AN INVESTIGATION OF THE HEALTH STATUS AND THE OCCURRENCE OF DISEASE AGENTS IN SEVERAL THREATENED WESTERN AUSTRALIAN MAMMAL SPECIES

REPORT SUBMITTED TO DR. J.A.FRIEND AND K.D. MORRIS, WOODVALE WILDLIFE RESEARCH CENTRE, DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT

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TABLE OF CONTENTS

AIMS

The purpose of this work was to:

1. Investigate the presence and prevalence of disease agents within threatened mammal species (Western barred bandicoot, Southern brown bandicoot, brush-tailed bettong, numbat, chuditch, brush wallaby, burrowing bettong, rufous hare wallby and banded hare wallaby).

2. Carry out a specific survey of the occurrence of acanthocephalan parasites in wild numbat populations, assess their potential impact on individuals and on populations, and determine a suitable screening method.

METHODS

Post mortems were carried out on Southern brown bandicoots, numbats, a brush wallaby and a brush-tailed bettong, and findings were documented. Blood and faeces were collected from wild numbats and normal parameters determined. Blood samples were collected from numbats for DNA analysis. Serum from numbats, chuditch and Western barred bandicoots was tested for Toxoplasmosis, Leptospirosis and Chlamydiosis. Serum from burrowing bettongs, rufous hare wallabies and banded hare wallabies on Dorre Is, Shark Bay, was tested for antibodies to *Toxoplasma gondii*. A method for field anaesthesia of numbats was developed. Faecal samples were collected from numbats and bandicoots and the bacterial and parasitic elements described.

Numbats were investigated for the occurrence of acanthocephalans through a combination of necropsies and examination of scats and intestinal contents.

SUMMARY OF RESULTS

Two of the 6 bandicoots moved from various locations to Julimar Conservation Park died of starvation. It was found that numbats can be fairly easily anaesthetised and bled in the field using injectable anaesthesia. There appears to be a large number of different endoparasites present normally in bandicoots and numbats. It may be appropriate to test and treat bandicoots for tapeworms and *Echinonema* sp. (a potentially pathogenic nematode) before they are moved, as high egg counts were found on faecal flotations. Although tapeworms can be present without causing disease, the added nutritional stress may become critical in the initial phases of the translocation.

Twenty three animals were necropsied, and of these appropriate samples could be taken from 19 animals only. Seven of 19 numbats tested for acanthocephalan parasites were positive. All the positive animals were from Dryandra, and all were collected in 1990 or later. Of the 23 animals, 1 was from Perup, 2 were from Karroun Hill Nature Reserve and 3 were of an unknown locality.

In at least 3 of the positive animals the infection caused significant pathology. The most appropriate method for testing live animals is to look for eggs using sedimentation techniques and faecal smears, although it was found that these methods were not very successful. As the effect of the parasites is rarely benign and their prevalence appears high, it is recommended that all numbats be tested and treated before translocation.

One Western barred bandicoot on Dorre Island was seropositive for ***Toxoplasma gondii*** on single direct agglutination testing. Of 20 plasma samples, 3 were positive for complement fixing antibody for ***Chlamydia psittaci***, although the titres were all borderline. A likely source for the Dorre Island bandicoots is exposure to avian faeces. Alll Western barred bandicoots were negative for **Leptospirosis.**

One hundred chuditch samples were submitted for serological analysis. These consisted of a total of 69 individual animals; a combination of Perth Zoo animals before and after their release into Julimar Conservation Park, and wild Batalling Forest animals. All were negative on microscopic agglutination testing for **Leptospirosis.** All complement fixation tests for ***Chlamydia psittaci*** antibodies were negative.

Of 69 animals tested for ***Toxoplasma gondii*** antibodies, 14 animals were positive at at least one sampling period. Three "new" animals (those that could not be traced back to a release from the Zoo, but were possibly wild animals or offspring of released animals) each bled at Julimar at one of the September 1993, November 1993, and May 1993 resampling periods were positive. Two animals released from the Zoo in September 1992 were each bled twice (one in July 1992 and November 1993, and the other in November 1992 and May 1993), and were negative on the first sample and had seroconverted by the second. One animal that was bled three times was negative in July 1992 (prior to its September 1992 release from the Zoo) and May 1993, and positive by November 1993. Another animal that was also negative in July 1992 at the Zoo (prior to its September 1992 release) was negative again in November 1992 and was positive by January 1993. An animal that was bled 4 times was negative in July 1992 prior to release from the Zoo in September 1992, positive in January 1993 and May 1993, and negative in September 1993 at Julimar.

An animal bled in February 1993 prior to its March 1993 release from the Zoo and another bled in July 1992 prior to its September 1992 release, were both positive initially and positive again when they were bled in May 1993. An animal that was bled in January 1993, May 1993, September 1993, and November 1993 had the following results respectively: negative, positive, negative, negative. Unfortunately this animal was not bled prior to its September 1992 release. An animal bled in November 1992 after its September 1992 release from the Zoo was negative then, but positive by May 1993. An animal bled in February 1993 prior to its March 1993 release from the Zoo was negative then, positive in May 1993, and negative by September 1993.

***Toxoplasma gondii* infection in wild chuditch**

Two of a total of 17 individual wild animals from Batalling sampled for ***Toxoplasma gondii*** antibodies were positive. One was bled in February 1993 during the wild population survey and was positive. It was brought to the Zoo in April 1993 for the breeding season and had maintained this positive titre. The other animal was also brought to the Zoo in April 1993 and was positive, but it had not been bled in February 1993.

All numbats tested for **Leptospirosis**, **Chlamydiosis** and **Toxoplasmosis** (both single direct agglutination tests and modified direct agglutination tests for *Toxoplasma gondii* antibody) were negative. All rufous hare wallabies, banded hare wallabies and burrowing bettongs were negative on modified direct agglutination tests for *Toxoplasma gondii* antibody.

More wild numbat serum and the remaining chuditch serum should be tested for **Toxoplasmosis** using the modified direct agglutination test.

NUMBAT ACANTHOCEPHALAN

INVESTIGATION

REPORT SUBMITTED BY STEPHANIE A. HAIGH BVSc.

JULY 1994

BACKGROUND

The general life cycle of acanthocephalan worms involves larval development in an intermediate host (insect or crustacean). When the intermediate host is eaten, the larva develops to an egg laying adult in the small intestine of the vertebrate definitive host. Development to the juvenile infective stage in the intermediate host takes 1-3 months, and development to egg laying adult in the definitive host takes 5-12 weeks. Thick walled embryonated eggs are passed in the faeces.

In the adult phase, most acanthocephalans are not host specific, and paratenic hosts are common (in which there is no development). The ingested larvae may reencyst if the invertebrate is eaten by the paratenic host. Paratenic hosts may infect the definitive host, however this would not be occurring in numbats. Host specificity is however present in the arthropod phases of development, ie completion of development occurs best in the selected species.

The pathogenesis of acanthocephalan parasitic infection can relate to "abdominal accidents" (such as intussusception) and the associated severe peritoneal effusion and toxemia due to gut compromise. A heavy parasitic worm burden is a common cause of intussusception in domestic animals. The acanthocephalan worms can also cause perforation of the gut wall and peritonitis.

What follows is a summary of the post mortem findings of a total of 7 animals (a combination of preserved and freshly dead animals) that were found to be infected with acanthocephalan parasites. Detailed post mortem reports of the 2 Yookamurra animals can be found in the appendix of this report.

METHODS

Formalin preserved faecal samples (and colon contents from necropsied animals) were submitted to the Murdoch University Parasitology Department for examination for acanthocephalan eggs. The usual proportion of 1 part faeces to 4 parts formalin was used. The scats had been collected from wild animals at several locations for several months. The technique of formalin/ether sedimentation was used. No eggs were found. The details of numbers of samples tested and the presence or absence of other parasitic elements in these samples are presented in another report entitled "Faecal Analysis".

Formalin preserved gastrointestinal contents from necropsied animals were submitted for examination for eggs and adults. Formalin/ether sedimentation was used for the eggs, and a dissecting microscope was used to search for adults. Results are presented in this report. Faecal smears were used to look for eggs in the first 2 adults known to have been infected with adults (the 2 Yookamurra animals "Spunk" and "Nad"). Several smears were looked at from both of these animals and only one egg was found in one animal on one smear only. It was decided to try a sedimentation technique (formalin/ether) for future samples, as it is believed that this technique is as reliable, if not more so, than faecal smears. Additionally, a method had to be found that would be practical and reliable for large numbers of samples, as this investigation was to be ongoing. Several faecal smears per animal would be required if this method was to be used, and for a large number of animals this would have been impractical.

As both the sedimentation technique and concentration flotation technique were not successful in finding eggs, it is possible that the adult acanthocephalans are shedding eggs intermittently or in low numbers, or for some other reason the infections are commonly non patent.

CASE SUMMARIES OF INFECTED NUMBATS

1. Female numbat "Lefty"

This animal was captured at Dryandra on May 22 1990. She had 2 young. On the weekend of July 21-22 she was found very unwell at Dryandra by a member of the public. She had lost both young and was in poor condition. She was taken to the Perth Zoo and died shortly after despite supportive treatment with fluids and corticosteroids. A post mortem carried out by Dr. David Foreshaw at the W.A. Department of Agriculture revealed the following: grossly the animal was well muscled but there was no depot fat, there was dehydration with ventral oedema of the muscles and subcutis, there was a 2 mm diameter white nodule on the serosal surface of the jejunum, and on the mucosal surface at this site was attached a 4 cm long worm with a flattened distal section. A urine dipstick test showed a trace of glucose, 3+ protein and 4+ blood.

Histopathological findings:

There was congestion of the superficial mucosa of the stomach, and there were helminths within the mucosa of the jejunum. There was marked vacuolar change in the nerve root tracks in the midbrain and cerebellar radiations of the brain. There were larvae on histopathological sections of the small intestine which were in all likelihood those from the trichostrongyle *Beveridgiella*. The worm and attached intestine was sent to Russ Hobbs at Murdoch University on 19/3/91 by Dietar Palmer (parasitologist at the W.A. Agriculture Department). It was stained and mounted there. It was tentatively identified by Russ Hobbs as the acanthocephalan *Australiformis semoni*. It was sent to Lesley Warner at University of Queensland around July 14/15 1994 by Russ Hobbs (Murdoch Collection No. X91/09). The Agriculture Department has been requested to send the histopathological slides of sections of the small intestine to Russ Hobbs so that he can confirm the identification of the larvae. Results are outstanding. The larvae are assumed to be from trichostrongyle nematodes, as they were proportionately much too small to belong to the acanthocephalan, which would not have larvae and adults present in the same host. The significance of the brain and urinalysis results was not determined.

2. Male numbat "Little Nad"

This animal was captured at Dryandra on 9/11/93 and moved to Yookamurra Sanctuary, South Australia on 10/11/93. He was found dead on 15/12/93 in his home range. Post mortem revealed severe peritonitis and abdominal effusion from an intussusception of the small intestine into the colon due to a large burden of acanthocephalan parasites in the small intestine.

3. Female numbat "Spunk"

This animal was captured at Dryandra on 6/12/93, released at Yookamurra on 7/12/93 and found dead on 12/12/93. The carcass was quite fresh and the animal appeared to have been scavenged or predated by a raptor. There were several large worms (acanthocephalans) present in and coming out of several segments of duodenum and jejunum, some of which were in the body and some scattered around the carcass. The worms were alive and unattached. It is possible that this animal died or became ill as a direct result of a large acanthocephalan worm burden, and was scavenged by a bird shortly after death, or was predated due to its compromised state. The integrity of the carcass was destroyed so that an abdominal effusion, intussusception, or other evidence of pathology from parasites would not have been apparent.

4. Female numbat found at Dryandra by Joe Van Den Elzen, 1992.

This animal (frozen) was necropsied on Friday April 22 1994 and found to have a whole acanthocephalan worm in her colon. She was a road kill, and the degree of internal destruction precluded submission of the rest of the gastrointestinal tract for parasitology or histopathology.

5. Female animal (00-004F-045F) caught at Dryandra 27/4/94.

This animal died under anaesthesia on 28/4/94 and was found on post mortem to have significant small intestinal gross and histopathology due to an adult acanthocephalan parasite infection.

6. Adult male numbat from the W.A.Museum collection (ID WAM M 35725, from Dryandra).

This animal was necropsied Friday May 20 1994. It was a road kill, found 1.8 km from the main turn off to Dryandra. It had a large right inguinal hernia of the small intestine. An adult acanthocephalan worm was found in the small intestine.

7. Juvenile male numbat from the W.A. Museum collection (ID WAM M 33990, found 31/1/90 at Dryandra).

This animal was necropsied on Friday May 20 1994. It was apparently a road kill, found on West Yornaning Rd. It was found to have an inguinal hernia, a gastrointestinal torsion, 2 adult acanthocephalan worms in the duodenum, and one in the jejunum or ileum.

Please see the report entitled "Numbat Post Mortems" for detailed necropsy findings of the above animals.

NUMBATS INVESTIGATED FOR ACANTHOCEPHALAN INFECTIONS

Table 1.

ANIMAL IDENTIFICATION	RESULTS	LOCALITY	DATE FOUND
Joe Van Den Elzen	Positive (adult whole worm: colon) No eggs were found*	Dryandra	1992
Moore	Negative	Perup	2/12/93
"Sara" 2/12/93	Negative	Dryandra	Captured
*00-004F-045F	Positive (adults:intestine) No eggs were found	Dryandra	Date of death 28/4/94
Male No.1 No ID	Negative	?	Found in Woodvale compound shed freezer 11/93
Male No. 2 No ID	Negative	?	Found in Woodvale compound shed freezer 11/93
WAM M 19522	Negative	Dryandra	11/1971 Butler and Archer
WAM M 34112	Negative	Dryandra	21/12/89
WAM M 33952	Negative	Dryandra	7/11/89

Table 1 (continued).

*Fresh and formalinised faecal samples submitted for acanthocephalan egg investigation on 29/4/94 and routine parasitology from this animal revealed only strongyle eggs and unidentified coccidia-like cysts (seen regularly in numbats on previous occasions). Investigation of small intestinal contents submitted on 2/5/94 revealed only adult nematodes. Histopathology slides of small intestinal lesions were taken from the Agriculture Department to Murdoch University Parasitology on 19/5/94 for identification of the large parasite seen in cross section on a slide. It was identified as an acanthocephalan.

Slides (x2, Agriculture Department Ref 94-1231), contain: (a) 2 Trichostrongyles (probably *Beveridgiella*) in cross section showing the typical "serrated" border (due to overlapping folds on the surface of the worm) surrounding and attached to a villus, and 1 glancing section of the proboscis of an acanthocephalan (orange with "stringy" filamentous projections from 1 side (hooklets), (b) section through main body of an acanthocephalan in the centre of the major lesion with an intense inflammatory reaction, showing undulating border and cross section of tubular organs. The trichostrongyles were associated with the ulcerated section, but the ulcer may have been caused by the acanthocephalan.

*Reports of presence or absence of eggs refers to flotation and dissecting microscope methods.

NUMBATS INVESTIGATED FOR ACANTHOCEPHALAN INFECTIONS

Table 2.

ANIMAL IDENTIFICATION	RESULTS	LOCALITY	DATE FOUND
WAM M 35725	Positive (adult:small intestine) No eggs were found*	Dryandra	19/10/90
WAM M 33990	Positive (adults:duodenum) No eggs were found	Dryandra	31/1/90
"Betty"	Negative	Karroun Hill Nature Reserve Ex Dryandra	28/8/90
"Sebastian"	Negative	Karroun Hill Nature Reserve	16/4/91
"Penelope"	No samples could be taken	Boyagin Ex Dryandra	21/1/86 alive 9/1/86
"Gomez"	Negative	Dryandra	5/12/87
"Roma"	Negative	Karroun Hill Nature Reserve	16/4/91
"Napoleon"	Negative	Dryandra	18/8/89
"Agnes"	No samples could be taken	Boyagin Ex Dryandra	30/12/87
No ID alcohol store Woodvale	No samples could be taken	?	?

*Reports of presence or absence of eggs refers to flotation and dissecting microscope methods.

NUMBATS INVESTIGATED FOR ACANTHOCEPHALAN INFECTIONS

Table 3.

ANIMAL IDENTIFICATION	RESULTS	LOCALITY	DATE FOUND
"Nefertiti"	No samples could be taken.	Boyagin Ex Dryandra	9/9/87
"Lefty"	Positive (adult: jejunum) No eggs were found.	Dryandra	1st capt.:5/90 2ndcapt::7/90
"Little Nad"	Positive (adults: small intestine) No eggs were found.	Yookamurra Ex Dryandra	15/12/93
"Spunk"	Positive (adults: intestine) One egg was found.	Yookamurra Ex Dryandra	12/12/93

*Reports of presence or absence of eggs refers to flotation and dissecting microscope methods.

CONCLUSIONS:

Flotation and formalin ether sedimentation methods do not appear to be effective ways of finding acanthocephalan eggs in faeces and/or intestinal contents. Faecal smears were successful once in finding an egg (on one occasion when there was a known adult infection), however in this case several smears were made from each animal and this would become impractical with large numbers of samples. Non patent infections may be common or egg shedding may be intermittent or in low numbers.

Acanthocephalan infection was known to be associated with severe pathology in at least three animals. It was the cause of death in one of these, was possibly associated with the abnormal reaction to anaesthesia and subsequent death in the second animal, and was possibly the cause of the illness in the third animal. Most of the 4 other animals infected were not in a good enough state of preservation to allow histopathological examination of intestinal samples.

If dead echidnas or bandicoots (or scats from these species) are obtained from Dryandra, they should be examined for adult acanthocephalan parasites and eggs. These could be sent to Lesley Warner for comparison with those found in numbats.

It is recommended that numbats be treated with Ivermectin (cattle subcutaneous preparation) subcutaneosly at 200 micrograms per kilogram twice, 3 weeks apart, at least 1 month prior to being moved. Scats should be collected in formalin on both occasions if possible, as there may be other concentration or sedimentation techniques that could be tried.

APPENDIX

1. FEMALE NUMBAT "SPUNK"

POST MORTEM: 14/12/93.

HISTORY: CAPTURED AT DRYANDRA 6/12/93, RELEASED AT YOOKAMURRA 7/12/93, FOUND DEAD 1730 12/12/93.

The above animal was found with its undamaged collar off, and the body a short distance away from the intestines, stomach, and ribs. The stomach was disconnected from the intestines. There was a lot of blood associated with this area. The body was still warm and fresh, had not gone into rigor mortis, and the blood on and around the area of the stomach and intestines was still wet.

There were several large worms (later identified as acanthocephalans) present in (and coming out of) the duodenum and jejunum. They were alive and unattached. The carcass was found with both thoracic limbs missing including the scapulae. There were 2 small fine scratches on the inside of the middle of both ear pinnae running parallel to the edges of the pinnae. These were scabbed. The skin on the dorsal side of the animal was intact and the scratches were concentrated over neck and base of ear. There was some hair missing between the scapulae. The scratches were in all orientations and most were to the level of the dermis only (not penetrating the skin completely). There was a long scratch at the base of the left ear and a few short "criss cross" scratches along the left edge of the main skin piece joining the head and body. There were 2 parallel scratches caudal to the scapulae in the middle of the back (3-5 mm apart, 30 mm long). There were no scratches dorsally caudal to this. Diagram and measurements of scratches done by Dr. J.A. Friend.

Ventrally the skin was missing from the angle of both mandibles to about the level corresponding with the cranial edge of the liver. There were 4 skin strips present between the head and body; the lateral most 2 were unattached at the head end and the middle two were attached to the skin caudal to the angle of the mandibles. There were 2 "nicks" under the chin; the left one was at the lip commissure and the right one was at the temperomandibular joint. The pharynx, larynx and tongue were missing and the remaining tissue surrounding the base of the skull was "sticking out" beyond the caudal extent of the ventral skin under the chin.

There were 2 incomplete round tears in the skin corresponding to the left side of the midventral abdomen, and 1 complete tear at about the level of the liver.

The vertebral canal and spinal cord were missing from the occipital condyle on the back of the skull to thoracic vertebra 11. Most ribs were missing, however on the right side the last 6 thoracic ribs were present, although some were fractured, and all were dislocated from the vertebrae except for rib T13. Five ribs remained on the left side, 4 were fractured very close to the base, 1 close to the vertebral body, all were dislocated from the vertebral bodies except for T13 rib. This includes the 2 ribs on either side that were bent back in/with the skin folds. There was haemorrhage in the lateral and ventral abdominal muscles corresponding to the area of the fractured ribs and severed vertebral canal. The caudal half of the right mandible was missing.

All thoracic viscera were missing; a small shred of diaphragm remained on the right side. The left kidney and adrenal were missing, and the spleen and liver were missing. The intestines (mostly small), pancreas and stomach were found some distance away from the body. The immature reproductive tract, bladder and caudal 6 cm of colon were untouched. The colon was severed at the same level as the vertebral canal. There were normal faeces in the colon (the portion that was still in the body). Three ticks were present, 2 on the medial aspect of each stifle, and 1 on the ventral abdomen.

There were 2 craniocaudal scratches on the skin of the ventral abdomen on right side at level of last rib, puncture wounds under the chin, 2 incomplete tears in the skin on the left side of the ventral abdomen, and 1 complete tear around the level of the liver. There was bruising in the peritoneum of the lateral abdomen and diaphragm at the level of the last ribs.

The reproductive tract appeared to be immature and inactive.
Photos were taken on Jo Cowie's camera (Zoo) exposures 18-24.
One whole body Xray was taken and kept at the Zoo (or given to T. Friend Woodvale).

The following parasitology samples were sent to Russ Hobbs (14/12/93) at Murdoch University.

1. Worms in Hartmann's solution, formalin and alcohol.

2. Faeces.

3. Stomach contents.

RESULTS

The adult worms were identified as acanthocephalans. Identification to genus level by Lesley Warner of the University of Queensland is pending. They have been identified to family level as belonging to **Oligocanthorynchidae** by Lesley Warner. These are apparently closest to some forms found in North American and African insectivorous mammals. One acanthocephalan egg was detected with difficulty on a smear only (not on any of the flotation methods). This egg was the same as the eggs inside the adult worm. Photos of eggs (from adult worms) were taken by Russ Hobbs, and the eggs did not appear to be mature. The usual numbat coccidia-like cysts with strap-like zoites were also present.

2. MALE NUMBAT "LITTLE NAD"

AGE:	AT LEAST 2 YEARS
POST MORTEM:	17/12/93.
HISTORY:	CAPTURED AT DRYANDRA AT 1630 ON 9/11/93, RELEASED AT YOOKAMURRA AT 1930 HRS 10/11/93. FOUND WITH COLLAR ON AT 1500 HRS ON 15/12/93 IN HOME RANGE AT YOOKAMURRA, SENT VIA SAME DAY COURIER TO 18 B KING ALBERT RD., RECEIVED 8 20 PM THURSDAY 16/12/93.
RELEASE WEIGHT	429 grams (ANIMAL HEALTH ELECTRONIC SCALES)
SCROTAL WIDTH	2.2 CM

At post mortem, the animals' state of decomposition indicated that there were probably 3 days between its death and discovery. Some decomposition may have occurred in the refrigerator and during transit. The animal was in moderate condition, with palpable prominences in the ileum of the pelvis only.

Both eyes were missing, presumably from being eaten out by ants. There were small maggots present in the mouth, cloaca, and burrowing into the skin of the ventral abdomen and back. There was some hair missing on the dorsal side of the neck where the collar would have been. The nostrils and tip of mandible were "scabbed" (ants).

Photos were taken on Zoo film, exposures 7-10., and T. Friend work camera exposures 6-9.

There was a small lesion on the dorsal surface of each hock that gave the impression of "stiffness" or "bruising", however the skin was not broken, and both joints appeared to function normally. The tail had a constrictive lesion at about the level of the last 2-3 caudal vertebrae. The skin caudal to this was necrotic and hairless. This wound could have occurred up to approximately 10 days prior to death. X rays were taken of both hock joints and tail. The hocks were both normal, and there were no fractures in the caudal vertebrae however there was some indication of osteonecrosis (infection).

There were 15 mls of clear serosanguinous fluid in the abdominal cavity. The fluid had a high protein and cell count, indicating a marked inflammatory response in the peritoneal cavity. Thick fluid brown gritty gastrointestinal contents were present from the stomach to the colon. There was an intussusception into the colon, and the entry point of the small intestine into the colon was about 6 cm from the cloaca. Approximately 8 cm of ileum and jejunum was telescoped into the colon. The wall of the section of gut inside the intussusception was haemorrhage and obviously very compromised.

There were no faeces present in the gastrointestinal tract caudal to the lesion. The wall of the colon caudal to the lesion was oedematous and haemorrhaged. The intestinal loops were dilated to 3 cm anterior to the lesion. There were many (3-4 per cross section of intestine) acanthocephalan worms present in the small intestine cranial to and at the level of the intussusception. Most were alive and attached to the mucosa. There were no obvious nodules at the point of attachment, but these could have been missed due to the advanced autolysis of the intestines. The average length of the worms was approximately 4 cm. The worms were narrowed at the anterior end and wide and bulbous at the posterior end.

The general life cycle of acanthocephalan worms involves larval development in an intermediate host (insect or crustacean). When the intermediate host is eaten, the larva develops to an egg laying adult in the small intestine of the vertebrate definitive host. Development to the juvenile infective stage in the intermediate host takes 1-3 months, and development to egg laying adult in the definitive host takes 5-12 weeks (DeGiusti1971). Thick walled embryonated eggs are passed in the faeces.

In the adult phase, most are not host specific, and paratenic hosts are common (in which there is no development). Paratenic hosts may infect the definitive host, however this would not be occurring in numbats. Host specificity is however present in the arthropod phases of development, ie completion of development occurs best in the selected species (DeGiusti 1971).

The liver was nearly indistinguishable due to autolysis, and was adhered to the diaphragm. The stomach was very dilated and abnormal looking, and full of brown liquid contents. There may have been a chronic resolved lesion in this area, for example an intestinal or gastric rupture. This may have also been due to parasite infection. Stomach contents were collected in methylated spirits for T. Friend. The carcass, head, brain and maggots plus distal intestine including the colon and the intussuscepted area were frozen in the animal health fridge (later moved to Woodvale). Samples for histopathology and bacteriology were not

taken due to the state of autolysis.

The cause of death was undoubtedly the intussusception and the associated severe peritoneal effusion and toxemia due to gut compromise. Acanthocephalan worms can also cause perforation of the gut wall and peritonitis. Death would have been fairly acute in this animal due to the severity of the lesion. This is supported by the full gut and the animals' relatively good condition.

Worms in water, formalin (with attached intestines), and methylated spirits were sent to Russ Hobbs at Murdoch University 17/12/93 for identification. Gut contents in formalin were also sent so that they could be checked for the presence of eggs. Worms were sent to Dr. Lesley Warner on 27/1/94. Russ Hobbs is currently (28/1/94) working on scanning electron microscopy of the parasites. Photos were taken of eggs (from adults) by Russ Hobbs.

The animal was frozen (lesion plus head and brain) on 17/12/93 at Animal Health at the Perth Zoo, and later moved to the Woodvale compound shed freezer (T. Friend).

RESULTS

The adult worms were identified as acanthocephalans. Identification to genus level by Lesley Warner of the University of Queensland is pending. The worms have been identified to family level as belonging to **Oligocanthorynchidae** by L.Warner. These are apparently closest to some forms found in North American and African insectivorous mammals.

TREATMENT DISCLAIMER

Any drugs or other pharmaceuticals mentioned in this report are not registered for use in numbats and have not been tested for adverse reactions in this species. Drugs should be obtained and administered by a registered Veterinary Surgeon.

REFERENCES

D.L. DeGiusti 1971, In *Parasitic Diseases of Wild Mammals,* Edited by Davis J W and Anderson R C, Iowa State University Press, Ames Iowa, p 140

NUMBAT BLOOD ANALYSIS

REPORT SUBMITTED BY STEPHANIE A. HAIGH BVSc.

JULY 1994

METHODS

All numbats were caught at Dryandra Woodland on field trips (April 11-15, 1994 and April 27-29, 1994) and bled in the field under Zoletil anaesthesia. For detailed notes of the anaesthetic records of each animal see the report entitled "NUMBAT FIELD ANAESTHESIA". All samples were processed at the Murdoch University Clinical Pathology Laboratory.

HAEMATOLOGY

Haemoglobin was measured colorimetrically using a Coulter haemoglobinometer (Coulter Electronics Pty. Ltd, Brookvale, N.S.W.). Packed cell volume (PCV) was obtained by microhaematocrit method and total protein by refractometer (American Optical, Buffalo, N.Y.). Total red blood cell (RBC) and white blood cell (WBC) counts were determined using a Coulter ZBI blood analyser. Red cell indices were calculated using standard formulae. Fibrinogen was determined using a heat precipitation method and centrifuge. Blood smears were stained with a modified Wright's stain using an automated stainer (Hematek, Miles Laboratories, Springvale, Victoria). Differential white blood cell counts and nucleated red blood cell counts were made using routine microscopy. Where possible an assessment of platelet numbers and red blood cell morphology was made by microscopy. Some samples were examined for reticulocyte number and type using a New Methylene Blue supravital stain.

BIOCHEMISTRY

Biochemical analysis was performed on a Cobas (Mira) random access analyser using Boehringer Mannheim (West Perth, W.A.) reagents for enzymes and Roche (Dee Why, N.S.W.) reagents for all other parameters. Serum protein electrophoresis was determined using a Gelman (Ann Arbor, Michigan) automatic computing densitometer and semi-micro electrophoresis chamber. Total serum protein was determined by the Biuret method. Total serum albumim was measured by the bromcresol green method and by electrophoresis. Serum protein electrophoresis was performed using sodium barbital buffer (pH 8.8, 200 volts, 15 mins.), and stained with Ponceau S. The albumin/globulin ratios reported are electrophoretic.

Haematological and biochemical values are compared with results obtained from wild animals bled on previous occasions.

RESULTS

HAEMATOLOGY

MALE NUMBAT "KLEPPER"

	UNITS			UNITS	
HB	g/L	135	SEGS	$x10^9/L$	1.31
PCV	L/L	0.48	BANDS	$x10^9/L$	0
RBC	$x10^{12}/L$	6.16	LYMPHS	$x10^9/L$	0.33
MCV	FL	78	MONOS	$x10^9/L$	0.05
MCH	pg	22	EOSINOS	$x10^9/L$	0.12
MCHC	g/L	281	BASOS	$x10^9/L$	0
WBC	$x10^9/L$	2.3	NUC RBC	$x10^9/L$	0
T.S.PROT	g/L	53	POIKILOCYTES		2+
FIBRINOGEN	g/L	4	HEINZ BODIES		Neg
PLATELETS	$10^3/mm^3$	314	POLYCHROMASIA		Neg
			ANISOCYTOSIS		Neg
			HJB		Slight

Abbreviations: HB = haemoglobin, PCV = packed cell volume, RBC = red blood cell count, MCV = mean cell volume, MCH = mean corpuscular haemoglobin, MCHC = mean corpuscular haemoglobin concentration, WBC = white blood cell count, T.S. PROT = Total serum protein, SEGS = segmented neutrophils, BANDS = band neutrophils, LYMPHS = lymphocytes, MONOS = monocytes, EOSINOS = eosinophils, BASOS = basophils, NUC RBC = nucleated red blood cells, HJB = Howell Jolly Bodies, HPF = high powered field.

COMMENTS:

There was some hypochromasia on this sample, which was reflected in a low MCHC and in the appearance of RBC on smears. This sample was slightly haemolysed, but this is unlikely to have affected the haematology results.

HAEMATOLOGY

MALE NUMBAT"WINNIE"

	UNITS			UNITS	
HB	g/L	122	SEGS	$x10^9/L$	0.71
PCV	L/L	0.47	BANDS	$x10^9/L$	0
RBC	$x10^{12}/L$	5.17	LYMPHS	$x10^9/L$	0.26
MCV	FL	91	MONOS	$x10^9/L$	0.03
MCH	pg	24	EOSINOS	$x10^9/L$	0
MCHC	g/L	260	BASOS	$x10^9/L$	0
WBC	$x10^9/L$	1.0	NUC RBC	$x10^9/L$	0
T.S.PROT	g/L	57	POIKILOCYTES		Neg
FIBRINOGEN	g/L	4	HEINZ BODIES		Neg
PLATELETS	$10^3/mm^3$	219	POLYCHROMASIA		1+
			ANISOCYTOSIS		Neg

COMMENTS:

There was some hypochromasia on this sample, which was reflected in a low MCHC and in the appearance of RBC on smears. The MCV or RBC counts may have been false, but possibly this animal may have been marginally iron deficient.

HAEMATOLOGY

FEMALE NUMBAT "KRISTY"

	UNITS			UNITS	
HB	g/L	133	SEGS	$x10^9/L$	1.92
PCV	L/L	0.42	BANDS	$x10^9/L$	0
RBC	$x10^{12}/L$	5.99	LYMPHS	$x10^9/L$	1.39
MCV	FL	70	MONOS	$x10^9/L$	0.04
MCH	pg	22	EOSINOS	$x10^9/L$	0.35
MCHC	g/L	317	BASOS	$x10^9/L$	0
WBC	$x10^9/L$	3.7	NUC RBC	$x10^9/L$	0
T.S.PROT	g/L	62	ANISOCYTOSIS		1+
FIBRINOGEN	g/L	2	POLYCHROMASIA		OCCAS
PLATELETS	$10^3/mm^3$	156	HJB		-
			HEINZ BODIES		<0.1%

COMMENTS:

This sample was slightly haemolysed.

HAEMATOLOGY

FEMALE NUMBAT "NIRVANA"

	UNITS			UNITS	
HB	g/L	129	SEGS	$x10^9/L$	1.24
PCV	L/L	0.44	BANDS	$x10^9/L$	0
RBC	$x10^{12}/L$	5.66	LYMPHS	$x10^9/L$	2.00
MCV	FL	78	MONOS	$x10^9/L$	0.05
MCH	pg	23	EOSINOS	$x10^9/L$	1 15
MCHC	g/L	293	BASOS	$x10^9/L$	0.02
WBC	$x10^9/L$	4.5	NUC RBC	$x10^9/L$	0.05
T.S.PROT	g/L	55	ANISOCYTOSIS		1+
FIBRINOGEN	g/L	2	POLYCHROMASIA		3-5 per 600 hpf
PLATELETS	$10^3/mm^3$	165	HJB		OCCAS
			HEINZ BODIES		<0.1%

COMMENTS:

Normal haemogram.

HAEMATOLOGY

MALE NUMBAT "KIRK"

	UNITS			UNITS	
HB	g/L	146	SEGS	$x10^9$/	1.36
PCV	L/L	0.43	BANDS	$x10^9$/	0
RBC	$x10^{12}$/L	6.63	LYMPHS	$x10^9$/L	1.08
MCV	FL	65	MONOS	$x10^9$/L	0.11
MCH	pg	22	EOSINOS	$x10^9$/L	0.25
MCHC	g/L	340	BASOS	$x10^9$/L	0
WBC	$x10^9$/L	2.8	NUC RBC	$x10^9$/L	-
T.S.PROT	g/L	58	ANISOCYTOSIS		0
FIBRINOGEN	g/L	2	POLYCHROMASIA		OCCAS
PLATELETS	$10^3/mm^3$	268	HJB		OCCAS
			HEINZ BODIES		0.1%

COMMENTS:

Normal haemogram.

HAEMATOLOGY

MALE NUMBAT "SPOCK"

	UNITS			UNITS	
HB	g/L	123	SEGS	$x10^9$/L	3.58
PCV	L/L	0.28	BANDS	$x10^9$/L	0
RBC	$x10^{12}$/L	5.73	LYMPHS	$x10^9$/L	1.42
MCV*	FL	49	MONOS	$x10^9$/L	0
MCH	pg	21	EOSINOS	$x10^9$/L	0
MCHC	g/L	439	BASOS	$x10^9$/L	0
WBC	$x10^9$/L	5.0	NUC RBC	$x10^9$/L	-
T.S.PROT	g/L	75	ANISOCYTOSIS		0
FIBRINOGEN	g/L	1	POLYCHROMASIA		OCCAS
PLATELETS	$10^3/mm^3$	-	HJB		0
			HEINZ BODIES		0

COMMENTS:

*The MCV count on this animal may be doubtful.

HAEMATOLOGY

MALE NUMBAT "MERLIN"

	UNITS			UNITS	
HB	g/L	137	SEGS	$x10^9$/L	1.18
PCV	L/L	0.42	BANDS	$x10^9$/L	0
RBC	$x10^{12}$/L	6.01	LYMPHS	$x10^9$/	0.94
MCV	FL	69	MONOS	$x10^9$/	0.05
MCH	pg	23	EOSINOS	$x10^9$/L	0.20
MCH	g/L	332	BASO	$x10^9$/L	0.01
WBC	$x10^9$/L	2.4	NUC RBC	$x10^9$/L	0.02
T.S.PROT	g/L	62	ANISOCYTOSIS		2+
FIBRINOGEN	g/L	3	POLYCHROMASIA		2-4 per 600 hpf
PLATELETS	10^3/mm^3	ADEQ	HJB		-
			HEINZ BODIES		-

COMMENTS:

Normal haemogram.

HAEMATOLOGY

FEMALE NUMBAT "SABRINA"

	UNITS			UNITS	
HB	g/L	150	SEGS	$x10^9$/L	3.06
PCV	L/L	0.48	BANDS	$x10^9$/L	0
RBC	$x10^{12}$/L	6.44	LYMPHS	$x10^9$/L	0.94
MCV	FL	70	MONOS	$x10^9$/L	0.09
MCH	pg	23	EOSINOS	$x10^9$/L	0.54
MCHC	g/L	331	BASOS	10^9/L	0.02
WBC	$x10^9$/L	4.7	NUC RBC	$x10^9$/L	0.05
T.S.PROT	g/L	59	ANISOCYTOSIS		1 +
FIBRINOGEN	g/L	4	POLYCHROMASIA		3 per 600 hpf
PLATELETS	$10^3/mm^3$	ADEQ	HJB		-
			HEINZ BODIES		-

COMMENTS:

Normal haemogram.

BIOCHEMISTRY

MALE NUMBAT "KLEPPER"

	UNITS	
CK (Creatine Kinase)	U/L	1078
ALT (Alanine Aminotransferase)	U/L	26
AST (Aspartate Aminotransferase)	U/L	34
PHOSPHATE	mmol/L	1.92
UREA	mmol/L	14.2
CREATININE	umol/L	250
CHOLESTEROL	mmol/L	2.28
GLUCOSE	mmol/L	5.6
PROTEIN	g/L	53.2
ALBUMIN (biuret)	g/L	34.3
ALBUMIN:GLOBULIN RATIO		1.63
ALBUMIN	g/L	32.95
ALPHA 1 GLOBULINS	g/L	2.37
ALPHA-2 GLOBULINS	g/L	5.35
BETA-1 GLOBULINS	g/L	8.27
GAMMA GLOBULINS	g/L	4.24

COMMENTS:

This animal had low globulins which was probably related to its young age. Otherwise the biochemistry panel is normal.

BIOCHEMISTRY

MALE NUMBAT "WINNIE"

	UNITS	
CK (Creatine Kinase)	U/L	1382
ALP (Alkaline phosphatase)	U/L	62
ALT (Alanine Aminotransferase)	U/L	52
AST (Aspartate Aminotransferase)	U/L	56
PHOSPHATE	mmol/L	1.98
UREA	mmol/L	13.0
CREATININE	umol/L	95
CALCIUM	mmol/L	2.17
CHOLESTEROL	mmol/L	3.07
GLUCOSE	mmol/L	7.8
BILIRUBIN TOTAL	umol/L	0.7
PROTEIN	g/L	58.1
ALBUMIN (biuret)	g/L	37.2
ALBUMIN:GLOBULIN RATIO		1.95
ALBUMIN	g/L	38.40
ALPHA 1 GLOBULINS	g/L	2.97
ALPHA-2 GLOBULINS	g/L	3.75
BETA-1 GLOBULINS	g/L	9.26
GAMMA GLOBULINS	g/L	3.69

COMMENTS: This animal had low globulins, which was probably related to its young age. Otherwise it had a normal biochemistry panel.

BIOCHEMISTRY

FEMALE NUMBAT "KRISTY"

	UNITS	
CK (Creatine Kinase)	U/L	2086
ALP (Alkaline phosphatase)	U/L	9
ALT (Alanine Aminotransferase)	U/L	42
AST (Aspartate Aminotransferase)	U/L	104
PHOSPHATE	mmol/L	1.64
UREA	mmol/L	15.8
CREATININE	umol/L	83
CALCIUM	mmol/L	0.30
CHOLESTEROL	mmol/L	2.67
GLUCOSE	mmol/L	7.1
BILIRUBIN TOTAL	umol/L	0.3
PROTEIN	g/L	67.6
ALBUMIN (biuret)	g/L	39.1
ALBUMIN:GLOBULIN RATIO		1.44
ALBUMIN	g/L	39.89
ALPHA 1 GLOBULINS	g/L	2.46
ALPHA-2 GLOBULINS	g/L	4.99
BETA-1 GLOBULINS	g/L	14.93
GAMMA GLOBULINS	g/L	5.13

COMMENTS: Normal biochemistry panel.

BIOCHEMISTRY

FEMALE NUMBAT "NIRVANA"

	UNITS	
CK (Creatine Kinase)	U/L	2024
ALP (Alkaline phosphatase)	U/L	46
ALT (Alanine Aminotransferase)	U/L	49
AST (Aspartate Aminotransferase)	U/L	51
PHOSPHATE	mmol/L	2.29
UREA	mmol/L	16.3
CREATININE	umol/L	86
CALCIUM	mmol/L	0.49
CHOLESTEROL	mmol/L	3.43
GLUCOSE	mmol/L	7.9
BILIRUBIN TOTAL	umol/L	0.6
PROTEIN	g/L	57.0
ALBUMIN (biuret)	g/L	39.3
ALBUMIN:GLOBULIN RATIO		1.96
ALBUMIN	g/L	37.73
ALPHA 1 GLOBULINS	g/L	2.54
ALPHA-2 GLOBULINS	g/L	4.39
BETA-1 GLOBULINS	g/L	10.02
GAMMA GLOBULINS	g/L	2.29

COMMENTS: Low globulins

BIOCHEMISTRY

MALE NUMBAT "KIRK"

	UNITS	
CK (Creatine Kinase)	U/L	1095
ALP (Alkaline phosphatase)	U/L	96
ALT (Alanine Aminotransferase)	U/L	64
AST (Aspartate Aminotransferase)	U/L	80
PHOSPHATE	mmol/L	2.31
UREA	mmol/L	23.0
CREATININE	umol/L	78
CALCIUM	mmol/L	2.53
CHOLESTEROL	mmol/L	4.53
GLUCOSE	mmol/L	8.7
BILIRUBIN TOTAL	umol/L	0.5
PROTEIN	g/L	58.4
ALBUMIN (Biuret)	g/L	38.5
ALBUMIN:GLOBULIN RATIO		1.59
ALBUMIN	g/L	35.88
ALPHA 1 GLOBULINS	g/L	2.72
ALPHA-2 GLOBULINS	g/L	4.54
BETA-1 GLOBULINS	g/L	11.69
GAMMA GLOBULINS	g/L	3.55

COMMENTS: Normal haemogram.

BIOCHEMISTRY

"SPOCK" MALE NUMBAT

	UNITS	
CK (Creatine Kinase)	U/L	15670
ALP (Alkaline phosphatase)	U/L	70
ALT (Alanine Aminotransferase)	U/L	111
AST (Aspartate Aminotransferase)	U/L	362
PHOSPHATE	mmol/L	2.29
UREA	mmol/L	21.5
CREATININE	umol/L	88
CALCIUM	mmol/L	2.40
CHOLESTEROL	mmol/L	3.14
GLUCOSE	mmol/L	4.2
BILIRUBIN TOTAL	umol/L	2.2
PROTEIN	g/L	55.8
ALBUMIN (Biuret)	g/L	38.3
ALBUMIN:GLOBULIN RATIO		2.01
ALBUMIN	g/L	37.26
ALPHA 1 GLOBULINS	g/L	2.55
ALPHA-2 GLOBULINS	g/L	4.51
BETA-1 GLOBULINS	g/L	7.83
GAMMA GLOBULINS	g/L	3.63

COMMENTS: Markedly elevated creatine kinase indicating some degree of exertional/stress/capture myopathy.

BIOCHEMISTRY

FEMALE NUMBAT "SABRINA"

	UNITS	
CK (Creatine Kinase)	U/L	2076
ALP (Alkaline phosphatase)	U/L	121
ALT (Alanine Aminotransferase)	U/L	163
AST (Aspartate Aminotransferase)	U/L	178
PHOSPHATE	mmol/L	3.25
UREA	mmol/L	24.4
CREATININE	umol/L	78
CALCIUM	mmol/L	2.55
CHOLESTEROL	mmol/L	3.66
GLUCOSE	mmol/L	7.7
BILIRUBIN TOTAL	umol/L	1.1
PROTEIN	g/L	63.2
ALBUMIN (Biuret)	g/L	40.2
ALBUMIN:GLOBULIN RATIO		1.73
ALBUMIN	g/L	40.05
ALPHA 1 GLOBULINS	g/L	2.52
ALPHA-2 GLOBULINS	g/L	4.78
BETA-1 GLOBULINS	g/L	13.58
GAMMA GLOBULINS	g/L	2.24

COMMENTS: Globulins appear low, urea appears high (slight dehydration?)

THE REMAINING PLASMA AND SERUM WAS SENT TO THE W.A. DEPARTMENT OF AGRICULTURE FOR SEROLOGY ON MAY 24 1994. IT WAS RETURNED TO TONY FRIENDS' COMPOUND SHED FREEZER.

NUMBAT SEROLOGICAL INVESTIGATION

REPORT SUBMITTED BY STEPHANIE A. HAIGH BVSc.
JULY 1994

NUMBAT SEROLOGY

METHODS

A total of 11 samples were submitted from 7 animals. Ten only were tested due to insufficient sample. The following samples were submitted:

"Winnie"	EDTA plasma x 2,	Murdoch Ref. No. 843/94
"Winnie"	Serum	" 843/94
"Sabrina"	EDTA plasma x 2	" 988B/94
"Sabrina"	Serum	" 988B/94
"Klepper"	EDTA plasma x 2	" 843/94
"Nirvana"	Serum	" 882B/94
"Kirk"	Serum	" 882C/94
"Kristy"	Serum	" 882A/94
"Spock"	Serum	" 882D/94

A combination of EDTA anticoagulated plasma and serum from 7 animals was tested for *Leptospira interrogans* antibodies (microagglutination), *Chlamydia psittaci* antibodies (complement fixation), and *Toxoplasma gondii* antibodies (latex agglutination). All plasma and serum was submitted to Dr.T Ellis at the Western Australian Department of Agriculture serology/virology section.

Antibody to *Chlamydia psittaci* was measured using the complement fixation test (CFT) as described by Timms (1992). For *Leptospira interrogans* serovars *pomona*, *hardjo*, *tarassovi* and *icterohaemorrhagiae*, the microscopic agglutination test (MAT) described by Chappel (1992) was used to detect specific antibody. Antibody to *Toxoplasma gondii* was measured using a latex agglutination test kit (Toxolatex(R), Fumouze Diagnostics, Asnieres, France.). The tests were reported either as negative or at the reactive titre above the negative cut-off described for the procedure. A modified direct agglutination test for *Toxoplasma gondii* antibody was done on 3 wild numbat serum samples (Murdoch University Clin Path Nos.1892/91, 2556/92, 2211/91). The methodology is available through Dr. David Obendorf at the Mount Pleasant Laboratories , Department of Primary Industries and Fisheries, Kings Meadows, Tasmania. This test is more specific, as it removes the non-specific IgM before the second agglutination test is done and will enable differentiation between asymptomatic (carrier) infections, acute disease resulting from recent infection and recrudescent infection;

RESULTS AND BACKGROUND

LEPTOSPIROSIS

Leptospirosis is a zoonotic bacterial disease. Wild rodents and domestic animals are the main reservoir of infection. It is shed in the urine of chronically infected cattle, other wild mammals and rodents. It produces jaundice, haemorrhages, kidney disease and abortions in the non reservoir host, and mild disease in the reservoir host. In the case of the numbats at Dryandra, the main relevance of testing for this disease is in the context of its zoonotic potential, as well as in its potential transmission from. domestic stock.

Of 10 (combination of EDTA plasma and serum) samples submitted, all microagglutination tests were negative for *Leptospira interrogans* serovar *hardjo*, *L. interrogans* serovar *icterohaemorrhagica*, *L. interrogans* serovar *pomona* and *L. interrogans* serovar *tarrassovi* antibodies. Serovars *hardjo* and *icterohaemorrhagica* occur in cattle in W.A., serovars *pomona* and *tarrassovi* occur in pigs in W.A., and both cross react with *L. interrogans* serovar *hardjo*. *L. icterohaemorrhagica* is the dominant serovar that occurs in domestic carnivores and marsupials in Australia. This testing therefore would have covered all the serovars that the numbats could have been exposed to.

CHLAMYDIOSIS

Chlamydia psittaci produces diseases in birds and mammals with a wide range of clinical signs ranging from asymptomatic infection to infertility and abortion to acute death. It is also a zoonosis. **Of 10 serum samples tested, none were positive for complement fixing antibodies.** Serum (rather than EDTA plasma) should be submitted for this test.

TOXOPLASMOSIS

Toxoplasmosis is a protozoal disease caused by the protozoan *Toxoplasma gondii*. It can produce pneumonia, encephalitis and myositis. Transmission in nature involves 2 main cycles:

1. From cats to intermediate hosts and back to cats and to humans through faecal contamination of the environment with oocysts that are generated during the intestinal stage in cats, mature in the outside environment, and are taken up in contaminated food or water.

2. From intermediate hosts to cats and back to intermediate hosts (and to humans) when zoites that are generated in tissues outside the intestine by asexual reproduction are ingested.

The role of humans in both of these cycles is that of a dead end intermediate host. Predation and cannibalism amongst intermediate hosts is important in enzooticity.

Five samples only were tested by single agglutination test for Toxoplasmosis due to insufficient sample and of these, all were negative The animals tested were "Winnie", "Sabrina" and "Klepper". The 3 animals tested by modified direct agglutination were negative for antibody on both steps.

Should future blood samples be taken from numbats it is recommended that samples be submitted to the W.A. State Health Laboratory for haemagglutination inhibition and fluorescent antibody testing, or to Mount Pleasant Laboratories, Launceston Tasmania (c/o Dr. David Obendorf) for direct and modified direct agglutination tests. The former tests require species specific antibody.

REFERENCES

Chappel RJ (1992) *Leptospirosis*, In *Australian Standard Diagnostic Techniques for Animal Disease*, edited by Corner LA and Bagust TJ, CSIRO Publications, East Melbourne, Victoria.

Timms P (1992) *Chlamydiosis in birds, wild and domestic animals In Australian Standard Diagnostic Techniques for Animal Disease*, edited by Corner LA and Bagust TJ, CSIRO Publications, East Melbourne, Victoria.

NUMBAT POST MORTEMS

REPORT SUBMITTED BY STEPHANIE A. HAIGH BVSc.
JULY 1994

The following groups of animals were necropsied at the Woodvale Wildlife Research Centre:

1. Frozen specimens.

2. Specimens held in the Woodvale alcohol store.

3. Western Australian Museum specimens.

Detailed post mortem reports are presented.

ANIMAL IDENTIFICATION/ DATE FOUND	On body "Dryandra Joe Van Den Elzen, 1992"
SEX	Female (adult)
PRESERVATION (prior to P.M.)	Formalin and alcohol(?) then frozen.
LOCATION	Dryandra
DATE OF POST MORTEM:	Friday April 22 1994
HISTORY:	Female with 2 young, both adult and young had been formalin (and alcohol?) preserved then frozen.
ANIMAL STORAGE/ ORGANS PRESENT	Animal refrozen Woodvale compound freezer T.Friend.

POST MORTEM FINDINGS:

The body was that of an adult female in good condition with 2 young. There was an open wound in the left inguinal area, the pouch was torn and there was bruising in the lymphatic and glandular tissues of the pouch. There was active mammary gland secretion visible upon sectioning of one of the glands.

Both ears were punched. Both eyes were sunken and collapsed (due to freezing or decomposition).

There was a fracture of the midshaft of the left fibula and tibia; the fibular fracture was slightly proximal to the tibial fracture. There was also a comminuted midshaft fracture of the left radius. There was an open fracture of the right distal radius and ulna, and there was a considerable amount of swelling and haemorrhage in this area. The left elbow was dislocated and the left distal humerus was fractured. There were multiple skull fractures. The pelvis was fractured at the ischium and at the symphysis. The spinal canal was fractured and dislocated at the sacrum and lumbosacral regions.

Caudal to the lumbosacral fractures 2 sacral vertebrae were missing. The head was dislocated from cervical vertebrae and the spinal cord severed at this point. Thoracic vertebrae 3-4 were missing. There was a large amount of subcutaneous fat present throughout the carcass. The contents of the thorax were liquefied, and the structures indistinguishable. The diaphragm and the stomach were ruptured and the liver was indistinguishable. The spleen was in place and intact, but the kidneys were not visible.

SAMPLES

1. Stomach contents submitted 9/5/94 to Murdoch Parasitology.

2. Section of colon plus colon contents submitted 9/5/94 to Murdoch Parasitology.

RESULTS

1. Negative for parasites

2. Strongyles and one whole acanthocephalan worm.

Young 1 male (?)

There was a hint of small testicular sac off midline (the abdomen had been opened). There was thoracic and abdominal organ eventration.

Young 2 female

There were multiple skull fractures and a laceration running mediolaterally in a straight line between the bases of the ears.

For reference only:

The bifurcation of the linguofacial vein was located 1 cm from the base of the ear pinna, 3/4 of the way from lateral canthus of the eye to base of ear. Both ovaries contained corpora lutea.

ANIMAL IDENTIFICATION/ DATE FOUND	On body "Richard Moore 2/12/93"
SEX	Male (adult)
LOCATION	Perup
DATE OF POST MORTEM	Tuesday April 26 1994
PRESERVATION (prior to P.M.)	Frozen
HISTORY	Hit by car (check)

ANIMAL STORAGE/ORGANS PRESENT

Frozen with all organs that were there originally and then sampled and replaced, including the genito-urinary system, stored in Woodvale compound freezer (T. Friend).

POST MORTEM FINDINGS

The animal was in good condition. There was a slight stain from scent gland, however it exuded quite a lot when cut.

The distal shaft of the right femur was fractured, and there were midshaft displaced tibial and fibular fractures. There was dried blood coming out of the right ear and both eyes were collapsed (probably an artifact of freezing). In the right ribcage the first 6 ribs were fractured dorsally and ventrally and the rest just ventrally. In the left ribcage, the first 6 ribs were fractured dorsally . There was extensive bruising in the subcutaneous area of the right ribcage and there were, haemorrhages in the left axilla There were fractures of the midshaft of the left and right mandibles. There was swelling in the skin and hair missing in cranial area of the right flank from the fracture.

The stomach was ruptured at the antrum and the abdomen was full of grainy gut contents. The diaphragm was ruptured and the stomach contents were present in the thorax. The lungs were indistinguishable within the thorax, and the small intestine was severed at the duodenal/jejunal junction.

The stomach contained several strips of torn mucosa, and there was a 0.3 cm diameter ulcerated area in the fundus of the stomach, with a reddened area in the surrounding mucosa. There were lacerations on the dorso medial surfaces of both forearms at the carpo/ metacarpo joints. There was a fracture of the right humerus. There were 2 lacerations in skin to the right of the sacrum dorsally running in craniocaudal direction. The cranial end of lateral laceration ran into the last stripe. The cranial end of the medial laceration was located caudal to last stripe and was 2 cm long, open, with a necrotic centre and extended into muscle. Both lacerations appear to have occurred about 1 week prior to death. There was a large (0.6 cm) laceration running craniocaudally in the centre of the tongue, and the mouth was full of rocks. The right kidney was detached and split in half, and the left scapula was fractured. There were 0.4 cm maggots on the tongue.

SAMPLES

1. Samples (small intestinal contents) submitted to Murdoch Parasitology 9/5/94.

2. Samples sent to Agriculture Department 19/5/94.

RESULTS

1. Strongyle eggs (77x37um); coccidia-like oocysts with single zoite.

2. Stomach, small intestine- No parasites seen, heart, kidney brain in formalin- no abnormality seen on histopathology.

ANIMAL IDENTIFICATION/ DATE FOUND	"Sara". Captured 2/12/92
SEX	Female
LOCATION	Dryandra
DATE OF POST MORTEM	26/4/94
PRESERVATION (prior to post mortem)	Frozen
HISTORY	Captured 2/12/92, died 12/2/93 (anaesthetic death).

ANIMAL STORAGE/ORGANS PRESENT

Body frozen containing female genitourinary system and all organs that were there originally (sampled and replaced) , brain kept frozen separately). All in T. Friend freezer (compound).

POST MORTEM FINDINGS

There was a graze on dorsum of the nose, and there was an incision running from caudal abdomen to cranial thorax. The spleen, liver and heart were missing and the intestines were slightly dried out. The general degree of preservation however was good.

The gut was full, and the brain liquefied due to freezing. The brain was removed and frozen, Woodvale freezer T. Friend. The kidneys contained calcified areas of medulla; samples for histopatholgy taken. Calcified kidneys have been seen previously in captive female numbats TA18 and TA19.

All organs found remaining in the abdomen were put in formalin (stomach, intestines and lungs). No acanthocephalan parasites were visible in the intestines. Photos of neck structures and salivary glands on P. Speldewinde camera exposures 20-27.

SAMPLES

1. The intestines, stomach and kidneys were submitted to the Agriculture Department 19/5/94 for histopathology (kidneys for calcification and intestines and stomach for acanthocephalans and associated pathology).

2. Colon contents submitted to Murdoch Parasitology 9/5/94

RESULTS

1. There were well circumscribed areas of mineralisation in the medulla of the kidney. No parasites were seen in the gastrointestinal section submitted.

2. Strongyle eggs (93x48um,74x36um) in the colon contents.

ANIMAL IDENTIFICATION/	Implanted no 00-004F-045F 28/4/94 not given a name, 4 young (1.3.0).
DATE FOUND	Date of death 28/4/94, caught 27/4/94
SEX	Female (adult)
LOCATION	Dryandra
DATE OF POST MORTEM	Friday 29 April 1994
PRESERVATION	Refrigerated
HISTORY	Anaesthetic death, see anaesthetic record for this animal under Dryandra April 27-29 field trip.

ANIMAL STORAGE/ORGANS PRESENT

Reproductive tract kept in formalin as very well preserved. A section of liver was frozen in Woodvale (T.Friend) freezer for DNA analysis. Whole animal frozen with all organs included (after sampling) in Woodvale compound freezer (T Friend). Brain not removed.

POST MORTEM FINDINGS

The liver was congested, the heart enlarged and displaced to left in the thoracic cavity, lungs areas of patchy congestion through all lobes of both lungs. The stomach had an area of red discolouration at serosa of pylorus and mucosa of stomach body. Several lesions were visible on the serosa of the descending duodenum; the first was a white nodule 8 cm from stomach, the second was located 2 cm from the first (a red bruise-like lesion), the third was located 4 cm from the second and was similar to the second but the serosal surface was friable and ulcerated. The intestines were not opened in order to preserve sections for histopathology. Faeces was located in a 6 cm segment of colon, the distal end of which was located 10 cm from cloaca. There was also faeces present in the distal 5 cm of the rectum.

SAMPLES

1. A small worm was seen among small intestinal contents, submitted with contents to Murdoch Parasitology 29/4/94

2. Submission to Agriculture Department 2/5/94 histopathology for all major organs with lesions, brain not removed.

3. Fresh samples submitted- lung fresh piece and swab for bacteriology, liver 2 x fresh pieces and 1 x swab for bacteriology.

4. The histopathology section (H and E slide) of small intestine containing a large worm was sent to Murdoch University Parasitology.

RESULTS

1. The worm was identified as *Beveridgiella inglisi* (2 males). Nematoda: Trichostrongyloidea: Nicollinidae: Herpetostrongylinae.

2. **Results of histopathology and bacteriology** Agriculture Department-

Stomach-ulcerative gastritis with intralesional nematode parasites. The eosinophilic infiltrate has extended through the basement membrane and into the submucosa.

Kidney- focal areas of acute tubular necrosis and degeneration.

Liver-severe congestion.

Lung-flooding oedema, probably agonal in nature.

Trachea, pancreas, spleen, heart - no abnormalities seen.

3. **Bacteriology**

Fresh liver and lung, and liver and lung swabs, no significant isolate.

4. **Small intestine**- large nematode parasite seen in cross section embedded deep within the basement membrane causing an intense subacute inflammatory infiltrate. Histopathology slides of small intestinal lesions taken from Ag Dept to Murdoch (R. Hobbs on 19/5/94) for identification of large parasite seen in cross section on section. It was identified as an acanthocephalan. Slides (x2) (Ag Dept Ref 94-1231), contain; (a) 2 trichostrongyles (probably *Beveridgiella*) in cross section showing the typical "serrated" border (due to overlapping folds on the surface of the worm) surrounding and attached to a villus, and 1 glancing section

of the proboscis of an acanthocephalan (orange, with "stringy" filamentous projections from 1 side (hooklets), (b) section through main body of an acanthocephalan in the centre of the major lesion with intense inflammatory reaction, showing undulating border and cross section of tubular organs. The trichostrongyles were associated with the ulcerated section, but the ulcer may have been caused by the acanthocephalan.

There were several lesions visible on the serosa of the small intestine; apparently histopathological sections were taken from1 lesion only, and there is no record of which gross lesion that might have been. The small intestine was not cut into deliberately at post mortem in order to preserve sections for histopathology. There may have been more adult parasites present in the lumen of the intestine. A request to the Agriculture Department for any adult parasites present within the lumen was not answered.

Fresh and formalinised faecal samples submitted for acanthocephalan egg investigation 29/4/94 and routine parasitology from this animal revealed only strongyle eggs and unidentified coccidia-like cysts (these have been seen regularly in the numbats), and investigation of small intestinal contents submitted 2/5/94 revealed only adult nematodes.

ANIMAL IDENTIFICATION/ DATE FOUND	No ID, found in Woodvale freezer Nov 1993 Called "Male no 1" for reference.
SEX	Male (adult)
LOCATION	Unknown
DATE OF POST MORTEM	5/5/94
PRESERVATION (prior to P.M)	Frozen
HISTORY	Unknown
ANIMAL STORAGE/ ORGANS PRESENT	Eviscerated carcass refrozen (plus any extra organs that were sampled) Testes kept in formalin at Woodvale

POST MORTEM FINDINGS

The state of preservation of the body was fairly good; the animal was probably frozen 1-2 days after death. The animal was in good condition and probably died in the breeding season as the scent gland stain extended to the costochondral junction and the gland itself was moderately thickened (though not obviously exuding). The pericloacal tissues were markedly swollen.

Ingesta was present throughout the entire gastrointestinal tract and very large nearly intact termites were visible in the stomach contents (was feeding close to time of death?)

The following injuries were apparent: fractured left scapula, fractured left distal femur (closed), fractured left distal tibia and fibula, midshaft closed fracture left mandible, multiple skull fractures dorsal left side, displaced thoracic vertebrae at T 8-9, and severed spinal cord at this point, extensive subcutaneous haemorrhage in the right inguinal region, the left eye was missing, the right eye was collapsed and dislocated from socket. The brain inside the fractured skull was liquified but refrozen (Woodvale freezer) for possible further analysis for Toxoplasmosis elements. The let and right jugular veins were ruptured and there was a small amount of haemorrhage in these areas.

The diaphragm was intact, and there was an abdominal hernia (intestines) slightly to the left of midline (but not inguinal). Fresh blood was present in the abdominal and thoracic cavities. There was a large amount of mesenteric and perirenal fat.

The prostate appeared to be enlarged and was herniating through abdominal wall at the left inguinal canal. On longitudinal section this 8cmx4cmx3cm organ was lobulated and had a median raphe.

The lungs were intact and there were diffuse areas of patchy congestion on both sides. The myocardium appeared reddened (congested?). The spleen, stomach and intestines were intact and the liver was fractured.

For reference only

Detailed drawings of breeding season genitalia were made. Photos taken on Woodvale work camera Neil Gibson exposures 30-34 (check).

MALE GENITOURINARY SYSTEM (breeding condition).

Compared with the non breeding season genitalia, the penis in the breeding season is bent twice, first at the attachment to caudal end of first set of glands at the base of the penis, and second at the first reflection of skin corresponding to prepuce at level of 2 small (glands?) with a caseous secretion. If the penis is extended totally cranially its length is approximately 3.5 cm. The reflection of the skin at the prepuce is located about 1 cm distal to the tip of the penis. The tip of the penis is bifid, and covered with barbules from the prepuce to the tip. At the base of the penis lie paired greyish glands 1.5cm x 1.3cm x 0.4cm. Under these and slightly lateral are 2 red round masses 1cm x 1cm x 0.5cm with the appearance of muscle, and extend to the attachment of the penis. These latter organs lie opposite and lateral to the cloacal opening, and the rectum/colon is visible running underneath both sets of organs. Caudal to this is a rim of tissue caudal to which lie paired very enlarged perianal glands (2.3 cm x 2.4 cm) in a large perianal/cloacal space surrounded by fairly loose skin. When these glands are ruptured, oily brown fluid exudes.

NB this area is very obviously outside the periperitoneal space (occupied by the folded penis, associated muscle and accessory sex glands).

No acanthocephalan parasitic worms or other worms were visible grossly in the gastro-intestinal contents. The intestinal wall was congested (?)(reddened and injected looking).

SAMPLES

1. Agriculture Department 6/5/94 samples sent for histopathology and bacteriology: Lung, heart, kidneys, the entire genital tract was submitted for histological sectioning in one jar (minus prostate, bladder and testes), the prostate and bladder were sent in another jar in formalin to the Agriculture Department for sectioning. The intestines, stomach and liver were sent for histopathology. The stomach contents were kept in formalin for T. Friend and the gastrointestinal contents were sent in formalin to R. Hobbs at Murdoch for parasitology.

RESULTS

Results of histopathology of genitourinary tract: most anterior pair of organs are seminal vesicles, next caudally are bulbourethral glands, and at the base of the penis there is a pair of muscle bundles which are composed entirely of smooth muscle.

The rest of the tissues sent for histopathological examination were disposed of before they were examined.

Bacteriology: no significant isolates.

Parasitology results small intestinal contents submitted result: Strongyle eggs (95x47um,75x37), whole *Beveridgiella inglisi* present; sporulated and unsporulated *Eimeria* (20x20).

ANIMAL IDENTIFICATION/ DATE FOUND	No ID, found in Woodvale freezer Nov 1993 Called "Male no 2" for reference.
SEX	Male (adult)
LOCATION	Unknown
DATE OF POST MORTEM	5/5/94
PRESERVATION (prior to P.M)	Frozen (approximately 3 days after death)
HISTORY	Unknown
ANIMAL STORAGE/ ORGANS PRESENT	Refrozen eviscerated Woodvale freezer (T Friend) Genitourinary tract kept at Woodvale in formalin Stomach, small intestines, spleen, pancreas and kidney, kept at Woodvale in formalin, and intestinal contents kept in formalin in a separate jar at Woodvale

GROSS POST MORTEM FINDINGS

The body was that of an adult male in moderate condition. It had an inactive scent gland and minimal pericloacal swelling.

Gastrointestinal contents were present throughout the abdomen. The distal right femur was fractured (closed), there were multiple skull fractures, thoracic vertebrae 9 and 10 were fractured and dislocated and the spinal cord was severed at this point. The right mandible and right scapula were fractured.

The abdomen was blood filled and there was a tear in the left part of the diaphragm through which the stomach was herniated. The right lobes of the liver had herniated into the right side of the thorax, the lungs were disintegrated and the stomach was ruptured at the antrum. The right caudal 6 ribs were fractured at their vertebral and sternal attachments. There was herniation of a 5 cm segment of small intestine through left inguinal canal

No histopathology samples were submitted. The brain was frozen Woodvale freezer (for future Toxoplasma cyst analysis).

SAMPLES

1. Small intestinal contents were put into formalin for R. Hobbs (parasitology, Murdoch University), 9/5/94.

2. Stomach contents were put in alcohol for T Friend.

3. Entire genitourinary tract preserved in formalin, kept at Woodvale, animal refrozen, eviscerated. Minimal samples were taken due to the state of decomposition.

4. Stomach, small intestines (and remainder of contents), spleen, pancreas and kidney sent to Murdoch Parasitology in formalin 19/5/94 for adult acanthocephalan search.

RESULTS

1. Small intestinal contents submitted 19/5/94, result: Strongyle eggs (108x42um).

4. Result of submission of stomach, intestines and kidneys and remainder of contents: several *Beveridgiella* worms present.

POST MORTEM OF PRESERVED NUMBATS FROM THE W.A. MUSEUM.

All were fairly intact and had been slit down the abdominal (and some the thoracic) midline for preservation. All had been preserved in formalin then stored in alcohol.

ANIMAL IDENTIFICATION/ DATE FOUND	WAM M 19522 11/71, Butler and Archer, accessed 1971.
SEX	Male (juvenile)
LOCATION	Congelin
DATE OF POST MORTEM	Friday May 20 1994
PRESERVATION (prior to P.M)	Formalin then alcohol store
HISTORY	?
ANIMAL STORAGE/ ORGANS PRESENT	Colon contents in formalin; stomach and intestines kept in a separate jar in formalin, both were returned to the W.A. Museum with the animal. Carcass contained liver, kidneys, and G/U tract when returned to the W.A. Museum

GROSS POST MORTEM FINDINGS

There was a large pericloacal swelling and scent gland stain, well preserved animal, in poorish condition

SAMPLES

Stomach, intestines, pancreas and spleen removed for sampling, liver, kidneys and rest of genitourinary tract remain in body. Stomach and gut predominantly empty except for last 5 cm of colon.

Stomach contents collected in alcohol and kept at Woodvale.

The following samples were submited to Murdoch University Parasitology 24/5/94.

1. Colon contents in formalin

2. Stomach, small and large intestines (tissue) in formalin.

No histopathology sampes were taken.

RESULTS:

1. Strongyle eggs

2. *Beveridgiella* whole worms

ANIMAL IDENTIFICATION/ DATE FOUND	WAM M 34112 21/12/89, accession date 1989
SEX	Female
LOCATION	Dryandra
DATE OF POST MORTEM	Friday May 20 1994
PRESERVATION (prior to P.M)	Formalin then alcohol store
HISTORY	Hit by car Wandering/Narrogin Road Pin put in leg by Narrogin vet Died in captivity Jan 1990
ANIMAL STORAGE/ ORGANS PRESENT	Colon contents and stomach and intestines (tissue) kept in formalin and returned to the W.A. Museum with the animal.

GROSS POST MORTEM FINDINGS

The animal was in poor condition, it had a fairly small frame but it was intact. There was a pin in the left tibia, and it had backed out through the skin at its proximal end. There was no obvious infection in the tissues surrounding the pin.

SAMPLES

The colon contents were put in formalin, the stomach contents (very small amount) were put in alcohol, and the stomach and intestines (tissue in formalin) and the colon contents were sent to Murdoch for adult acanthocephalan worm search on 24/5/94. No histopathology samples were submitted.

RESULTS:

1. Colon contents: strongyle eggs.

2. Stomach and intestinal tissues: physalopterid nematode larvae (L4)(*Skrjabinoptera*), from mucosa of stomach only.

T. Friend has 1 whole body X ray of this animal.

ANIMAL IDENTIFICATION/ DATE FOUND	WAM M 33952 7/11/89, accession date 1989
SEX	Male
LOCATION	Narrogin
DATE OF POST MORTEM	Friday May 20 1994
PRESERVATION (prior to P.M)	Formalin then alcohol store
HISTORY	None available
ANIMAL STORAGE/ ORGANS PRESENT	Intestinal contents and stomach, spleen, pancreas, small and large intestines (tissue) kept in formalin and returned to the W.A. Museum with the animal.

The animal was in good condition. There were bilateral mandibular fractures and maxillary fractures; the rostral tip of the nose was bent dorsally. Both forearms were fractured. The extent of the injuries is difficult to assess in these preserved animals as they are too "rubbery" to palpate.

The stomach was ruptured and there was one small tear in the distal duodenum. There was ingesta throughout the entire abdomen. The stomach, spleen and surrounding mesentery were shredded into strips (unusual for a closed abdominal road kill, looks more like the abdominal cavity had been opened, the stomach exteriorised and so shredded. It is difficult to say if the abdomen was opened by anything other than a manmade slit put in for preservation.

SAMPLES

The Intestinal contents were kept in formalin, the intestines, stomach, spleen and pancreas were put in formalin; the stomach contents were not recoverable. 24/5/94 intestinal contents, stomach, spleen, pancreas, and intestinal tissue was sent to Murdoch parasitology for adult acanthocephalan search. Histopathology samples were not submitted.

RESULTS

1. Strongyle eggs found amongst small and large intestinal contents

2. *Beveridgiella* whole worms found in jar containing stomach and intestinal tissues.

ANIMAL IDENTIFICATION/ DATE FOUND	WAM M 35725 19/10/90 accession date 1991
SEX	Male (adult)
LOCATION	Dryandra
DATE OF POST MORTEM	Friday May 20 1994
PRESERVATION (prior to P.M)	Formalin then alcohol store
HISTORY	"Road kill, found 1.8 km from main turn off to Dryandra"
ANIMAL STORAGE/ ORGANS PRESENT	Colon contents and stomach, spleen, pancreas and intestines (tissue) kept in formalin and returned to the W.A. Museum with the animal.

GROSS POST MORTEM FINDINGS

There was an impression of haemorrhage in the walls of the of peritoneum and thorax, and the lower lip was avulsed.

The abdomen had been slit open in a cross shape, and on lifting the right caudal flap the entire small intestine was visible sitting over the muscle layer.

There was a large right inguinal hernia, and 24 cm of mainly small intestine was herniated and lying under the skin at the right inguinal area. Grossly the condition of the herniated intestines was difficult to assess due to preservation, however they appeared empty, discoloured, "papery" and "crinkled" compared to the non-herniated proximal duodemun and colon. The distal end of the herniated intestine corresponded to the caecum. The colon was packed full of ingesta and there was haemorrhage in the colon walls. After the hernia was reduced, the hernial ring was obvious, dilated and was oval in shape (3cm x 1cm). The hernia may have been present prior to death.

It was difficult ot palpate the animal to determine if it had fractures or to gauge its ondition due to the method of preservation. The stomach was only moderately full, and there was obvious haemorrhage in the stomach wall at the antrum and body. There were also some lesions in the mucosa of the duodenum 9-10 cm from the pylorus, corresponding approximately to the beginning of the herniated segment. For reference only: the caecum in the caecum in the numbat is very reduced and is only a small outpocketing located 15 cm from the cloaca.

SAMPLES

The following were sent to Murdoch Parasitology 24/5/94:

1. Small intestinal contents in formalin

2. Colon contents in formlain

3. Jar containing stomach and intestinal tissue in formalin.

No histopathology samples were submitted.

RESULTS

1. *Beveridgiella* whole worms.

2. *Beveridgiella* whole worms.

3. Acanthocephalan worm (parts of an acanthocephalan worm from the duodenum, including an embedded proboscis), physalopterid (whole worm) nematode, probably *Skrjabinoptera* from stomach.

ANIMAL IDENTIFICATION/ DATE FOUND	WAM M 33990 31/1/90 accession date not specified
SEX	Male (juvenile)
LOCATION	Dryandra
DATE OF POST MORTEM	Friday May 20 1994
PRESERVATION (prior to P.M)	Formalin then alcohol store
HISTORY	"Road kill", found on West Yornaning Rd.
ANIMAL STORAGE/ ORGANS PRESENT	Colon contents, and stomach, intestines, spleen and pancreas (tissue) plus herniated segment and Acanthocephalans kept in formalin, and returned to the W.A. Museum with the animal.

GROSS POST MORTEM FINDINGS

The animal was in very poor condition. There was an open wound at the right hock with medial dislocation of the distal end of the tibia and lateral deviation of the foot. There was necrotic skin and subcutaneous tissue surrounding the wound and the exposed tip of bone was very necrotic. Estimation of time of injury: 10 days prior to death.

The intestines were very difficult to exteriorise in this animal due to a large segment of the colon "doubled over" and entrapping the small intestines through this loop and into the right caudal abdominal segment. The entrapped portion of intestines was twisted around the dorsal mesenteric root, and a small segment (2 cm) had herniated into the right inguinal ring and was very difficult to reduce. A small incision was made across the skin overlying the hernia while it was reduced. The herniated segment was very obviously infarcted (compromised) and it was ruptured, however this may have happened during reduction.

The gut in this animal was remarkably empty except for the colon. Two 3 cm acanthocephalan adult parasites were seen in the duodenum, 8 cm from the pylorus. They were dead and unattached to the mucosa, which in this animal was very dry, flaky and peeling off, and it was the same colour as the worms.

ALCOHOL STORE (WOODVALE) NUMBATS

ANIMAL IDENTIFICATION/ DATE FOUND	"NEFERTITI" 9/9/87
SEX	Female
LOCATION	Boyagin Nature Reserve
DATE OF POST MORTEM	Friday May 20 1994
PRESERVATION (prior to P.M)	Formalin then alcohol store
HISTORY	Found buried (scavenged or predated) in home range
ANIMAL STORAGE/ ORGANS PRESENT	Returned to alcohol store at Woodvale No organs present (they had been previously removed)

GROSS POST MORTEM FINDINGS

The body was of an adult female numbat in moderate to poor condition.

The tail was bent (it was dislocated at caudal vertebra 7 and 8). All skin covering the ventral caudal half of the abdomen was missing, there was a fairly straight "incision" down the midline of the ventral abdomen, and all organs within the abdomen were missing. The spinal canal was bent and dislocated at the 5th thoracic vertebra, and the cranial half of the body was contorted to the animals' right. The skin over the entire dorsal surface of the animal was intact and there were no other injuries. There was fur missing symmetrically dorsally over the skin caudal to the sacrum.

This animals' pattern of injuries resembled that of one of the Yookamurra animals' ("Spunk") (previously post mortemed) who may have been killed (or later scavenged) by birds.

SAMPLES:

The following were submitted to Murdoch University Parasitology 24/5/94.

1. Worms in duodenum (in formalin) found dead and unattached to mucosa. (parts of at least 2 worms, including an embedded proboscis submitted).

2. Colon contents in formalin.

3. Jar containing stomach and intestines (also spleen and pancreas) in formalin.

RESULTS:

1. Two adult acanthocephalans.

2. Strongyle eggs and possible acanthocephalan egg.

3. Acanthocephalan in small intestine, *Beveridgiella* loose and on lining of small intestine

No histopathology samples were submitted.

ANIMAL IDENTIFICATION/ DATE FOUND	"BETTY" 28/8/90
SEX	Female
LOCATION	Karroun Hill Nature Reserve
DATE OF POST MORTEM	23/6/94
PRESERVATION (prior to P.M)	Formalin then alcohol store
HISTORY	Intact animal found buried/collar on/off?
ANIMAL STORAGE/ ORGANS PRESENT	Woodvale alcohol store. The stomach, intestines, pancreas and spleen were removed from the body but have been saved in a separate jar in formalin as have colon and small intestinal contents and tissue section of neck All else was left in the animal which was put back into the alcohol store at Woodvale.

GROSS POST MORTEM FINDINGS

When the fur was shaved from the dorsal surface of the animal, short (up to 2cm) wide (0.2 cm) white "scratch" marks were visible scattered over the length of the back but concentrated over the mid portion of the back (both planes). There was a 1.5 cm (longest) by 1 cm (widest) roughly triangular wound at the atlanto occipital joint. There was dermis exposed over the main part of the wound and a central deeper hole measuring 0.5 cm by 0.3 cm. There were bilateral subcutaneous swellings palpable cranial to both shoulders extending ventrally to the sternum and dorsally to the dorsal limit of the scapulae. The right side was slightly more swollen than the left. When the swellings were cut into with a scalpel, there was yellowish material present between the skin and muscle layers of the shoulder and neck. This "tissue" was concentrated ventrally. There was an impression mark located just caudal to the shoulder running from caudal left to cranial right The skin appeared crushed but it was not open. There were 2 small round lesions (0.3 cm diameter) located caudal to the right eye and at the temperomandibular joint. They were 1 cm apart from each other.

The duodenum was ruptured. The distal 28 cm of intestines were very dilated (3 cm) and filled with increased amounts of ingesta. The middle 13 cm of intestines were empty and torsed around the dorsal mesenteric root. There were some serosal lesions visible on the duodenum.

There were several puncture marks on the dorsal surface of the skin at the points of the scapulae and further distally. There appeared to be a large swelling under the skin of both shoulders. There was also a suggestion of some thickened dark serosal lesions in the small intestine.

SAMPLES

1. Stomach contents were put in alcohol for Dr T. Friend, Woodvale.

2. Intestines and stomach (tissue) plus colon and small intestinal contents were sent to Murdoch for parasitology (including a search for acanthocephalans).

3. Rectangular sections of the right neck were taken for histopathology to confirm the reason for the apparent neck swelling (inflammation and sepsis, prescapular lymph node hyperplasia or salivary gland hyperplasia). Histopathology samples have not been submitted (8/7/94).

RESULTS PARASITOLOGY

1. Colon and small intestinal contents: strongyle eggs

2. Stomach and intestines in formalin: *Beveridgiella* whole worms and physalopterid (posterior end one worm only) nematode, probably *Skrjabinoptera,* (latter in stomach only).

ANIMAL IDENTIFICATION/ DATE FOUND	"SEBASTIAN" April 16 1991.
SEX	Male
LOCATION	Karroun Hill Nature Reserve
DATE OF POST MORTEM	23/6/94
PRESERVATION (prior to P.M)	Formalin then alcohol store
HISTORY	Found in home range scavenged or predated by a bird/collar on/off?
ANIMAL STORAGE/ ORGANS PRESENT	The caudal 5 cm of the colon (plus contents) were sent to parasitology at Murdoch and returned to Woodvale, the body was returned to the alcohol store as it was found (containing genitourinary tract and right kidney). Incision made in caudal ventral abdomen.

GROSS POST MORTEM FINDINGS

The forelegs and all thoracic viscera were missing. There was a strip of skin dorsally connecting the head to the cranial thorax. All tissues of the neck incuding the spinal cord were missing. The right kidney was present. All abdominal viscera were missing except for the male genitourinary tract (including bladder). There was a large amount of vegetative matter around the left lateral cranial side of the neck and base of the ear covering an apparent wound, which consisted of shredded muscle tissue and a darker central necrotic looking core of muscle. The ventral part of the head was entirely intact, but the neck and cranial thorax were open and shredded. On the left side the lumbosacral muscles appeared to be slightly shredded longitudinally adjacent to the spinal canal.

There was a definite collar impression very close to the base of the ears which was present on the whole circumference of the neck.

A clean straight scalpel incision was made in the midline from the caudalmost point of the original abdominal (scavenged?) wound so that the caudal 5 cm of colon could be taken in formalin for parasitology.

There was skin missing from the third cervical vertebra to the tip of the sternum ventrally in a tear drop shape.

SAMPLES

The caudal 5 cm of the colon (plus contents) were sent to parasitology at Murdoch for acanthocephalan parasites 24/6/94.

RESULTS

Parasitology: No whole worms or eggs detected.

ANIMAL IDENTIFICATION/ DATE FOUND	"PENELOPE" (written on card: 21/1/86, alive 9/1/86) Thomas and Turner
SEX	Female
LOCATION	Boyagin Nature Reserve
DATE OF POST MORTEM	23/6/94
PRESERVATION (prior to P.M)	Formalin then alcohol store
HISTORY	Translocated from Dryandra 12/86.
ANIMAL STORAGE/ ORGANS PRESENT	No samples were taken and the animal was returned as it was found to the alcohol store at Woodvale

GROSS POST MORTEM FINDINGS

Both forelegs and the right hind leg were missing. The animal had been completely eviscerated There was skin present only on the dorsal side of the carcass; the skin on the ventral side was missing in a "teardrop" shape between the area just caudal to the angle of the jaw and the cranial thorax, and between the pelvic area to the tail base. The skin was intact in the mid ventral abdominal area. There were 3-4 strips of skin connecting the cranial and caudal limits of the two "gaps" described above. The dorsal and ventral skin at the cranial end of the animal looks slightly drier and more decomposed than the rest of the skin- area of teeth impression marks?. The left ear was missing from the base as was the skin caudally from this point to the shoulder.

No samples were taken.

ANIMAL IDENTIFICATION/ DATE FOUND	"GOMEZ" 5/12/87
SEX	Male
LOCATION	Dryandra
DATE OF POST MORTEM	23/6/94
PRESERVATION (prior to P.M)	Formalin then alcohol store
HISTORY	Found dead in home range shortly after release or (first capture)/collar on/off?
ANIMAL STORAGE/ ORGANS PRESENT	Animal returned to alcohol store at Woodvale containing all organs except spleen, pancreas, stomach, and intestines, which are in formalin at Woodvale in a separate jar.

GROSS POST MORTEM FINDINGS

The animal appeared to have been in a very advanced state of decomposition when it was preserved-the skin was darkly discoloured and the pads of all feet were peeling off. The mouth was full of dirt and vegetative matter. All limbs were present and there did not appear to be any fractures. From a superficial examination the animal did not appear to have been predated. The skin was intact around the whole animal. There was a distinct collar impression around the entire circumference of the neck. The pericloacal area appeared to be intact.

A scalplel incision was made in the ventral midlline from the mid sternum to the pelvis to sample the gastrointestinal tract for parasites.

SAMPLES

The stomach, spleen, pancreas and intestines were removed (plus contents) and sent to Murdoch University for parasitology in formalin 24/6/94.

The gastrointestinal tract was too friable to cut into to obtain contents.

RESULTS

No worms were detected.

ANIMAL IDENTIFICATION/ DATE FOUND	"ROMA" 16 April 1991
SEX	Female, adult with 3 young
LOCATION	Karroun Hill Nature Reserve.
DATE OF POST MORTEM	23/6/94.
PRESERVATION (prior to P.M)	Formalin then alcohol store.
HISTORY	Found in home range scavenged or predated by a bird (?)/collar on/off?
ANIMAL STORAGE/ ORGANS PRESENT	The remaining caudal segment of the colon was removed and returned to Woodvale in formalin. The entire reproductive tract and bladder were left intact and in situ. The left kidney was present and left in situ. The animal was returned to the Woodvale alcohol store.

GROSS POST MORTEM FINDINGS

The entire mid portion of the body was missing from the atlanto/occipital joint to the thoracolumbar junction of the bony spinal canal. The head was present in the jar separately. The caudal portion of the body had been opened at the ventral midline (fairly straight clean incision). The skin incision extended to the base of the tail, but the opening in the ventral midline abdominal wall was smaller than the skin incision. The bladder was exposed at this opening. The remaining caudal segment of the colon was removed and the entire reproductive tract and bladder were left intact and in situ. The left kidney was present. There was a small (0.2 cm diam) patch of skin missing dorsally at the middle of the length of the tail.

SAMPLES

The caudal 3 cm of colon plus contents were submitted to Murdoch University for parasitology 24/6/94.

RESULTS

Parasitology: No whole worms or eggs were detected.

ANIMAL IDENTIFICATION/ DATE FOUND	"NAPOLEON" 18/8/89
SEX	Male
LOCATION	Dryandra.
DATE OF POST MORTEM	23/6/94.
PRESERVATION (prior to P.M)	Formalin then alcohol store.
HISTORY	Found lying on back intact
ANIMAL STORAGE/ ORGANS PRESENT	Animal returned to alcohol store at Woodvale All organs present except for stomach and intestines, these kept at Woodvale in a separate jar in formlain.

GROSS POST MORTEM FINDINGS

The animal was generally intact. Both ears were missing at the base. There was a definite collar impression, as well as a "fold" or "roll" of skin caudal to where the collar would sit. This was especially marked on the dorsal left side of the neck. On the dorsal and lateral surface of the left cranial part of the animal from the dorsal tip of the scapula to the last rib, there was a large patch of hairless necrotic skin 8 cm x 4 cm (impression from lying ?) The intestines were very dilated and fluid filled- and this did not just appear to be due to decomposition.

A straight clean scalpel incision was made down the ventral midline from pelvis to sternum.

SAMPLES

1. Stomach contents in alcohol Dr. T. Friend in alcohol.

2. Stomach, intestines and contents sent to Murdoch University Parasitology.in formalin 24/6/94.

RESULTS

Parasitology: *Beveridgiella* spp. present.

ANIMAL IDENTIFICATION/ DATE FOUND	"AGNES" 30 Dec. 1987
SEX	Female
LOCATION	Boyagin Nature Reserve
DATE OF POST MORTEM	23/6/94
PRESERVATION (prior to P.M)	Formalin then alcohol store.
HISTORY	Found dead in home range/ collar on/off?
ANIMAL STORAGE/ ORGANS PRESENT	Animal returned to alcohol store at Woodvale as found, no samples were taken.

GROSS POST MORTEM FINDINGS

All limbs were missing. The skin over the dorsal surface of the animal was intact. There was hair loss bilaterally symmetrically over the dorsal points of both hips. The pelvis and spinal cord were intact. There was a 4 cm strip of skin connecting the 2 lateral sections of skin and 2 large ventral defects: one cranially from the throat to the 2nd thoracic vertebra, and the other caudally from T5 to the caudalmost point of the pelvis. The rostrum of the head was missing from just cranial to the right eye and from the base of the left ear. The animal was totally eviscerated. The left ear pinna was chewed, and there was a small patch of hair loss on the top of the head.

SAMPLES

No samples could be taken.

MALE ANIMAL, NO ID OR LABEL FOUND IN JAR.

The animal appears to be a juvenile in poor condition. The testicles had been sectioned in a star pattern. There was a long straight incision in the venrtral midline from the base of the neck to the cloaca and all organs except the testicles had been removed.

The animal was possibly a road kill-the head was violently crushed from a dorsal force; the mandible and maxilla were separated and dislocated. Both hind legs appeared deformed; the toes were fractured on the right and the left tibia was fractured and the left hock dislocated. The cervical spine was fractured at C6 and C7 with seriously contused and exposed spinal canal nervous tissue (cord and ventral roots).

SAMPLES

No samples could be taken.

POST MORTEM REPORT MALE WOYLIE (DRYANDRA)

ANIMAL IDENTIFICATION/ DATE FOUND	BRUSH TAILED BETTONG 28/4/94 (fairly fresh).
SEX	Male
LOCATION	Dryandra found on road next to sandalwood exclusion plot on Gura Rd.
DATE OF POST MORTEM	29/4/94
PRESERVATION (prior to P.M)	Refrigerated
HISTORY	See location
ANIMAL STORAGE/ ORGANS PRESENT	Body and organs disposed of except for skull gven to Jackie Courtenay for Edith Cowan University.

GROSS POST MORTEM FINDINGS

There was an open fracture of right distal tibia and a fractured right ileum of the pelvis. There were multiple skull fractures, mandibular fractures, and a distal left ulnar fracture (open, some swelling and bruising).

There was a diaphragmatic hernia-the diaphragm was torn and the liver was fractured - the right lobes of the liver and the entire stomach were in the thoracic cavity. There was some fresh haemorrhage in thoracic cavity. The caecum was ruptured.

There was also an abdominal hernia breaking through the pelvic abdominal midline. The seminal vesicle appeared symmetrically very enlarged and bilobed, and the neck was torn or twisted.2/5/94.

Result of histopathology (sent 2/5/94). The caudal end of the vesicle was plugged by pale green caseous material. Histologically the seminal vesicle epithelium was degenerate and the acinus filled with eosinophilic staining cellular debris. There was a very small inflammatory component.

Diagnosis - seminal vesiculitis, this may be a normal reaction of the gland during or preceeding reproductive activity.

The role of humans in both of these cycles is that of a dead end intermediate host. Predation and cannibalism amongst intermediate hosts is important in enzooticity.

Five samples only were tested for Toxoplasmosis due to insufficient sample and of these, all were negative The animals tested were "Winnie", "Sabrina" and "Klepper".

Should future blood samples be taken from numbats it is recommended that samples be submitted to the W.A. State Health Laboratory for haemagglutination inhibition and fluorescent antibody testing, or to Mount Pleasant Laboratories, Launceston Tasmania (c/o Dr. David Obendorf) for direct and modified direct agglutination tests. The latter will enable differentiation between asymptomatic (carrier) infections, acute disease resulting from recent infection and recrudescent infection; the former tests require species specific antibody.

REFERENCES

Chappel RJ (1992) *Leptospirosis*, In *Australian Standard Diagnostic Techniques for Animal Disease*, edited by Corner LA and Bagust TJ, CSIRO Publications, East Melbourne, Victoria.

Timms P (1992) *Chlamydiosis in birds, wild and domestic animals In Australian Standard Diagnostic Techniques for Animal Disease*, edited by Corner LA and Bagust TJ, CSIRO Publications, East Melbourne, Victoria.

NUMBAT FIELD ANAESTHESIA

DRYANDRA FIELD TRIPS
APRIL 11 TO APRIL 15 AND APRIL 27 TO APRIL 29 1994

REPORT SUBMITTED BY STEPHANIE A. HAIGH BVSc.
JULY 1994

ANIMAL NAME/SEX	**"KLEPPER"/Male (juvenile)**
CAPTURE DATE/TIME	11/4/94 pm
BLED DATE/TIME	12/4/94 pm
AMOUNT TAKEN	2 x EDTA microtainers (1.2 ml), 2 x smears.
RELEASE DATE	13/4/94 am
SENT FOR/PLACE/DATE	Complete blood count (cbc), biochemistry panel (bioch) and electrophoresis (epg)/Murdoch/13/4/94.
FAECAL TAKEN/ DATE/DATE SUBMITTED	Yes/13/4/94 in trap/submitted 15/4/94 to Murdoch for parasitology (1 x fresh, 1 x formalin), Ag Department for bacteriology (1 x fresh).
BLOOD FOR DNA	No
SERUM SPUN OFF FOR BIOCH/DATE	No
TUBES SUBMITTED TO MURDOCH	2 EDTA microtainers/2 blood smears.
WEIGHT	492 grams

ANAESTHESIA RECORD

The initial dose was based on 5 mg/kg for the Eastern barred bandicoot (Shima *et al* 1993). 2.46 mg Zoletil (0.123 ml, 20 mg/ml) was given I/M (intramuscularly) at 128 pm and caused no reaction. At 135 pm the animal was removed from the bag and was already quite anaesthetised, its respiratory rate (RR) was 36 and there was still some reaction to noise and movement. At 145 pm there was a reaction to the needle prick at the cephalic vein and the animal was still fairly alert to noise. At 240 pm it started to shake and would not allow bleeding, at 250 pm it allowed measuring and collaring without a struggle, and at 430 pm it was fully recovered.

ANIMAL NAME/SEX	**"WINNIE"/Male (juvenile)**
CAPTURE DATE/TIME	12/4/94 am
BLED DATE/TIME	12/4/94 pm
RELEASE DATE	13/4/94 am
AMOUNT TAKEN	2 x EDTA microtainers, 2 x serum microtainers (total 2 ml), 1 x EDTA microtainer for DNA
SENT FOR/PLACE/DATE	cbc/bioch/epg/Murdoch/13/4/94
FAECAL TAKEN/DATE/ DATE SUBMITTED	Yes/12/4/94 on table/13/4/94 to Murdoch for parasitology (1 x fresh, 1 x formalin), Agriculture (Ag) Department for bacteriology (1 x fresh).
BLOOD FOR DNA	Yes
PLASMA KEPT ON	Yes
DATE FROZEN	13/4/94
STORAGE/AMOUNT	Woodvale compound shed freezer (T. Friend)/0.5 ml, no pellet.
SERUM SPUN OFF FOR BIOCH/DATE	No
TUBES SUBMITTED TO MURDOCH	2 x EDTA microtainers, 2 x serum microtainers
WEIGHT	450 grams

ANAESTHESIA RECORD

At 254 pm the animal was given 5 mg/kg (2.25 mg, 0.1125 ml) Zoletil (20 mg/ml) I/M left hind leg (LHL), at 302 pm it was still blinking, moving head, its RR was 28, and its heart rate (HR) was 224. The tentative assessment at this stage was that the drug was effective initially then it started to wear off, and at 306 pm there was still a reaction to noise. At 320 pm the animal was topped up with 0.6 mg (0.03 ml) Zoletil (20 mg/ml) I/M, and at 331 pm it was still sitting with its head up, so it was given 0.07 ml (1.4 mg) Zoletil (20 mg/ml), and at 355 pm 1 ml of blood was taken. At 359 pm 0.05 ml (1 mg) Zoletil (20 mg/ml) was given I/M, and at 413 pm more blood could be taken with difficulty, as the animal was very sensitive to noise and was still struggling. The total dose of Zoletil was 11.66 mg.

ANIMAL NAME/SEX	**"NIRVANA"/adult female with 4 young**
CAPTURE DATE/TIME	13/4/94 pm
BLED DATE/TIME	14/4/94 am
AMOUNT TAKEN	2 x EDTA microtainers, 2 serum microtainers (2.4 ml total)
SENT FOR/DATE	cbc/bioch/epg/15/4/94; 1 x EDTA microtainer for DNA
FAECAL TAKEN/DATE/ DATE SUBMITTED	No
BLOOD FOR DNA/	Yes
PLASMA LEFT ON/	Yes
DATE FROZEN/	15/4/94
STORAGE/AMOUNT	Woodvale compound shed freezer (T. Friend)/ small pellet containing EDTA pellets from blood tube.
SERUM SPUN OFF FOR BIOCH/DATE	Yes/12 pm 14/4/94.
TUBES SUBMITTED TO MURDOCH	2 x EDTA microtainers, 2 x serum microtainers.
WEIGHT	503 grams

ANAESTHESIA RECORD

At 936 am this animal was given 6 mg/kg (3.02 mg, 0.15 ml) Zoletil (20 mg/ml) I/M right hind leg (RHL), as it seemed to be a more "touchy" animal than the previous. At 949 am it was taken out of the bag and was well anaesthetised; its eyes were closed, its tongue was out, and at 954 am there was no reaction to clippers, at 10 am the level of anaesthesia was appropriate for bleeding. At 1003 am, 1 ml of blood was collected into EDTA easily and there was no reaction to the needle. At 1011 am 0.6 ml was collected into a serum tube, but there was a slight reaction to the needle at the end of the draw. At 1022 am 1 ml of blood was collected into a plain serum tube, with no reaction, and at 1057 am the animal was starting to get active. The young were active and **there had been no reduction in pouch young activity over the whole anaesthetic period**, at 1057 am the adults' ears were clipped. There was some reaction to the first clip, and an attempt was made at taking more blood but this failed.

ANIMAL NAME/SEX	**"KRISTY"/collared adult female with 4 young**
ID	Implanted with B45-00015-82FC/14/4/94
CAPTURE DATE/TIME	On 13/4/94 in the afternoon she was radio tracked to her "day log" which was about 500 m away from her night nest, which consisted of a hollow amongst a termite mound in a hollow upright tree trunk. The entrance was about 1.5 feet above the ground.
BLED DATE/TIME	14/4/94 am
AMOUNT TAKEN	2.7 ml (3 EDTA microtainers, 3 serum microtainers)
SENT FOR/DATE	cbc/bioch/epg/15/4/94; 1 x EDTA microtainer for DNA.
FAECAL TAKEN/DATE/ DATE SUBMITTED	Yes/15/4/94/Murdoch for parasitology 1 x formalin, 1 x fresh), Ag Department for bacteriology (1 x fresh).
BLOOD FOR DNA/	Yes
PLASMA KEPT ON	No
DATE FROZEN	14/4/94
STORAGE/AMOUNT	Woodvale freezer/1ml pellet.
SERUM SPUN OFF FOR BIOCH/DATE	Yes/12 pm/14/4/94
TUBES SUBMITTED TO MURDOCH	2 x EDTA microtainers 2 x plain tubes containing spun serum
WEIGHT	503 grams

ANAESTHESIA RECORD

The animal was given 5 mg/kg (2.625 mg, 0.13 ml Zoletil, 20 mg/ml) at 822 am I/M in the LHL. At 826 am it was anaesthetised but still blinking, paddling and showing some involuntary movements. At 836 am it was much more sedated and there was less twitching, however at 839 am it was reacting to the clipping, had started to shake and would occasionally sit up. At 845 am blood was obtained without any problems (there was no reaction to the needle), and at 850 am more blood could be taken. At 857 am there was some reaction to the needle, however at 906 am 0.7 ml of blood was taken into EDTA. There was some reaction and muscle tension.

At 913 am the animal was implanted (without reaction), and at 916 am it was ear clipped (with some reaction). At 925 am it was given 5 mls of subcutaneous (S/C) fluids. **Throughout the entire procedure there was no visible depression of the young**, and at 936 am the animal was still affected but alert, however it was not recovered enough to release.

ANIMAL NAME/SEX	**"KIRK"/Male**
ID	000013-2429/14/4/94
CAPTURE DATE/TIME	14/4/94/2-3 pm
BLED DATE/TIME	14/4/94/pm
AMOUNT TAKEN	3.6 ml
SENT FOR/DATE	cbc/bioch/epg/15/4/94
FAECAL TAKEN/DATE/ DATE SUBMITTED	No
BLOOD FOR DNA/	Yes
PLASMA KEPT ON/	No
DATE FROZEN/	14/4/94
STORAGE/AMOUNT	Woodvale freezer/0.75 ml total volume, no pellet.
SERUM SPUN OFF FOR BIOCH/DATE	No
TUBES SUBMITTED TO MURDOCH	2 x EDTA microtainers (total 1ml), EDTA plasma in 2 ml EDTA container, 0.6 ml serum in 1 plain serum microtainer, 0.3 ml haemolysed serum in a syringe.
WEIGHT	479 grams

ANAESTHESIA RECORD

At 327 pm this animal was given 6 mg/kg (2.874 mg 0.14 ml) Zoletil 20 mg/ml I/M in RHL, at 343 pm it was taken out of the bag and appeared to be well anaesthetised. At 349 and 354 pm, blood was taken with no reaction, at 356 pm there was some reaction to holding off the vein, at 359 pm 1 ml of blood was taken into 2 plain tubes. At 403 pm 1 ml of serum was divided 1/2 to EDTA (1 microtainer EDTA) and 1/2 into a plain tube. At 405 pm the HR was 216, the RR 36, and at 412 pm, 0.6 ml of EDTA blood was taken with no reaction and 1 x EDTA microtainer of blood for DNA was taken. The animal was implanted (000013-2429) with no reaction, however at 435 pm there was some reaction to noise.

ANIMAL NAME/SEX	**"SPOCK"/Male**
ID	00-000D-7EAC/14/4/94
CAPTURE DATE/TIME	14/4/94, 3 15 pm, capture history-the animal had been chased 100 m to a log, then extracted from the log within 5 minutes.
BLED DATE/TIME	14/4/94 pm
AMOUNT TAKEN	2.2 mls
SENT FOR/DATE	cbc/bioch/epg/Murdoch/15/4/94
FAECAL TAKEN/DATE/ DATE SUBMITTED	Yes/Murdoch parasitology (1x fresh, 1 x formalin), Ag Department (1x fresh)/15/4/94.
BLOOD FOR DNA/ PLASMA KEPT ON/ DATE FROZEN/ STORAGE/AMOUNT	Yes Yes 15/4/94 Woodvale compound shed freezer (T. Friend)/ 0.5 ml total amount in tube, no pellet.
SERUM SPUN OFF FOR BIOCH/DATE	No
TUBES SUBMITTED TO MURDOCH	2 x serum microtainers, 2 x EDTA 2 ml vials
WEIGHT	630 grams

ANAESTHESIA RECORD

Conscious heart (232) and respiration rates (60, sporadic) were taken in this animal. The initial impression was that it was a little jumpy, therefore 6.5 mg/kg was tried (total dose 4.095 mg, 0.204 ml Zoletil 20 mg/ml) at 426 pm in the RHL. At 435 pm there were involuntary movements, at 437 pm the animal was moving, digging and vocalising, and at 443 pm it was taken out of the bag and seemed anaesthetised, there was minimal reaction. At 449 pm a 23 gauge needle was tried to enable more blood to be taken more quickly, however there was too much reaction to this needle. At 451 pm the animal was topped up with 0.04 ml (0.8 mg) Zoletil 20 mg/ml I/M in the LHL, and at 4 58 pm it started to shake and to lighten, and at 505 pm it was given 0.15 ml (3 mg) Zoletil (20 mg/ml) I/M in the LHL.

By 5 17 pm there appeared to be no effect, and the animal was still paddling and digging in the bag. At 5 21 pm it was topped up with 0.2 ml (4 mg) Zoletil 20 mg/ml. At 539 pm there was still some paddling and twitching, and the animal had started to show generally very undesirable extrapyramidal reactions. At 5 44 pm it was topped up with 0.15 ml (3 mg) Zoletil 20 mg/ml I/M LHL, at 6 pm it was measured and radio collared as it showed no sign of slowing down. At 610 pm the radio collaring was finished, but the animal was still very twitchy.

At 8 33 pm another attempt at bleeding was made, and 0.2 ml (4 mg) Zoletil 20 mg/ml) (6.35 mg/kg) was given I/M RHL, as the animal seemed more settled. By 8 36 pm a good level of anaesthesia was obtained, and at 8 40 pm the animal was taken out of the bag. At 8 42 pm it started to twitch and 0.3 ml of EDTA blood only could be collected. Because the animal started to wake up, it was given 0.1 ml (2 mg) of Zoletil (20 mg/ml) at 908 pm I/M in the LHL, at 920 pm 0.6 ml of blood in EDTA was obtained, and at 938 pm 0.6 ml of blood was collected in a plain tube as the animal was well anaesthetised by this stage.

CONCLUSION

The initial non response to the anaesthetic may have been due to the procedure being attempted too soon after capture when the animal was too "hyped up". **It is recommended therefore that information on the capture history of the animal be obtained prior to anaesthesia, and the procedure be postponed for about 2 hours if there has been any chasing, especially if injectable anaesthetics such as Zoletil are being used.**

It may also be a good idea to give each animal about 5 mls of S/C Hartmann's fluids routinely when Zoletil is used, as it is excreted by the kidneys.

ANIMAL NAME/SEX	**Female 4 young, no name given**
ID	00-004F-045F
CAPTURE DATE/TIME	27/4/94 am
ANAESTHETIC DATE/ TIME	28/4/94 am
WEIGHT	505 grams
COMMENTS	There were large and small ticks present on the adult animal and small ticks present on the young.

ANAESTHETIC RECORD

This animal was initially given 6 mg/kg (3.03 mg, 0.15 ml of Zoletil 20 mg/ml) I/M RHL at 807 am, at 818 am it was still awake and shaking its head, reacting to noise, and its heart rate was 220, RR 72. At 819 am some jerky involuntary movement started, and at 822 am the RR was 60, the HR 216, and there was some reaction to the stethoscope. At 826 am the animal was taken out of the bag and was still quite alert but it was yawning. At 829 am it was given 0.04 ml (0.8 mg) Zoletil (20 mg/ml) as a top up I/M and at 830 am there was some involuntary muscle activity, at 832 am the RR was 48 and the animal seemed slightly calmer. The 4 young were active. At 836 am the adult female reacted to the clippers, at 839 am she was topped up with 0.05 ml (1 mg Zoletil 20 mg/ml) I/M RHL, and there was a marked reaction. At 851 am she was still awake and had started to shake. At 857 am she was topped up with 0.15 ml (3 mg) Zoletil 20 mg/ml I/M RHL and there was a reaction. An attempt was made to take blood but she pulled away from the needle, and at 859 am she was paddling and appeared to be quite agitated. At 906 am she was still paddling and was not anaesthetised at all, and was still spasming and twitching. At 913 am she was topped up with 0.15 ml (3 mg) Zoletil 20 mg/ml I/M.

At 929 am she was too spooked to bleed, she was given a rest, and at 1045 am another attempt to anaesthetise her was made. She was given 8 mg/kg (4.04 mg) Zoletil 20 mg/ml I/M. She appeared to have recovered well from the previous episode by this stage, and by 1048 am she was anaesthetised (RR 36), at 1052 am there was marked twitching, muscle spasming started, and she started to move again. The procedure was permanently aborted at this stage, and the animal was put back into the bag to recover. There was seizure like activity, vocalising and spastic movements in the bag at 1105 am, and this continued to about 2 minutes before she was found dead in the bag at 12 noon. Prior to this she was vocalising (almost a whimper).

Perhaps this noise should be taken to be an indicator of perceived "distress".

Anaesthetic summary:

10.8 mg over 1 hour 6 mins = 21 mg/kg over this period. 1 hour and 30 minutes later given 4 mg, total dose 14.8 mg over 2 hours 38 mins = 29.3 mg/kg TOTAL over 2 hours 38 mins.

CONCLUSIONS:

1. One hour and 30 minutes may not have been enough time for full recovery from the initial attempt at anaesthesia.

2. Violent spasms, twitching, shaking, vocalising or paddling are probably a sign of undesirable extrapyramidal reactions, and indicate that the procedure should be aborted. Anaesthesia from this point onwards via topping up apparently is not possible, and the repeated injections from the top ups become counter productive, and actually start to wake the animal up.

3. In general try to avoid any topping up.

4. The response to Zoletil (and the success of the anaesthetic) seems to be very dependent on the animals' apparent levels of physical and mental "stress" prior to the procedure. It is recommended that if the animal appears agitated (jumping in bag at any movement or noise, sweating, shaking) or is cold, that it not be anaesthetised that day if possible.

ANIMAL NAME/SEX	**"MERLIN"/ Male**
ID	00-004E-0FCD (NEW)
CAPTURE DATE/TIME	28/4/94/ 2 30 pm
BLED DATE/TIME	28/4/94/5 pm
AMOUNT TAKEN	0.4 ml in EDTA
BLOOD SENT FOR/ PLACE/DATE	cbc/bioch/epg/Murdoch (EDTA plasma used for biochemistry).
FAECAL TAKEN/DATE/ DATE SUBMITTED	Yes/28/4/94/ 29/4/94
FAECES SENT FOR/LAB	Parasitology Murdoch/ bacteriology Ag Department.
BLOOD FOR DNA	No
SERUM SPUN OFF FOR BIOCH/DATE	No
TUBES SUBMITTED TO MURDOCH	1 x EDTA microtainer
WEIGHT	500 grams
EARS CLIPPED	Yes

ANAESTHESIA RECORD

At 4 44 pm the animal was given 7 mg/kg I/M LHL (3.5 mg, 0.175 ml Zoletil 20 mg/ml) and taken out of the bag at 4 56 pm. The heart rate was 225, and RR 32 (sporadic), and the level of anaesthesia good, although there was a slight reaction to the clippers. At 5 pm 0.4 ml blood was taken into EDTA. At 5 06 pm there was a reaction to the needle, and the animal was too fidgety, therefore at 5 30 pm it was topped up with 1/3 dose (0.05 ml, 1.05 mg Zoletil 20 mg/ml) I/M RHL, and at 5 49 pm it was too jumpy to bleed. From this animal it appears as though a top up did not have any effect and in fact probably only agitated it.

ANIMAL NAME/SEX	**"KILBY"/ Male**
ID	**00-001F-0488 (NEW)**
CAPTURE DATE/TIME	28/4/94/ pm
BLED DATE/TIME	28/4/94/ 5 30 pm
AMOUNT TAKEN	None
RELEASE DATE	29/4/94
BLOOD SENT FOR PLACE/DATE	N/A
FAECAL TAKEN/DATE DATE SUBMITTED	No
FAECES SENT FOR/LAB	-
BLOOD FOR DNA	No
SERUM SPUN OFF FOR BIOCH/DATE	No
TUBES SUBMITTED TO MURDOCH	-
WEIGHT	475 g
EARS CLIPPED	?

ANAESTHESIA RECORD

This animal was given 8 mg/kg Zoletil 20 mg/ml (3.8 mg, 0.218 ml) I/M RHL at 5 36 pm, and at 5 48 pm it started twitching, at 5 54 pm it was still twitching, and could not be bled. At 7 pm the animal was topped up with 1/3 of the original dose of Zoletil (1.3 mg, 0.065 ml), at 704 pm muscle spasms were evident and attempts to bleed the animal were abandoned. Noise appeared to upset this animal. At 7 15 pm he was sleeping OK, at 7 25 pm he started trembling and reacted to being implanted. At 7 35 pm he had fully recovered.

ANIMAL NAME/SEX	**"SABRINA"/female numbat with 4 young**
ID	00-0017-1499 (New)
CAPTURE DATE/TI/ME	28/4/94/ pm
BLED DATE/TI/ME	28/4/94 8 pm
AMOUNT TAKEN	1.3 ml
RELEASE DATE	29/4/94
BLOOD SENT FOR PLACE/DATE	cbc/bioch/epg/Murdoch/29/4/94
FAECAL TAKEN/DATE/ DATE SUBMITTED	Yes/28/4/94 /29/4/94
FAECES SENT FOR/LAB	Parasitology fresh and formalin Murdoch/ bacteriology Ag Department
BLOOD FOR DNA	No
SERUM SPUN OFF FOR BIOCH/DATE	No
TUBES SUBMITTED TO MURDOCH	N/A
WEIGHT	475 grams
EARS CLIPPED	?

ANAESTHESIA RECORD

The animal was given 9 mg/kg I/M Zoletil 20 mg/ml (4.275 mg, 0.213 ml) at 7 52 pm, at 8 pm it was anaesthetised, there was no reaction to clippers, at 8 05 pm 2 x EDTA microtainers (1 ml total) of blood were collected. At 8 10 pm there was a reaction to needle, at 8 40 pm 0.3 ml of blood was collected into a serum (plain) tube, at 9 15 pm further attempts caused the needle to pull out of the vein due to excess movement by the animal and the procedure was aborted.

CONCLUSIONS:

1. Violent spasms, twitching, shaking, vocalising or paddling are probably a sign of undesirable extrapyramidal reactions, and indicate that the procedure should be aborted. Anaesthesia from this point onwards via topping up apparently is not possible, and the repeated injections from the top ups become counter productive, and actually start to wake the animal up.

2. In general try to avoid any topping up.

3. The response to Zoletil (and the success of the anaesthetic) seems to be very dependent on the animals' apparent levels of physical and mental "stress" prior to the procedure. It is recommended that if the animal appears agitated (jumping in bag at any movement or noise, sweating, shaking) or is cold, that it not be anaesthetised that day if possible.

4. **Recommended dose rate of Zoletil for numbats:** The smoothest and most successful anaesthetics appeared to be achieved with 8-9 mg/kg. At this dose rate the animal generally did not require topping up.

TREATMENT DISCLAIMER

Any drugs or other pharmaceuticals mentioned in this report are not registered for use in numbats and have not been tested for adverse reactions in this species. Drugs should be obtained and administered by a registered Veterinary Surgeon.

REFERENCES:

Shima A, McCracken H, Booth R, and Lynch M, 1993 "Use of Tiletamine-Zolazepam in the Immobilisation of Marsupials", In *Proceedings of the American Association of Zoo Veterinarians Annual Meeting,* October 1993, Edited by Junge R.E, Saint Louis Zoo, p 171

NUMBAT AND SOUTHERN BROWN BANDICOOT FAECAL ANALYSIS

REPORT SUBMITTED BY STEPHANIE A. HAIGH
JULY 1994

METHODS

Bacteriology

Microbiologic examination of faecal samples included **routine culture** using Blood Agar (BA) plate (5 % horse blood agar and MacConkey plates) incubated at 37 degrees. For the **anaerobic culture**, *Clostridia* was cultured onto BA and incubated in an Oxoid Anaerobe Jar at 37 degrees for 24-48 hours. *Yersinia* was cultured using *Yersinia* Selective Agar (oxoid). *Campylobacter* was cultured onto BPNA plates (De Keyser's Agar 1972), VPT plates (Skirrow's Agar 1977) and incubated in an Oxoid Anaerobe Jar at 37 degrees for 6 days, positive cultures were subcultured to BA then biochemical tests were done for organism identification (see Bacteriology Laboratory Western Australian Department of Agriculture for details). *Salmonella* was cultured onto Strontium chloride broth, then subcultured at 24 and 48 hours to Brilliant Green Agar (BGA) and Desoxycholate-Citrate Agar (DCA) and incubated at 42 degrees. *Salmonella* was cultured onto Rappaports broth, subcultured at 48 hours to BGA and DCA, and incubated at 37 degrees. *Salmonella* was serotyped by slide agglutination for Poly O and H antigens, then samples were sent to the Western Australian State Health Laboratory for identification of serotype or species. Faecal samples were examined microscopically for **acid-fast bacilli** after Ziehl Neelsen staining (Cowan and Steel 1970).

Parasitology

Faecal samples were examined for parasitic elements using Faecalyser (sodium nitrate) and zinc sulphate flotations.

BANDICOOT FAECAL RESULTS

PARASITOLOGY
(Samples submitted in formalin)

ANIMAL ID	DATE COLLECTED	BOTTLE NO.	RESULT
Male no. 36	19/4/94	11	*Echinonema* sp 40x40 um
Female no.76	19/4/94	14	As above
Female no.48	20/4/94	12	Unsporulated Coccidia oocyst (1 only)
Male I/P 9C26	27/6/94		Negative Submitted 6/7/94
Male I/P 01BB-E7B7	At post mortem 31/5/94 DOD 27/5/94, rel S.Harb. 5/5/94, colon and small intestinal contents collected		Small. intestine: *Echinonema* sp. *Labiobulura inglisi* Colon: *Labiobulura inglisi*
Male Beechboro road kill	At post mortem 30/5/94		Small intestine: 3 specimens of *Parastrongyloides australis.* Colon: 1 specimen of *Labiobulura inglisi* (nematode).

NUMBAT FAECAL RESULTS

BACTERIOLOGY

Animal ID	Routine culture	Anaerobic culture	*Salmonella* culture	*Campylobacter* culture	Z.N. stain
"Kristy"	Normal flora	*C. perfringens.*	Negative	Negative	Neg
"Spock"	Normal flora	Neg *C.perfringens.*	Negative	Negative	Neg
"Winnie"	Normal flora	*C. perfringens.*	Negative	Negative	Neg
"Klepper"	Normal flora	Neg *C.perfringens.*	Negative	Negative	Neg
"Merlin"	Normal flora	Neg *C.perfringens.*	Negative	Negative	Neg
4F-045F No name	Normal flora	Neg *C.perfringens.*	Negative	Negative	Neg
17-1499 "Sabrina"	Normal flora	Neg *C.perfringens.*	Negative	Negative	Neg

NUMBAT FAECAL AND INTESTINAL CONTENTS RESULTS

PARASITOLOGY

Fresh and formalin preserved scats submitted.

ANIMAL ID	DATE SUBMITTED	DATE/PLACE COLLECTED	RESULT
"Klepper"	15/4/94	Dryandra	Strongyle eggs 72.5x40,67.5x35, 80x35, 67.5x35, 102.5x47.5, 70x35um
"Kristy"	15/4/94	Dryandra	Coccidia (25x20um) and Coccidia-like oocysts (strap-like zoites present). Strongyle eggs present; 75x35, 90x32.5, 97.5x45, 67.5x37.5, 72.5x37.5, 90x32um.
"Spock"	15/4/94	Dryandra	Strongyle eggs 97.5x35, 77.5x37.5, 95x45um
"Spock""	19/5/94	13 or 14/5 Dryandra	Strongyle eggs
"Winnie"	13/4/94	12/4/94 Dryandra	Strongyle eggs 3+ various sizes; Coccidian oocysts (not viable) 1x unidentified egg possibly *Echinonema*

NUMBAT FAECAL AND INTESTINAL CONTENTS RESULTS

PARASITOLOGY (Fresh and formalin preserved scats submitted).

ANIMAL ID	DATE SUBMITTED	DATE/PLACE COLLECTED	RESULT
Winnie"	19/5/94	13 or 14/5 Dryandra	Coccidia-like oocysts with a single zoite.
"Merlin" 00-004E-0FCD	29/4/94	28/4/94 Dryandra	Strongyle eggs Unsporulated Coccidia, unidentified eggs present (75x42.5um, 65x37um)similar to oxyuroid egg, one of 2 not viable, with bacteria so these may be artefact only.
Female* unnamed, I/P 00-004F-045F	29/4/94	28/4/94 Dryandra	Strongyle eggs Unidentified coccidia-like (17.5umx15um) cysts seen regularly.
"Sabrina" 00-0017-1499	29/4/94	28/4/94 Dryandra	Strongyle eggs present, unidentified oxyuroid-like egg (75x42.5um), only one present.
"Leonie"	2/5/94	28/4/94 Batalling	Strongyle eggs (formalin only submitted).

*See post mortem report of this animal for a description of small intestinal and gastric parasites and pathology.

RUFOUS HARE WALLABY, BANDED HARE WALLABY AND BURROWING BETTONG *TOXOPLASMA GONDII* SEROLOGY

REPORT SUBMITTED BY STEPHANIE A. HAIGH
JULY 1994

METHODS

Serum collected on Dorre Island Shark Bay in August 1992 from 22 burrowing bettongs, 4 banded hare wallabies and 10 rufous hare wallbies was tested for *Toxoplasma gondii* antibodies using a modified direct agglutination test. The methodology is available through Dr. David Obendorf at the Mount Pleasant Laboratories , Department of Primary Industries and Fisheries, Kings Meadows, Tasmania. This test is more specific than the single direct agglutination test, as it removes the non-specific IgM before the second agglutination test is done.

RESULTS

Four of 10 rufous hare wallabies tested had a 1:16 titre on the first agglutination test, but all were negative on the second. This reaction on the first test is apparently due to non specific IgM and can be taken as negative for Toxoplasmosis if the second agglutination test is negative. This was also the case with 3 of 22 burrowing bettong samples, and the rest were negative on both tests. Both tests on all 4 banded hare wallabies were negative.

BANDICOOT POST MORTEMS

REPORT SUBMITTED BY STEPHANIE A.HAIGH BVSc
JULY 1994

This report contains details of 4 animals released at Julimar from various locations and 1 road kill.

POST MORTEM

MALE SOUTHERN BROWN BANDICOOT

IDENTIFICATION: IMPLANT 00-01DA-9C26

DATE OF POST MORTEM: 27/6/94

HISTORY: FOUND DEAD 18/6/94 AT JULIMAR. RELEASED AT JULIMAR 26/5/94 FROM FORRESTFIELD SENIOR HIGH. KEPT FROZEN, THAWED 26/6/94.

PHOTOS: T. FRIEND CAMERA EXPOSURES 14-16

GROSS POST MORTEM FINDINGS

The animal was found intact in left lateral recumbency. The collar was found (undamaged) on the animal, however it was very loose and could be slipped off over the animals' head. There were a very large number of 3-4 cm maggots in and on the fur over the abdomen, however not many had broken through the skin.

There were haemorrhages on the dorsal surfaces of the digits of the right fore and hind legs. This may be part of the mummification process, as the digits seem to be the first parts to desiccate. There was a collar impression in the skin anterior to the right scapula. The mandible was dislocated at both left and right TMJ's, presumably due to the decomposition of the muscle and skin holding it in place. The stomach in this animal was fairly empty compared to those seen in previous bandicoots that were road kill victims. The gastrointestinal tract from the caecum to the cloaca appeared to be abnormally distended with green very fibrous ingesta. Previous experience suggests that this ingesta is composed at least partly of eucalyptus leaves.

For reference only: In the unopened and undisturbed abdomen of this animal the diaphragm, heart and gastrointestinal tract from the stomach to the cloaca were intact; all other organs had completely decomposed and were not visible. The estimation of approximate dates of death of animals found with no known history may be facilitated by keeping records of differential organ decomposition such as these. A known date of translocation may help to pinpoint the approximate date of death, and the information regarding the organs present or absent may be correlated with similar findings in those animals with no known history.

SAMPLES COLLECTED:

Stomach contents in alcohol for T. Friend.

Colon contents fresh and in formalin for parasitology.

Results: There were no faecal parasites detected

The animal was refrozen in T. Friends' freezer 27/6/94.

POST MORTEM

ADULT FEMALE SOUTHERN BROWN BANDICOOT, RELEASED WITH 3 POUCH YOUNG.

IDENTIFICATION: IMPLANT 00-01BD-F684

DATE OF POST MORTEM: 27/6/94

HISTORY: FOUND 26/6/94 AT JULIMAR.
RELEASED AT JULIMAR 26/5/94 FROM FORRESTFIELD SENIOR HIGH.

PHOTOS: T. FRIEND CAMERA EXPOSURES 16-18

GROSS POST MORTEM FINDINGS

The animal was found intact in right lateral recumbency on a large strip of bark surrounded by a pile of leaves. The mandible was disarticulated at the temperomandibular joint and it was turned around so that the distal tip of the mandible was resting against the neck with a small bit of skin still attached to it. The occlusal surface of the lower arcade molar teeth were facing dorsally.

The collar was found around the animal at mid scapular level on the right side. The point of the right shoulder was located above the collar. On the left side, the point of the shoulder was below the collar, however there appeared to be an impression in the skin on this side from the collar. The collar was very loose and could easily be slipped over the animals head. It also could easily be moved caudally on the right side. Generally there was more damage on the left side; haemorrhage was visible in the subcutaneous tissues of the left lateral scapula, there was a gap of normal tissue at the shoulder joint, then the haemorrhage continued along the lateral humerus. There was a dark red area extending from the dorso/lateral surface of the mid radius and ulna to the wrist joint.

The ventral caudal abdomen was open; this may have been due to decomposition or to scavenging. The abdomen and thorax were opened (at post mortem) along the ventral midline. There was nothing present in the abdominal and thoracic cavities except for the distal intestine which contained a very small amount of gastrointestinal contents. No samples were taken from this animal.

The animal was frozen T.Friend freezer 27/6/94.

Conclusion:

The cause of death was probably starvation, however tissue atrophy from the mummification process would have contributed to some of the apparent loss of condition. The apparent entrapment of the right upper foreleg may have contributed to the animals' demise in the late stages, however it is my feeling that as the animal lost weight, the collar was able to slide back and forth over the left and right scapulae, ultimately damaging the left side more.

POST MORTEM REPORT

SPECIES/SEX	Southern brown bandicoot/female
IDENTIFICATION	Implant 00-0133-DD83
DATE OF POST MORTEM	31/5/94
HISTORY	Released at Julimar from Secret Harbour May 5 1994 (check), found 3 weeks prior (?), had been frozen since found (?).
ESTIMATED DATE OF DEATH	4-5 days prior to being frozen (from the post mortem)
COLLARED	yes
STORAGE/PRESERVATION	(?) Frozen since day found.
DECOMPOSITION	Severe autolysis.

POST MORTEM FINDINGS

The general condition of the animal seemed poor gauging by the degree of muscle atrophy. Muscle softening due to autolysis may have contributed to this in a minor way.

The tail was missing at the base. The lumbar spinal canal was dislocated from the rest from L3 to L7. The face appeared to be chewed but the state of decomposition was too severe to allow examination of the skin. There were several large patches of whitish "granular" skin distributed over the left mid thorax at the level of the middle of each rib and the right mid lateral thorax and abdomen. This may have been an artefact of decomposition or it may have been due to maggot tracts. There was bruising under the left mandible.

The pouch was empty but one nipple (right side, third from cranial to caudal) was enlarged. The sacral spinal canal was dislocated from the pelvis on both sides, the skull was fractured at the maxilla cranial to the orbital foraminae, and the left temperomandibular joint was dislocated. The entire pinna of the right ear was missing as was half of the left.

There was major internal destruction of the abdominal and thoracic organs. A large segment of the spinal canal was dislocated from the rest of the canal from the cervical intumescence to lumbar vertebra 4. The rib cage was crushed. The intestinal tract and stomach were ruptured and most of the thoracic and abdominal contents were indistinguishable. The abdominal and thoracic cavities were filled with ingesta.
The scapulae were ripped from their attachments from the lateral costal arches and were deviated laterally.

Ventrally there was haemorrhage from tenth rib to the thirteenth rib, extending dorsally to the middle of each rib.

No samples were taken due to degree of decomposition and destruction.

Photos T Friend work camera exposures 15-25. Each exposure was labelled with the animals implant number.

BANDICOOT POST MORTEM

SPECIES/SEX	SOUTHERN BROWN BANDICOOT/MALE
IDENTIFIICATION	IMPLANT 00-01BB-E7B7
DATE OF POST MORTEM	31/5/94
HISTORY	Released at Julimar from Secret Harbour May 5 1994 (check), found 28/5/94, was alive 1 week earlier
ESTIMATED DATE OF DEATH	27/5/94 from post mortem
COLLARED	yes
STORAGE/PRESERVATION	refrigerated since day found
DECOMPOSITION	moderate

POST MORTEM FINDINGS

The animal was in poor condition. There was fur missing from the back of the neck (corresponds to collar position), and on the right side of the rump adjacent to the tail base. There was dirt in the fur around the dorsal and ventral neck and along the back. There were 2 full thickness holes (0.5cm x 0.3cm, 0.2 x 0.2 cm) in the skin under the chin in the midline at the level of the temperomandibular joint. Caudal to this area at the level of the base of each ear there were several very small fine punctures 0.2 cm to 0.5 cm apart.

On the right side of the animal there were 2 long thin scratches (skin broken) over the lateral abdomen and chest, and there were two round pale brown necrotic looking patches 0.4 cm diameter adjoining these patches. There were several scratches and point impressions on the dorsal surface of the animal over the rump, and the skin in this area was discoloured (increased decomposition). The base of the right ear pinna and the dorsal right surface of the skull was bruised. The left caudal aspect of the skull was crushed and fractured, and the brain in this area considerably damaged.

The left lateral surface of the animal was undamaged except for a 1 cm long scratch cranial to the point of the hip and some very small fine point impressions in the skin caudal to the axilla. The ventral surface of the animal had a pale yellow 2 x 1.5 cm diameter "patch" in the skin of the right ventral abdomen just off the midline. There was a large (3x3cm diameter) area of haemorrhage in the skin at the sternum.

There was a 0.4 cm diameter abrasion on the dorsal lateral surface of the base of the middle digit of each foreleg. These lesions are likely to have occurred antemortem (digging in inappropriate substrate?). The animal had 2 unengorged ticks in the axilla. The gut was moderately full up to the caecum, but the latter and the colon were virtually empty of ingesta.

The stomach and intestines were fairly decomposed. There was a fracture or dislocation of the spinal canal at T13/L1, and corresponding impression marks in the skin at this point. Once the skin was removed over the dorsal surface of the animal, there was extensive haemorrhage visible on both sides from the cranial point of the scapulae to thoracic vertebrae 8 and 9. There was no damage to the dorsal musulature of the neck. The back of the skull was completely crushed but there was minimal haemorrhage associated with this. Ribs 8 and 9 on the left side and ribs 6,7 and 8 on the right were fractured dorsally. The left side of the chest contained clotted blood which appeared to be associated with the fractured ribs. The lungs had a diffuse unusual grainy texture
The small intestinal contents contained a large number of what appeared to be 2 types of worms.

All organs plus body frozen T Friend lab fridge, small intestinal contents saved in formalin at Woodvale.

Photos taken with the animals implant number label on T. Friend work camera exposures 1 to 15.

SAMPLES TAKEN/LAB/DATE SENT

1. Stomach contents in alcohol for T. Friend.

2. Small intestinal and colon contents in formalin for parasitology sent to Murdoch 15/6/94.

RESULTS

PARASITOLOGY

Small intestine: 4 specimens of *Echinonema* sp. , 168 specimens of *Labiobulura inglisi.*

Colon: 1 specimen of *Labiobulura inglisi.*

POST MORTEM 30/5/94

ROAD KILL MALE BANDICOOT BEECHBORO, FOUND BY N. MARLOW 30/5/94.

ADULT MALE SOUTHERN BROWN BANDICOOT .

The animal was a very large male in good condition. There were no external signs of injury except for a very small single puncture wound in the skin on the dorsal surface of the mid shaft of the left tibia, and some fur missing on the dorsal surface of the right rump and directly above the sacral vertebrae.

The right ileum and ischium and the left ileum were fractured and there was very extensive haemorrhage between the muscle planes of the thigh and lumbosacral areas. There was a 2.5 cm diameter tear in the left side of the diaphragm and the stomach (and spleen) was present in the chest up to the pylorus. There was no haemorrhage, effusion or other damage obvious within the chest.

For reference only: the prostate of this species is squarish in shape and slightly narrower at the distal end.

SAMPLES TAKEN/LAB/DATE:

1. Small intestinal and colon contents in formalin for parasitology. Submitted to Murdoch parasitology 15/6/94.

2. Brain in formalin-kept at Woodvale for future submission to look at histopathology for Toxoplasmal elements.

Small intestinal and colon contents kept in formalin at Woodvale.

RESULTS

PARASITOLOGY:

Small intestine: 3 specimens of *Parastrongyloides australis*.

Colon: 1 specimen of *Labiobulura inglisi* (nematode).

WESTERN BARRED BANDICOOT SEROLOGICAL INVESTIGATION

REPORT SUBMITTED BY STEPHANIE A. HAIGH
JULY 1994

EDTA anticoagulated plasma from 20 animals bled in August 1992 on Dorre Island, Shark Bay was tested for *Leptospira interrogans* antibodies, *Chlamydia psittaci* antibodies, and *Toxoplasma gondii* antibodies. All plasma was submitted to the Western Australian Department of Agriculture serology/virology section. Antibody to *Chlamydia psittaci* was measured using the complement fixation test (CFT) as described by Timms (1992). For ***Leptospira interrogans*** serovars *pomona*, *hardjo*, *tarassovi* and *icterohaemorrhagiae*, the microscopic agglutination test (MAT) described by Chappel (1992) was used to detect specific antibody. Antibody to *Toxoplasma gondii* was measured using a latex agglutination test kit (Toxolatex(R), Fumouze Diagnostics, Asnieres, France.). The tests were reported either as negative or at the reactive titre above the negative cut-off described for the procedure.

LEPTOSPIROSIS

Leptospirosis is a zoonotic bacterial disease. Wild rodents and domestic animals are the main reservoir of infection. It is shed in the urine of chronically infected cattle, other wild mammals and rodents. It produces jaundice, haemorrhages, kidney disease and abortions in the non reservoir host, and mild disease in the reservoir host. In the case of the Western barred bandicoot, the main relevance of testing for this disease is in the context of its zoonotic potential.

Of 20 EDTA plasma samples submitted, all microagglutination tests were negative for *Leptospira interrogans* serovar *hardjo*, *L. interrogans* serovar *icterohaemorrhagica*, *L. interrogans* serovar *pomona* and *L. interrogans* serovar *tarrassovi* antibodies. Serovars *hardjo* and *icterohaemorrhagica* occur in cattle in W.A., serovars *pomona* and *tarrasovi* occur in pigs in W.A., and both cross react with *L. interrogans* serovar *hardjo*. *L. icterohaemorrhagica* is the dominant serovar that occurs in domestic carnivores and marsupials in Australia.

CHLAMYDIOSIS

Chlamydia psittaci produces diseases in birds and mammals with a wide range of clinical signs ranging from asymptomatic infection to infertility and abortion to acute death. It is also a zoonosis. Of 20 plasma samples, 3 were positive for complement fixing antibody, although the titres were all borderline (8). This represents a true response at the lowest positive level. The pattern of chlamydial disease in mammals is such that there is a high immediate titre (64 and 128) which then tapers. It is therefore posible that a significant rise was missed and that the positive results represent prior rather than recent exposure. A likely source for the Dorre Island bandicoots is exposure to avian faeces.

There were 11 false positive responses due to EDTA producing anticomplementary reactions. These reactors are therefore difficult to interpret, however it is possible they are true low positive titres as for the above 3.

The results were as follows:

Female 43	8
Male 2	Negative
Number 74	64 AC
Male 92	Negative
Male 93	Negative
Number 1 26/8/92	32 AC
Male 90	Negative
Number 43 19/8/92	16 AC
Number 86 19/8/92	16 AC
Number 81-2 19/8/92	8
Number 80 19/8/92	8 AC
Number 84 19/8/92	8 AC
Number 81-1 19/8/92	32 AC
Number 81 19/8/92	Negative
Number 82 19/8/92	Negative
Number 81-2 19/8/92	8
Number 87 19/8/92	32 AC
Number 53	8 AC
Number 6 19/8/92	16 AC
Number 85 19/8/92	8 AC

(AC- anticomplementary reactions).

Ideally paired **serum** samples showing about a fourfold rise in titre over 3-4 weeks need to be taken to show active Chlamydial disease.

TOXOPLASMOSIS

Toxoplasmosis is a protozoal disease caused by the *Toxoplasma gondii*. It can produce pneumonia, encephalitis and myositis. Transmission in nature involves 2 main cycles:

1. From cats to intermediate hosts and back to cats and to humans through faecal contamination of the environment with oocysts that are generated during the intestinal stage in cats, mature in the outside environment, and are taken up in contaminated food or water.

2. From intermediate hosts to cats and to intermediate hosts (and to humans) when zoites that are generated in tissues outside the intestine by asexual reproduction are ingested.

The role of humans in both of these cycles is that of a dead end intermediate host. Predation and cannibalism amongst intermediate hosts is important in enzooticity.

One of the plasma samples submitted was positive on latex agglutination for Toxoplasma antibody. The animals ID was male number 2. This represents clear evidence of antibody to *Toxoplasma gondii*. The antibodies may be detected by latex agglutination tests for up to 8-10 months after the initial infection. This method however will not differentiate between animals with acute infection (usually young, previously seronegative animals), those with an endemic or chronic infection, and those with a recrudescent infection. It is possible that if this result was due to a low titre on the DAT (1:16), it might represent a non specific IgM reaction.

Given the assumed natural diet of Western barred bandicoots, the sole source of infection would presumably be cats. Should future blood samples be taken from Western barred bandicoots, it is recommended that samples be submitted to the W.A. State Health Laboratory for haemagglutination inhibition and fluorescent antibody testing, or to Mount Pleasant Laboratories, Launceston Tasmania (c/o Dr. David Obendorf), for direct and modified agglutination tests. The latter will enable differentiation between asymptomatic (carrier) infections, acute disease resulting from recent infection and recrudescent infection.

REFERENCES

Chappel RJ (1992) *Leptospirosis*, In *Australian Standard Diagnostic Techniques for Animal Disease,* edited by Corner LA and Bagust TJ, CSIRO Publications, East Melbourne, Victoria.

Timms P (1992) Chlamydiosis in birds, wild and domestic animals, In *Australian Standard Diagnostic Techniques for Animal Disease*, edited by Corner LA and Bagust TJ, CSIRO Publications East Melbourne, Victoria.

CHUDITCH SEROLOGICAL INVESTIGATION

STEPHANIE A. HAIGH BVSc.
JULY 1994

METHODS

Captive, wild and translocated chuditch were tested serologically as a part of the Health Monitoring Program for The Recovery Plan. Further details of the methodology, numbers and histories of the animals tested can be found in a paper by Haigh and Morris (1994) (in press).

SEROLOGY

Antibody to *Chlamydia psittaci* was measured using the complement fixation test (CFT) as described by Timms (1992). For ***Leptospira interrogans*** serovars *pomona*, *hardjo*, *tarassovi* and *icterohaemorrhagiae*, the microscopic agglutination test (MAT) described by Chappel (1992) was used to detect specific antibody. Antibody to *Toxoplasma gondii* was measured using a latex agglutination test kit (Toxolatex(R), Fumouze Diagnostics, Asnieres, France.). The tests were reported either as negative or at the reactive titre above the negative cut-off described for the procedure.

BACKGROUND

LEPTOSPIROSIS

Leptospirosis is a zoonotic bacterial disease. Wild rodents and domestic animals are the main reservoir of infection. It is shed in the urine of chronically infected cattle, other wild mammals and rodents. It produces jaundice, haemorrhages, kidney disease and abortions in the non reservoir host, and mild disease in the reservoir host.

The relevance of testing for Leptospirosis in the chuditch is that it is a zoonotic disease and also that it may be present in domestic farmed ruminants and domestic carnivores which are present close to or at the release site at Julimar Conservation Park, Batalling Nature Reserve, and the Perth Zoo.

RESULTS

Of 100 samples tested (a combination of Zoo animals before and after their release at Julimar Conservation Park, and wild Batalling animals) none were positive on microagglutination testing for *Leptospira interrogans* serovar *hardjo*, *L interrogans* serovar *icterohaemorrhagica*, *L interrogans* serovar *pomona* and *L interrogans* serovar *tarrassovi* antibodies. Serovars *hardjo* and *icterohaemorrhagica* occur in cattle in W.A., serovars *pomona* and *tarrassovi* occur in pigs in W.A and both cross react with *L. interrogans* serovar *hardjo*. *L. interrogans* serovar *icterohaemorrhagica* is the dominant serovar that occurs in domestic carnivores and marsupials in Australia.

Therefore this testing would have covered the whole possible range of serovars that the chuditch may have been exposed to.

TOXOPLASMOSIS

The test performed was a latex agglutination test for antibodies.

BACKGROUND

Toxoplasmosis is a protozoal disease caused by the protozoan parasite *Toxoplasma gondii*. It can produce pneumonia, encephalitis, myositis and abortion. Transmission in nature involves 2 main cycles:

1. From cats to intermediate hosts and back to cats and to humans through faecal contamination of the environment with oocysts that are generated during the intestinal stage in cats, mature in the outside environment, and are taken up in contaminated food or water.

2. From intermediate hosts to cats and to intermediate hosts (and to humans) when zoites that are generated in tissues outside the intestine by asexual reproduction are ingested.

Members of the family *Felidae* are the definitive hosts, and a wide range of wild and domestic mammals and birds are the intermediate hosts. Cats acquire infection by eating meat containing bradyzoites in tissue cysts or by ingesting infective oocysts. In the small intestine of the cat, the parasites go though a typical coccidian cycle resulting in the shedding of unsporulated oocysts in the faeces which sporulate after a few days and become infective. They may remain infective for up to a year depending on conditions. Cysts survive longer in wetter conditions.

The oocysts are ingested by the intermediate host and multiply in the reticuloendothelial sysytem for 2 to 3 weeks, then invade tissues as cysts. The cycle therefore requires cats for perpetuation, and in the absence of cats, there may be apparent seroconversion due to recrudescence of a previous infection. In latent infections there will be little or no antibody in the blood. If there is a recrudescence or a new infection, antibody rises quicky but may subside by the time clinical signs are obvious. In the United States 34% of cats are seropositive for Toxoplasmosis.

The disease can commonly be the latent and then become clinical if the hosts immune system is compromied. Harmless tissue cysts may thus rupture, invade susceptible tissues and produce active disease.

The role of humans in both of these cycles is that of a dead end intermediate host. Predation and cannibalism amongst intermediate hosts is important in enzooticity.

The antibodies may be detected by latex agglutination tests. This method however will not differentiate between animals with acute infection (usually young, previously seronegative animals), those with an endemic or chronic infection, and those with a recrudescent infection. Paired sera results will be most informative, although positive titres in some species may remain static for years. In the acute stages titres may be minimal and difficult to pick up serologically.

Should future blood samples be taken from chuditch, it is recommended that paired samples (check with the laboratory for the interval) be submitted to the W.A. State Health Laboratory for haemagglutination inhibition (this test may lack specificity) and fluorescent antibody testing, or to Mount Pleasant Laboratories, Launceston Tasmania (c/o Dr. David Obendorf), for modified direct agglutination tests. The former test may not be possible unless species specific antibodies can be used. The latter will enable differentiation between asymptomatic (carrier) infections, acute disease resulting from recent infection, and recrudescent infection.

RESULTS

Of a total of 100 samples tested (this number contains some repeat samples from the same animals) for *Toxoplasma* antibodies, 16 animals were positive at least once. Several animals were seropositive on serial sampling; and seroconversion was seen in several animals (see below). The numbers in brackets refer to the Murdoch University Clinical Pathology Reference Number. "New animals" refer to those not identified and to those not traceable to any release period from the Zoo.

TOXOPLASMOSIS RESULTS

ANIMAL ID (E/T No.) Sex	HISTORY	CLIIN PATH NO. RESULT
1778/1779 (male)	bled September 1993 (J) New animal	2008A/93/ positive
1877/1878 (male)	bled November 1993 (J) New animal	2647C/93/ positive
728/729 (male) I/P A 4D81E	bled July 1992 (Z) bled November 1993 (J) Sept 1992 release	1304B/92/ negative 2647E/93/ positive
1473/1786 (1315/1316) (male)	bled July 1992 (Z) bled May 1993 (J) bled November 1993 (J) Sept 1992 release	1304C/92/ negative 857B/93/ negative 2647J/93/ positive
1317/1318 (male)	bled July 1992 (Z) bled November 1992 (J) bled January 1993 (J) Sept 1992 release	1304D/92/ negative 2408C/92/ negative 114B/93/ positive
1303/1304 (male)	bled July 1992 (Z) bled January 1993 (J) bled May 1993 (J) bled September 1993 (J) Sept 1992 release	1299B/92/ negative 114D/93/ positive 864A/93/ positive 2008B/93/ negative*
1363/1364 (male)	bled Feb 1993 (B) bled May 20 1993 (Z) Batalling wild animal. Brought into Zoo April 1993 from Bataling for breeding season, bled late May at Zoo, not part of May Julimar resampling period.	217 D/ positive 972B/93/ positive

J = Julimar
Z = Zoo
B = Batalling

TOXOPLASMOSIS RESULTS

ANIMAL ID (E/T No.) Sex	HISTORY	CLIN PATH NO./ RESULT
1715/1716 (924/925)	bled Feb 1993 (B) bled May 1993 (J) Mar 1993 release	244K/93/ positive 880A/93/ positive
1761/1762 (male)	bled May 1993 (J) New animal	842A/93/ positive
1551/1474 (male)	bled Jan 1993 (J) bled May 1993 (J) bled Sept 1993 (J) bled Nov 1993 (J) Sept 1992 release	114H/93/ negative 857A/93/ positive 2034A/93/ negative 2647H/93/ negative
1305/1306 (male)	bled Nov 1992 (J) bled May 1993 (J) Sept 1992 release	2408B/92/ negative 864B/93/ positive
1719/1720 (male)	bled Feb 1993 (Z) bled May 1993 (J) bled Sept 1993 (J) Mar 1993 release	244M/93/ negative 880B/93/ positive 2008C/93/ negative
1342/1343 TA X/4 (male)	bled July 1992 (Z) bled May 1993 (J) Sept 1992 release	1314B/92/ positive 880C/93/ positive
1026/1027	bled May 20 1993 (Z) Wild Batalling animal brought to Zoo for breeding season	972A/93/ positive

J = Julimar
Z = Zoo
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SUMMARY OF CHUDITCH *TOXOPLASMA GONDII* SEROLOGY RESULTS

One hundred samples were tested. These consisted of a total of 69 individual animals; a combination of Perth Zoo animals before and after their release into Julimar Conservation Park, and wild Batalling Forest animals.

Of 69 animals tested for *Toxoplasma gondii* antibodies, 14 animals were positive at at least one sampling period. Three "new" animals (those that could not be traced back to a release from the Zoo, but were possibly wild animals or offspring of released animals) each bled at Julimar at one of the September 1993, November 1993, and May 1993 resampling periods were positive. Two animals released from the Zoo in September 1992 were each bled twice (one in July 1992 and November 1993, and the other in November 1992 and May 1993), and were negative on the first sample and had seroconverted by the second. One animal that was bled three times was negative in July 1992 (prior to its September 1992 release from the Zoo) and May 1993, and positive by November 1993. Another animal that was also negative in July 1992 at the Zoo (prior to its September 1992 release) was negative again in November 1992 and was positive by January 1993. An animal that was bled 4 times was negative in July 1992 prior to release from the Zoo in September 1992, positive in January 1993 and May 1993, and negative in September 1993 at Julimar.

An animal bled in February 1993 prior to its March 1993 release from the Zoo and another bled in July 1992 prior to its September 1992 release, were both positive initially and positive again when they were bled in May 1993. An animal that was bled in January 1993, May 1993, September 1993, and November 1993 had the following results respectively: negative, positive, negative, negative. Unfortunately this animal was not bled prior to its September 1992 release. An animal bled in November 1992 after its September 1992 release from the Zoo was negative then, but positive by May 1993. An animal bled in February 1993 prior to its March 1993 release from the Zoo was negative then, positive in May 1993, and negative by September 1993.

Toxoplasma gondii infection in wild chuditch

Two of a total of 17 individual wild animals from Batalling sampled for *Toxoplasma gondii* antibodies were positive. One was bled in February 1993 during the wild population survey and was positive. It was brought to the Zoo in April 1993 for the breeding season and had maintained this positive titre. The other animal was also brought to the Zoo in April 1993 and was positive, but it had not been bled in February 1993.

CHLAMYDIOSIS

BACKGROUND

Chlamydia psittaci produces diseases in birds and mammals with a wide range of clinical signs ranging from asymptomatic infection to infertility and abortion to acute death. It is also a zoonosis.

The test performed was a complement fixation test for antibodies. Of 100 serum samples tested, all were negative. For this test in future it is important to submit serum only (instead of anticoagulated plasma) as EDTA and possibly heparin interfere with the complement fixation test.

REFERENCES

Chappel RJ (1992) *Leptospirosis*, In *Australian Standard Diagnostic Techniques for Animal Disease,* edited by Corner LA and Bagust TJ, CSIRO Publications, East Melbourne, Victoria.

Haigh SA and Morris KD (1994), A Health Monitoring Program for Captive, Wild and Translocated Chuditch (*Dasyurus geoffroii),* In *Proceedings of the Australian Association of Veterinary Conservation Biologists Meeting*, Australian Veterinary Association Conference, Canberra, March 1994.

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WESTERN QUOLL AND SOUTHERN BROWN BANDICOOT ANAESTHESIA

STEPHANIE A. HAIGH
JULY 1994

WESTERN QUOLL AND SOUTHERN BROWN BANDICOOT ANAESTHESIA TRIAL, CALM LESCHENAULT OFFICE MAY 17 1994 AND MAY 23 1994.

STEPHANIE A. HAIGH
JUNE 1994

6 QUOLLS AND 2 BANDICOOTS TRAPPED AT HONEYMOON POOL 17/5/94, PLUS ONE QUOLL TRAPPED AT ? ON 22/5/94.

Drugs used:
ketamine HCL 100 mg/ml
xylazine 20 mg/ml
Zoletil (tiletamine HCL and zolazepam) 20mg/ml.

QUOLL NO.1, MALE

Weight 1.585 kg

Given **17 mg/kg (26.9 mg) ketamine, 5 mg/kg (7.9 mg) xylazine** I/M, RR 64 6 minutes after injection, at 7 minutes still some sensitivity to noise, 8 minutes reacting to stethoscope, 10 minutes still shivering and reacting to noise, 14 minutes RR 36 HR 52, at this point still lifting head and looking around., 17 minutes minimal effect from anaesthetic.

At 24 minutes **topped up with 1/3 of the original dose of ketamine and xylazine** (8.8 mg ketamine, 2.6 mg xylazine). No reaction to top up injection, but 2 minutes later some paddling and other extrapyramidal reactions started., 29 minutes still some movement and animal appeared to be very hot, 33 minutes RR 40 and some twitching, at 35 minutes some reaction to being ear tagged. At 49 minutes not enough anaesthetic effect to enable the animal to be bled.

At **one hour post original injection** the animal was moving completely normally and would be OK for release.

Total dose 35.7 mg (22.52 mg/kg) ketamine, 10.54 mg (6.65 mg/kg) xylazine.

Comments

This dose was too low initially and the subsequent top up dose did not significantly deepen the animal, instead there were some undesireable reactions from the ketamine

QUOLL NO. 2, FEMALE.

Weight: 0.838 kg

Given **18.4 mg ketamine (22mg/kg), 4.19 mg xylazine (5mg/kg)** I/M

No reaction to initial injection, RR 88 at 5 mins post injection, HR 196 at 7 minutes post injection. At 9 minutes the animal was still reacting to restraint, and at 10 minutes it was still moving its head and looking around. Top up at 19 minutes with 9 mg ketamine, 2.09 mg xylazine (1/2 of original dose). There was a reaction to this needle and some struggling from the restraint. At 21 minutes there was some vocalising.

Total dose ketamine 27.4 mg (32.6 mg/kg), xylazine, 6.28 mg (7.49 mg/kg).

Comments

The initial dose was again too low, and the higher top up dose (1/2 of original) was ineffective.

QUOLL NO. 3, MALE?

Weight 1.645 kg

Given 44 mg **ketamine (27 mg/kg) and 8.2 mg xylazine (5 mg/kg)** I/M. There was no reaction to the initial injection, at 2 minutes post injection the RR was 44 and sporadic, and at 5 minutes the HR was 240, the **time to effect was 6 minutes,** at 25 minutes the animal started to struggle, and attempted bleeding at 36 minutes failed due to increased struggling. At 47 minutes there was some excessive activity during recovery in the bag, nd at 50 minutes the animal was still a little shaky.

Comments

This dose gave **effective immobilisation for approximately 15 minutes only.** The ketamine dose may have been too high relative to the xylazine dose (shaking and inappropriately increased activity during recovery).

QUOLL NO. 4, MALE?

Weight 1.128 kg

Given 31.58 mg **(28 mg/kg) ketamine, 6.2 mg (5.5 mg/kg) xylazine** I/M. The animal was still moving around at 5 minutes post injection, at 11 minutes it was still quite alert and reacting to noise, at 21 minutes reacting to noise and muscles tense, at 28 minutes the animal seemed to deepen, there was less movement and this immobilising dose lasted for another 30 minutes when spontaneous head movement started. The **best effect seemed to be between 28 and 53 minutes** post initial injection. The animal was not bled due to difficulties in visualising the jugular vein.

Comments

This gave a good level of immobilisation. With the higher xylazine dose the time to acceptable effect (30 minutes) and total recovery time (2-2 1/2 hrs) was relatively longer than previous anaesthetics.

QUOLL NO 5, MALE (?)

Weight 1.183 kg

Given 9mg/kg (10.65 mg) **Zoletil (20 mg/ml)** I/M. This dose was worked out from previous trials in *Myrmecobius fasciatus* (Haigh, unpublished, 1994). At 2 minutes post injection RR 92, at 4 minutes still reacting to handling, at 6 minutes taken out of bag well immobilised, minimal movement, HR at 7 minutes 220. At 15 minutes some paddling started and at 16 minutes there was resistance to being held and paddling, and at 19 minutes there was a failed attempt to bleed the animal. At 33 minutes there was an increased response to touch. At 47 minutes another attempt was made to bleed the animal but strong resistance and foreleg movements made this impossible.

Comments

Zoletil gave rapid smooth induction at this dose rate, however the duration of the effect was short (shorter than the ketamine/xylazine combination). **A higher per kilogram dose of this drug would not be recommended. Topping up with further I/M doses (ie giving more than the first injection) would also not be recommended for this drug.**

Time to effect:	6 minutes
Duration of immobilisation:	15 minutes
Time to full recovery:	1 hour

QUOLL NO.6, MALE

Weight 1.884 kg, male (?)

Given 47.1 mg **(25 mg/kg) ketamine and 11.3 mg (6 mg/kg) xylazine I/M,** at 10 minutes post injection the animal was out, and there was only slight movement, no reaction to skin over back being pinched as if for implanting. At 13 minutes some muscle rigidity was present, and at 23 minutes there was a lot of pawing and stuggling - too difficult to bleed and restrain at 40 minutes. At 48 minutes the animal resented being ear tagged and measured. Details of recovery times (?)

Comments

This dose gave a more rapid induction (10 minutes) and **effective immobilisation for 15 minutes.** The induction may have in fact been quicker than 10 minutes (the animal was not pulled out of the bag until 10 minutes and was well immobilised by this stage).

QUOLL NO.7, MALE

WEIGHT	1.428 kg		
DATE	23/5/94		
Head	104.9	**Collar frequency (nom)**	151.389
Foot	69.6	**Collar frequency (act)**	151.386.2
Ear tag	Reflective (white left ear)	**Collar wt.**	17 grams
Trovan	00-01BB-E193		

Anaesthetic record

Induction dose of 27 mg/kg (38.56 mg) ketamine I/M and 6 mg/kg (8.56 mg) xylasine I/M at 5 42 pm. At 8 minutes post induction heart rate 128, respiratory rate 44, some head movement, at 13 minutes head swaying, at 15 minutes **topped up** with 1/2 dose again of ketamine and 1/3 dose xylasine I/M, at 24 minutes some involuntary movement, but seemed sedated (tongue and penis out), at 31 minutes excessive muscle rigidity became obvious (tail and 2 legs rigid). Collaring the animal at this stage did not seem to cause any problems. At 35 minutes required restraining for collaring, at 37 minutes reacting to the above and vocalising. At 38 minutes minor reaction to ear tagging although it was still able to be carried out. At 19 minutes started to recollar the animal as the collar may have been too tight.

At 43 minutes required holding whilst being recollared, at 58 minutes rebagged, at 63 minutes still moving around in bag a little. At around 15 minutes after the animal was bagged, it started showing very violent paddling, head shaking/excessive activity/urination and distress responses. This continued for another 45 minutes then the animal gradually quietened down.

Total dose ketamine 57.84 mg, total dose xylasine 11.4 mg.

Comment:

If topping up is needed do not exceed 1/3 of the original dose of ketamine, it is assumed that the undesireable recovery reaction in this animal was due to too much ketamine.

SUGGESTIONS FOR FUTURE QUOLL ANAESTHETICS

Use stronger xylazine (50 or 100 mg/ml) to reduce syringe volume and therefore minimise stress and reaction from initial or top up doses.

The duration of effective immobilisation (and length of time to recovery) seems to be related to the amount of xylazine given. Total doses of **ketamine higher than 27 mg/kg may result in undesireable extrapyramidal reactions** during recovery (paddling/vocalising/seizure-like activity/extreme distress).

In general try to avoid topping up at all, but if it is necessary a general rule is to use 1/3 of the original dose of each of ketamine and xylazine I/M. Top up at 15 minutes If there is not an obvious effect from the original dose within this time (the animals activity has been **increasing** over this period). Topping up later with 1/3 of the original dose will not be effective, and topping up later with more than 1/3 extra is not recommended (due to ketamine reaction).

Do not top up with Zoletil.

BANDICOOT ANAESTHESIA

BANDICOOT NO 1, MALE

Weight 0.971 kg

Given **20 mg/kg (19.41 mg) ketamine and 5 mg/kg (4.85 mg) xylazine** I/M. There was no reaction to being hand injected in the bag At 7 minutes RR 48, reacting to being touched, at 10 minutes taken out of bag, laid quietly for a while but then escaped and was able to run quite well around the room. At 20 minutes topped up with 1/3 the original dose of ketamine/xylazine **(6.4 mg ketamine, 1.65 mg xylazine)** I/M, and there was some reaction, at 21 minutes still some movement in the bag, at **31 minutes** taken out of bag and appeared to be **moderately anaesthetised,** although there was some reaction to when it was taken out of the bag initially. At 31 minutes the HR was 124 (arrhythmic), the RR was 44 and there was some reaction to the stethoscope. At 33 minutes the animal did not react to being ear tagged however it did react to having its jugular vein held off. At 37 minutes the animal tolerated measuring quite well, and at 42 minutes it allowed shaving for bleeding, however swabbing caused some reaction.

Total dose: 25.81 mg ketamine (26.5 mg/kg), 6.5 mg xylazine (6.69 mg/kg)

Comment:

The initial dose was too low. The total dose provided a good level of anaesthesia for collaring and measuring but bleeding may have required more. Giving the total dose (26.5 mg/kg ketamine and 6.69 mg/kg xylazine) **initially** may have resulted in a dose that was too heavy.

BANDICOOT NO.2 , MALE

Weight 1.185 kg

Given **25 mg/kg (29.62 mg) ketamine and 5 mg/kg (5.92 mg) xylazine** I/M. Shortly after injection RR 32 HR 72, at 8 minutes taken out of bag, but was still too awake, at 11 minutes taken out and scratched the handler (quite violent response to being taken out of bag). **At 15 minutes immobilised.** At 16 minutes did not react to being ear tagged, at 19 minutes reacting to noise, at **22 minutes the dose seemed to be having its maximal effect.** At 25 minutes there was no pain response to a significant toe pinch, given 0.15 ml (3 mg) dopram I/M as the animal appeared to be quite deep, RR 32, HR 100. At 36 minutes there was some voluntary movement in the hind legs, and **at 66 minutes the animal was recovered.**

Comments:

The time to maximal effect was 22-25 minutes. 8 minutes was too soon to attempt to remove the animal from the bag initially. Generally this dose was too heavy, and the recovery prolonged. Try less ketamine, maybe 23 mg/kg and 3-4 mg/kg xylazine.

Recommendations for Southern Brown Bandicoot Anaesthesia.

From 2 animals only it is difficult to make definitive statements, but it would appear that the tolerance range for ketamine and probably xylazine in this species is fairly narrow. Generally try **ketamine at 22-24 mg/kg and xylazine 3-5 mg /kg.** Tend towards the upper end (especially for the xylazine) in young males or animals that seem particularly unsettled or stressed in the bag.

GENERAL RECOMMENDATIONS:

Minimise as much as possible restraint or handling of the animal before the anaesthetic. Pre weigh bags, and peel the bag down to expose the leg rather than restraining the animal for the injection. Animlas will generally not respond to the injection if it is delivered quickly through a fine gauge needle, and is a small volume.

If an animal is particularly jumpy, aggressive or distressed prior to the anaesthetic, and does not appear to be affected by the initial dose, abort the procedure until the animal has calmed down and has no effects from the first dose.

If there are any ketamine reactions (see above) during the anaesthetic do not give any more ketamine.

DISCLAIMER

The drugs listed above are not registered for use in quolls or bandicoots . They have not been tested with therapeutic trials and may therefore result in undesireable reactions or death.

It is recommended that a Veterinary Surgeon obtain and administer the above S4 drugs in accordance with the Veterinary Surgeons Act and the Poisons Act.