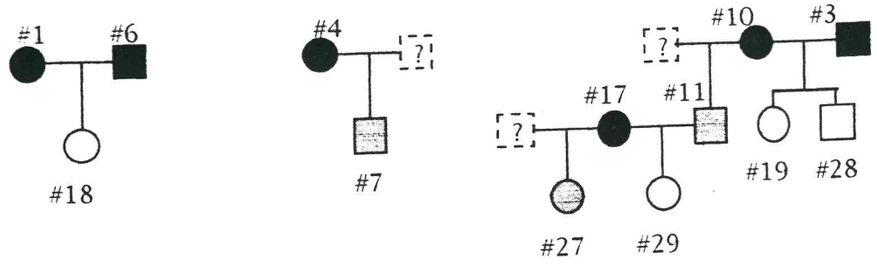
(B) Reproductive History of the Colony

To date seven young have been raised to independence in the colony. Three of these came in to the colony as pouch young or young at heel, and four have been conceived in the colony. Figure 1 illustrates the relationships of all the individuals in the colony. The colony currently contains 13 individuals[1] - 4 adult males, 4 adult females, 3 subadult-young adult females, a juvenile male and a female young at heel. Males are indicated by squares and females by circles. Individuals in black are founders who were brought into the colony as adults and are assumed to be "unrelated" to any other founder adults (DNA fingerprinting studies are in progress to determine exact relationships).

[1] Female #17 has since died. The details of this death and subsequent actions are outlined in the "Report on the death of Female #17".

Individuals in grey have one parent in the colony, and uncoloured individuals have both parents in the colony. Males indicated by an incomplete square and question mark (?) are unknown fathers of young that were brought into the colony with their mothers. The genealogy indicates clearly that the lineage of Female #10 is already becoming the dominant lineage in the colony and future pairings are being planned to try to increase the representation of individuals from other lineages, especially that of Female #4/Male #7.

Figure 1: Status and known relationships of individuals in the captive colony of Gilbert's Potoroo.



Breeding success in the first twelve months of the colony was poor but this appears to be due to factors such as loss of pouch young (in diapause at time of capture) through handling stress, moving to new enclosures and adapting to captivity, as well as the fact that males only became sexually mature towards the end of the year. Three young were conceived at the end of 1995, and a further young in August 1996. While several females have been housed with males since, no further pouch young are currently being carried. Table 1 outlines the reproductive histories of the males in the captive colony, and lists the females with whom they are currently paired. Table 2 outlines the reproductive history of each female, noting also the contributions of the various males. Young with unknown sires came into the colony as pouch young or young at heel with their mothers.

Possible reasons for reduced breeding success in recent months include

(1) Incompatibility of Pairings

Incompatibility of pairings may be due to behavioural or physiological factors

Table 1: Reproductive histories of captive male Gilbert's Potoroos including estimated date of sexual maturity and infants sired. Male #11 is noted as the least preferred sire because he is the son of #10 and thus part of the lineage which is currently heavily represented in the colony. Breeding of other males is thus preferred in the short term in an attempt to equalise the genetic representation of the various lineages.

Male	Born	Mature	Sired	Notes
#3			#19, #28	Housed with #27
#6			#18	Housed with #10 & #19
#7	Sept ? 1994	Sept 1995	None as yet	Housed with # 18 & #1
#11	Jan? 1995	Jan 1996	#29	Least preferred sire
#28	April 1996	April 1997?	N/A	

Table 2: Reproductive histories of female adults and preferred pairings for non-reproductive female Gilberts Potoroos. Age codes are as follows: OA = Old Adult, A = Adult, YA = Young Adult, J = Juvenile.

Female	Age	Young	Born	Sire	Notes
#1	A	#18 (f)	Dec 1995	#6	Housed with #7
#4	OA	#7 (m)	Sept? 94	Unknown	Believed senescent
#10	A	#11 (m)		Unknown	Housed with #6
		#19 (f)	Dec 1995	#3	Housed with #6
		#28 (m)	April 1995	#3	Alone
#17	OA	#27 (f)	Jan? 1996	Unknown	Dead (see report)
		#29 (f)	Oct 1996	#11	
#18	YA	N/A	N/A		Housed with #7
#19	YA	N/A	N/A		Only mates #7 or #6
#27	YA	N/A	N/A		Housed with #3
#29	Juv	N/A	N/A		Prefer #3

(a) Behavioural

Behavioural incompatibility in captive animals resulting in lack of breeding is well documented in zoos and other captive breeding colonies. Pairings in both Woylies in South Australian colonies (Dave Taggart pers. comm) and *Potorous longipes* at Healesville have had to be carefully managed including frequent rearrangement of partners to obtain fertile pairings.

Among captive Mala (*Lagorchestes hirsutus*), one male was so aggressive that he killed several females, although he did sire one young (Day and Christie, 1996: 62). It is therefore not unlikely that certain individuals may simply not "get on" together, and that pairings need to be rearranged until suitable partnerings are found.

(b) Biochemical

While biochemical incompatibilities can occur in mammal species Dr. Taggart felt that this was an unlikely cause of breeding problems and that behavioural factors were probably far more likely.

(2) Overcrowding

While the Gilbert's Potoroos are currently housed at lower density than has previously been used at Healesville, it is interesting to note that no breeding has occurred (even in previously compatible animals) when housed two to a cage, rather than in two adjoining cages with the connecting door open. This was not a seasonal factor because Female #17 conceived in less than a month at the same time of year when housed next to Male #11 with the adjoining door open. Space considerations as the colony has expanded mean that it is not now possible to house paired animals in two cages without having to overcrowd other animals. In an attempt to resolve this problem, in two cases an adult female, her now adult female young and a suitable male are housed in two adjoining cages with the connecting door open. An additional benefit of this housing arrangement is that the younger females are housed with a reproductively active adult female. Dr. Taggart commented that sometimes young females needed to be in contact with an older female, either for their cycles to commence/establish or to learn courtship or mating behaviour. While generally Potoroids appear to be very instinctive in these types of behaviours, Mascha Lissowsky (pers. comm.) has noted that among captive

woylies (*Bettongia penicillata*) females that are housed with their mothers, and continue nest sharing with them through raising their first young, experience higher reproductive success with both the first and subsequent young. Housing the young females with their mothers may therefore be advantageous.

Overcrowding may also be a problem if a pathogen is found to be the cause of the penis encrustation because the closer proximity of animals may allow for easier transmission, and because of the inability to isolate animals or to rest cages before moving individuals around.

(3) Inhibition of mating caused by penis condition

Male #11 successfully fertilised Female #17 after less than 6 weeks of access. Male #11 is now housed alone and is currently the worst affected of the five males. Since the condition was not discovered until Dec/Jan it is impossible to determine whether the male was suffering from the penis encrustation at the time of mating. Other males currently housed with females are #7 who is mildly affected but is housed with a female who is possibly not fully mature, and #3. Dr David Taggart noted that a similar penis encrustation when observed in wombats was taken as an indication that mating had occurred because the penis is rarely sheathed immediately following copulation and thus is open to the sand at a time when it could be expected to be quite sticky. This is probably not the case in the Potoroos, however, as the worst affected individuals are those housed alone. Planned behavioural studies (to be conducted by an Edith Cowan University Honours student) will hopefully shed some light on this question.

(4) Possible dietary inadequacy

Three females have been housed in the colony since its creation in December 1994. Of these, the old female (#4) has not conceived since raising Male #7, Female #10 conceived two young at the end of 1995 (one held in diapause) but has not (to our knowledge) conceived again since, and Female #1 conceived one young at the end of 1995 and again has not apparently conceived since. The only female to conceive a young in 1996 was Female #17 who was brought into the colony from the North Firebreak site in April 1996. Concern was expressed in the discussion paper in June 1996 that although the diet appeared

adequate, there may be some deficiency (for example of a trace element or fat stored vitamin) that could result in health or fertility problems at a later date as body stores were depleted. The fact that the females housed in the colony longer term appear to have stopped breeding (despite being relatively young and housed with previously compatible males) could be the result of some dietary deficiency. Dietary studies of the wild population and nutrient analysis of the captive diet are therefore essential to ensure that all nutritional needs are being met.

The need for dietary studies was mooted at the recovery team meeting of June 1995 and again in the Discussion paper but were considered as being of lower priority. This was revisited with Dr Tony Start at the meeting in February (although not specifically in relation to a possible dietary inadequacy leading to reduced fertility) (see minutes) who now feels that dietary studies are of prime importance and should be conducted. It may also be worthwhile to consider adding a vitamin supplement (such as Pentavite) to the food or water in the pens, or medicating the animals with a multivitamin supplement at fortnightly handling. Veterinary advice, especially from Healesville, is being sought on this matter.

(C) Hygiene of Food Preparation and Animal Handling Areas

The captive management discussion paper prepared for the recovery team in June 1996 raised a number of issues concerning health, hygiene and monitoring protocols in the captive colony. The main issues discussed in this paper were:

- housing density including a detailed discussion of the monitoring problems associated with multiply housing animals
- monitoring of animal health. This section covered three main areas which were considered problematic (a) the absence of running water and a sink in the prep. room, (b) the ongoing problem of mice in both the cages and the prep. room and (c) monitoring protocols, particularly concerning the monitoring of multiply housed animals.
- Feeding. While the diet appears adequate in terms of animals maintaining health and weight, concern that some essential nutrient or trace element may be missing that could affect health or fertility at a later date was expressed.

Progress has been made on most of these issues including:

•Installation of bench tops and a sink with running water. This has enabled great improvement in feeding hygiene - dishes are now washed daily, food items are washed as seems necessary and soap and water are available for hand washing both prior to handling food and during handling of animals, both between handling individual animals and during handling if necessary (for example if the teeth are to be checked after checking the genitalia.).

•Mouse control has been successful over the past few months with the use of four multiple mouse traps rotating between cages and the patching of some sections of wire which provided an inlet from the outside. In the period of Nov/Dec 1996 over 70 mice were caught over a one month period but since then mice are no longer seen, smelt or heard in the cages, there is no evidence of their scats in the food bowls or on the feeding trolley in the corridor(as previously seen regularly), and no further mice have been trapped. It is possible therefore, that the cages are, in fact, mouse proof and the previous population consisted of animals (and their descendants) that had been present at the time the cages were built. The installation of the mouse barrier has been delayed owing to the need to think carefully about its design, and the unavailability of District staff to provide labour owing to the fires in the Stirlings and Torndirrup. The barrier is, however, due to be installed in the next few weeks.

•Handling protocols. Fortnightly monitoring of animals was implemented as of October 1996 and has proved to be successful. Animals frequently do not eat well the night after handling but with two week intervals between handlings this does not appear to have a detrimental affect on their health. The more regular handling has been of benefit in alerting us to health problems for example in the older female (evidence that she was being bitten by the male that she was housed with, and was also losing weight consistently). These problems were resolved by removing the male and cutting the female's food into smaller portions for ease of chewing and her weight and general condition has improved markedly. Veterinary care has also been included as a regular part of the normal monitoring protocol. Kevin Ellard, the District

Veterinary Officer from Agriculture WA has been donating his own time on a regular basis to assist with the monitoring of the animals.

•Handling hygiene. All animal handling sacks are washed in hot water, Lux Flakes and Napisan after each handling session. These products were chosen because they will kill bacteria while being gentle and not leaving strong detergent or bleach residues which may be an irritant to the animals. Separate sacks are used for each individual during a handling session. Individual (numbered) sacks are being purchased to further reduce the risks of cross infection. Handling sacks used for wild and captive handling are kept separate to avoid the risk of disease transmission from the captives to the wild (or vice versa, although this seems less likely). Wild animals are handled in the research house rather than in the prep. room for the same reason of quarantine, and any shared equipment for example measuring callipers are sterilised before use. Plans are underway to modify the existing pens to provide a quarantined handling area for the wild animals in the existing pens as handling in the living areas of the research house is unsatisfactory. Costings for the necessary modifications are being sought.

The advice of Dr. Kevin Ellard on the set up and hygiene of the handling area has been sought and followed. The appearance of the handling area could be improved by the purchase of cupboards for storage of measuring equipment and veterinary supplies. Kevin is satisfied with the hygiene of the area and has commented that to attempt hospital like sterility could in fact be detrimental by altering normal bacterial balances.

Continuing Problems

An ongoing serious concern is the overcrowding of animals in the cages such that there are no cages available to isolate animals without putting other animals at higher density, and there is no possibility of "resting" cages between transfer of animals to allow for the break down of faeces or natural clearing of soil borne pathogens. This issue will hopefully be overcome in the not too distant future with the building of additional cages. Some improved biosecurity measures (for example wearing clean clothing or clean overalls and different shoes in the pens and when handling animals than elsewhere) are being implemented. The possibility of introducing a sterile foot bath at the

prep room door for people to sterilise the soles of their shoes before walking into the pens has also been discussed

Dust in the prep. room area is a problem as long as the floor remains unsealed and/or uncovered by heavy duty linoleum. Sweeping is ineffective and serves only to raise quantities of cement dust which not only then settles on the food prep. area, but is also undesirable for staff to be breathing in. Vacuuming of the area has been carried out on several occasions.

Plagues of both moths and beetles in recent weeks have also been a problem in the prep. room although there is evidence (from chewed beetles and moths in and near feeding bowls) that animals are actually eating the insects in the cages and it was not felt that they posed a significant health hazard. Insects form variable proportions of the diet of both *Potorous tridactylus* (Bennett and Baxter 1989) and *Potorous longipes* and many other macropod species are also known to eat insects opportunistically - for example *L. conspicillatus* (Courtenay pers. obs) and *L. hirsutus* (Lundie-Jenkins, 1989).

Dietary studies on wild animals have still not been started, although fresh faecal material has now been collected from 6 animals and is being dried for analysis as soon as expertise is available. At the Recovery Team meeting in July 1996 in which the problem was presented in the Discussion paper, dietary studies were considered to be a lower priority than other field work considerations such as searching for further populations outside Two Peoples Bay and more extensive surveys on Mt. Gardner. The wet winter weather followed by a series of extreme fire danger days prevented access to Manypeaks until January, and trapping on Mt. Gardner was also resumed about this time to check the health of the East Firebreak population and to determine the extent of populations at other sites such as Hakea and South Firebreak which have not been retrapped for a considerable period of time.
Management of the captive colony (including researching and writing the captive management plan and drafts of the Recovery plan and instituting the changes in monitoring and veterinary care outlined above) was therefore the sole focus of the program from July 1996 until January 1997.

Recommendations/Actions

•Dust in the prep. room and corridor area can only be resolved by sealing the floor or purchasing a heavy duty lino floor covering or both.
•Cupboards are required to store veterinary and other equipment to provide a tidier appearance and to protect equipment from cement dust until the floor is sealed. Lawrence Cuthbert has offered to donate a week of his time to "finish" areas of the prep. room and pens such as sealing cracks where water is leaking, fixing cage doors which stick, sealing the prep. room and corridor floors, fixing the bench so that it is secured to the wall and installing cupboards under the bench. Materials for these actions are estimated at no more than $1050.
•The need for isolation areas and the capacity to rest cages between transferring animals are essential issues which need to be incorporated into the number and design of new cages.
•New cages are required increasingly urgently. The young male (#28) now needs to be housed separately from his sister (#19) as he is showing signs of sexual activity. He is now alone and #19 has been moved back with their mother and a suitable male. It is hoped that this arrangement of housing a young female with her mother will result in improved breeding success (see above). The young male cannot be housed with other males because of the risk of aggression, and all the other females are sexually mature (or nearly so) and thus need to be with mature males if breeding is to be maximised. In addition, the young male is of the "overrepresented" lineage and breeding with him should be avoided until other lineages have increased their representation.. The lack of space means that it is not now possible to allow females a six week rest between moving one male out and adding another. Since we do not have a detailed understanding of gestation periods, any young born within 3-6 weeks of a female being separated from one male and paired with another will need to be DNA fingerprinted to determine paternity. Further breeding will only exacerbate these problems.

Further Research

•Behavioural studies
Investigations are in progress to obtain video equipment similar to that used at Healesville in order to conduct a behavioural study of the reproductive

behaviour of the Potoroos. A potential Honours student - Kylie Bourke - has expressed interest in the project and is prepared to begin as soon as video equipment is obtained. Discussions with Edith Cowan University Security Technology Dept, the Police Dept., and Sony (who lent equipment to Healesville for a study of Pygmy Possum behaviour) are in progress.

•Dietary Studies

As noted above, fresh scats are being routinely collected for dietary analysis when expertise becomes available.

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Agriculture
WESTERN AUSTRALIA

D.Forshaw
28 February, 1997
DF

Jackie Courtenay
CALM
120 Albany Highway
ALBANY WA 6330

Dear Jackie,

Re. Investigation of Gilbert's Potoroo health problems

After our discussion last week I checked with my supervisor about contracting my services to investigate the current problem in the Potoroos at Two Peoples' Bay and have received the OK to do so.

I believe this could be done in two ways; either on an as needs basis with contracting by the hour, or on a daily or weekly basis. Material costs would be in addition to this.

Hourly rate - $110/hour for professional services.
Daily rate $410/day for level 6/7 veterinary officer (myself).
Daily rate $336/day for level 2/4 veterinary officer (Kevin Ellard)

I suggest that you purchase a lump sum of time and this could be used to investigate whatever veterinary conditions arise such as the intra erythrocytic parasites and the preputial exudates. Any unused allocation could be carried forward.

If you decide to go ahead, let me know as soon as possible so that I can organise the appropriate paperwork. Kevin and I would be very pleased to be involved in this interesting project.

Yours faithfully,

David Forshaw
VETERINARY PATHOLOGIST

ALBANY DISTRICT OFFICE
444 Albany Highway Western Australia 6330 Telephone: (098) 928 444 Facsimile: (098) 412 707

Kevin Ellard
Wildlife Veterinary Services
649 Lower King Road
Albany WA 6330

Dr Jackie Courtney
CALM
120 Albany Highway
Albany WA 6330

Dear Jackie

RE: Health Report on Potoroos, Two Peoples Bay Albany.

Please find attached an interim report from David Forshaw, Regional Pathologist Agriculture WA, together with my conclusions relating to recent health checks on potoroos in you care.

Haemoprotozoa parasites.
All blood smears so far examined by David and myself since collection began in November 1996 have revealed the presence of haemoprotozoa attached to the red blood cells. The degree of infection varies between individuals, however parasites are easily located in most individuals. There is no evidence of haemolysis within any of the smears and the PCV's of three infected individuals tested were 42-43%.

I have forwarded blood samples to Cleve Main (Veterinary Pathologist, Agriculture WA, South Perth), Jenny Mills (Clinical Pathologist, Murdoch University) and Bill Hartley (Pathologist, Taronga Zoo, NSW). General opinion at this stage is that the organism is most likely either a *Theileria sp.* or *Babesia sp.* Preliminary scanning electronmicroscophy failed to reveal further information on the structure or location of these parasites. We plan to undertake transmission EM to obtain better structure detail.

Considering the parasite has now been identified in wild potoroos it appears reasonable to assume that this may be non-pathogenic in this species. I suggest that routine samples are taken from both wild and captive animals to ensure the parasite is not causing haemolytic anaemia or other damage. Any potoroos which become available for necropsy should be examined for evidence of the parasite in other tissues in order to better understand this condition.

Posthitis.
All captive males together with a number of wild potoroos have shown evidence of sand/dirt accumulation around the shaft of the penis and suppurative material at the base. This has resulted in inflammation of the cloaca in one male which has since resolved.

Bacterial swabs and smears have revealed the presence of a large number of inflammatory cells and a diverse population of bacteria. Discussions with other veterinary officers at zoos in NSW, Victoria and the Northern Territory suggested that this condition has not previously been noted in other captive potoroo colonies. All officers consulted have however agreed that this may have been due to not looking than not present.

The presence of spirochaetes within the smears is of somewhat more concern. As noted in David Foreshow's report this organism has been reported to cause crusty exudation in other species. Further investigation of both the captive animals and the wild population is required to determine if this condition is pathogenic, behavioural or normal. I would advise against any therapeutic treatment of affected animals apart from the gentle cleaning of soil accumulations with normal saline. More aggressive therapy is likely to upset the natural bacterial flora and remove protective secretions.

As all males are affected to varying degrees and these animals have previously been in regular contact there appears little point in isolating affected males at this late stage. I would suggest monitoring males during routine health checks and undertaking further investigation into the pathogenicity of the spirochaetes identified.

Aged Female, Number 4.
Clinical examination of this female suggests that she is an aged animal. Indications of age are given by the presence of nuclear sclerosis and tooth wear. Cataracts in at least one of the eyes may also be associated with age, although this is not definite.

Recent trauma to the left rear hock has resulted in moderate stiffness and possible osteo-arthritis at this joint. It is assumed that the damage to this joint plus scarring to the tail was the result of bullying from another animal. These wounds which were first noted in November 1996 have healed well and do not appear to have caused major restrictions on the locomotion of this animal.

Examination of the mouth and jaw suggests there may be some pain associated with eating in this animal, most likely from tooth wear, however this is difficult to determine with any degree of certainty. This problem has been somewhat alleviated through the modification of food preparation.

The weight loss in this animal may be associated with a number of causes which apart from mouth pain may include, stress, muscle atrophy associated with age or poor liver function also associated with age. Radiographs and blood testing of liver enzymes may be undertaken however these would of limited value without first establishing normal values.

This animal remains bright and alert at present. Although somewhat low in body condition at the moment she is not, in my opinion, emaciated. She should remain in a stress free environment and continue to have her weight and eating monitored. It appears unlikely that this female is fertile and therefore should not be considered in the captive breeding program.

Kevin Ellard
Veterinary Surgeon

March 10, 1997.

Ellard, Kevin

From: Forshaw, Dave
To: Ellard, Kevin
Subject: potoroo interim report
Date: Friday, 21 February 1997 9:21AM

AGRICULTURE WESTERN AUSTRALIA - ANIMAL HEALTH LABORATORIES

PERTH: Baron-Hay Court, South Perth, WA 6151 Tel:(09)368 3333 Fax:(09)474 1881
BUNBURY: North Boyanup Road, Bunbury WA 6231 Tel:(097)806 100 Fax:(097)806 136
ALBANY: Albany Highway, Albany WA 6330 Tel:(098)928 444 Fax:(098)412 707

Your Ref: NOT SUPPLIED
Enquiries: MR D. FORSHAW
Date: 21-02-97

Case Number: A-97-68
Submission number: 27932

MR K ELLARD
DVO ALBANY
ALBANY REGIONAL OFFICE
AGRICULTURE W.A.
ALBANY 6330

Owner:
JACKIE COURTENAY
CALM
120 ALBANY HIGHWAY
ALBANY

Classification:
DIAGNOSTIC MISCELLANEOUS - ALBANY

Date Received: 13-02-97
Species: MARSUPIAL - GILBERT'S POTO

REPORT ON LABORATORY SUBMISSIONS
Sample(s) Submitted: 7 SMEARS, 6 SWABS, 7 BLOOD SMEARS a page,<Q> to quit

Pathology Results

HISTORY:
Problems with male Gilbert's Potoroos developing crusty purulent preputial exudates which become contaminated with sand (due to rubbing?). Have improved since the first examination. One female also had blood on a cloacal swab taken very gently.
#11 - badly affected.
28,7, 6, 27 - in good shape some with crusty exudate but not purulent.

Blood smears from wild caught animals. Previous smears from captured animals have had large numbers of haemoprotozoa.

CYTOLOGY:

Blood smears (wild caught)
16
Very thick smear but some RBC contain pyriform shaped bodies.
20
Thinner smear with numerous round to pyriform bodies in the RBC.

26
Similar.

Preputial smears
11
Background of bluish material with numerous polymorphs, many of which are degenerating. Numerous blue and brown staining large (soil?) granules, The blue material is basically a bacterial soup composed of many different types including rare spirochaetes.
28
Large numbers of polymorphs and a diverse bacterial population

including low numbers of spirochaetes.
6
Similar cellular population. Numerous spirochaetes in the bacterial population.

Female 27 cloacal smear
Mixed cell population mainly red cells, plump epithelial cells, polymorphs and lymphocytes. Low numbers of bacteria comparatively in the light background including numerous spirochaetes.

DIAGNOSIS:
1.
Haemoprotozoan infection.
2.
Posthitis, acute, suppurative.
3.
Cloacitis, subacute suppurative.

COMMENT:
The red blood cell parasite looks the same as those previously identified in captive animals. It is difficult to comment on the severity of the infection because of problems with comparing smears made using different techniques.

The posthitis and "cloacitis" may or may not be a normal occurrence. The bacterial flora so far isolated has been quite similar between males with crust or no crust and in the female with the cloacal discharge. The presence of significant numbers of lymphocytic cells in the female swab suggests that she has a more long standing inflammatory process.

Note: the female did not have a cloacal discharge. She was swabbed for comparison as she was a young female who had not had contact with males.

The presence of spirochaetes in the smears is of concern as diseases due to spirochaetes which result in crusty exudation at muco-cutaneous junctions are described in other species, notably humans and rabbits. I am trying to find more information on these syndromes. The presence of the same organisms in an unmated female mitigates against this being a venereal disease but infections with syphilis and rabbit syphilis can occur in immature animals through non venereal contact.

Full bacterial culture results to follow.