NUMBAT RECOVERY TEAM

ANNUAL REPORT

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by Tony Friend

for

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SUMMARY

The numbat population at Dryandra is one of the only two original populations surviving, and has been used as the primary source of animals for the reintroduction program. In 1993, after rising steadily since the introduction of a fox-control program, the Dryandra population dropped to about half of its 1992 size. Since then, surveys in 1994 and 1995 have shown that the numbat sighting rate has remained close to the level it fell to by the end of 1993, indicating that population numbers have stabilised at the level that can be sustained by the resources available. Surveys at Boyagin NR, the first reintroduction site, and at Montague, an outer block of Dryandra, indicate a similar pattern of steady population increase, which has been followed in the longest-monitored populations (Dryandra and east Boyagin) by a rapid fall to a lower (sustainable) level. Monitoring of radio-collared animals at Dryandra has not revealed any unusual mortality there since early 1994.

Monitoring of radio-collared animals at reintroduction sites at Tutanning, Batalling, Karroun Hill, Yookamurra and Karakamia continued in 1995. Problems with radio-collars and/or batteries have led to loss of signals at all sites and obscured the status of the populations in some cases. These problems have been sorted out for future translocations, and driven surveys and diggings searches will be used more widely as an alternative to radio-tracking in 1996.

During 1995, a new reintroduction site was established at Dragon Rocks Nature Reserve between Lake Grace and Hyden. A fox control program comprising six ground and two aerial baitings each year was implemented in September and a numbat release site was chosen. In December twenty animals were translocated there from Dryandra, while nine were translocated from Dryandra to Batalling.

INTRODUCTION

The Numbat (*Myrmecobius fasciatus*) is one of Australia's more threatened mammals. Since European settlement, its distribution has shrunk to less than 1% of its former extent and numbers had fallen well below 500 by the late 1970s. Intensive research aimed at the conservation of the species commenced in 1980, and even since then a number of small populations have become extinct. Total population numbers are still below 1500, and a very substantial increase in population numbers is required before the Numbat can be regarded as secure.

Only two original populations have survived, at Dryandra Woodland and Perup Nature Reserve in the south-west of Western Australia. Fox control by regular distribution of 1080 meat baits has caused substantial increases in those two populations. A re-introduced population, at Boyagin Nature Reserve 40 km north of Dryandra, is now self-sustaining. Further Numbat populations are being established through translocation, largely from Dryandra, to areas of former occurrence in Western Australia and at one site in South Australia (Friend 1994).

The Numbat Recovery Team was established in 1993. The Numbat Recovery Plan was completed in 1994 and submitted to the Australian Nature Conservation Agency (ANCA) for funding. The Plan presents objectives and criteria for recovery of the species and specifies a number of actions to achieve recovery, extending the conservation program that has been in progress since the early 1980s (Friend 1994). Commencing in January 1995, the Western Australian Department of Conservation and Land Management received funding from through ANCA's Endangered Species Program to implement the Numbat Recovery Plan. This is the third annual report of the Numbat Recovery Team and it summarises the progress on actions scheduled in the Recovery Plan for 1995.

MEMBERSHIP

The membership of the Numbat Recovery Team at the commencement of 1995 was as follows:

Tony Friend (Chair)	CALM Division of Science and Information
Rob Brazell	CALM Collie District, Central Forest Region
Paul Brown	CALM Swan Region
Andrew Burbidge	CALM WA Threatened Species and Communities Unit
Peter Copley	SA Department of Environment and Natural Resources
Bob Hagan	CALM Southern Forest Region
Graham Hall	Perth Zoo
David Mitchell	CALM Wheatbelt Region
Ray Nias	World Wide Fund for Nature Australia
Sally Stephens	Australian Nature Conservation Agency, Endangered Species Program

In October 1995 Graham Hall left Perth Zoo and was replaced on the Team for the November meeting by Colin Hyde, Director of Conservation, Perth Zoo.

MEETINGS

The Recovery Team met in Western Australia twice during 1995. Meeting 5 was held at the Western Australian Wildlife Research Centre, Woodvale on 30 June 1995. Meeting 6 was held at CALM's Hills Forest Activity Centre, Mundaring, on 16 November 1995.

RECOVERY PLAN STATUS AND FUNDING

The Numbat Recovery Plan was completed and submitted to ANCA in May 1994 as an application for funding under the Endangered Species Program in 1994/95. The Recovery Plan establishes a series of actions to be carried out over the 10 years from 1995-2004. This application was successful, and the funding requested was granted in full. ANCA funding for work in 1995 totals $70 200.

PROGRESS ON RECOVERY PLAN ACTIONS

Action 1. Management of existing populations and habitat

The Recovery Plan refers to three "existing populations" of numbats, comprising those at Dryandra and Perup-Kingston, which are the only surviving original populations, and at Boyagin, where numbats were reintroduced in 1985-1987 resulting in the establishment of a self-sustaining population.

Action 1.1. Exotic predator control

Fox control by baiting with 1080 dried meat baits is now part of CALM's routine management procedure at Dryandra Woodland, Boyagin Nature Reserve and Perup Nature Reserve-Kingston State forest. Baiting is carried out at four-week intervals (13 times per year) in the main block of Dryandra (13 000 ha) and at Boyagin (5 000 ha). This regime has been shown to cause increases in medium-sized mammal populations in these areas (Kinnear *et al.* 1988, Friend 1990, Kinnear 1990, Friend in press, J.E. Kinnear unpublished data) and twice per year at Perup-Kingston. The area under fox control at Perup-Kingston is now approximately 60 000 ha. The large extent of this baited area provides a significant buffer to strategic areas, so more frequent baiting is not considered necessary. In addition, an experimental fox control program, with baiting at eight-week intervals, has been carried out since January 1989 in Montague block at Dryandra, an area of 5000 ha separated from the main block at the closest point by 100 m of farmland. The numbat population in Montague block is monitored by an annual driven survey and diggings searches, to measure the effectiveness of this regime.

Action 1.2. Monitoring of existing populations

Dryandra

The Recovery Plan (Friend 1994) described recent changes in the numbat population at Dryandra. After a steady increase in the sighting rate following the introduction of fox control in 1982, there was a dramatic decline during 1993 so that the sighting rate in November 1993 was less than half the value recorded in November 1992. Several hypotheses have been advanced to explain the decline: a) a readjustment following the increase of the population beyond the carrying capacity of the environment, b) the effect of an infection by an acanthocephalan parasite recorded in Dryandra numbats that has been shown to cause death, c) an increase in fox predation following a change in the baiting regime between June 1992 and June 1993, or d) an increase in predation by cats.

In 1994, several measures were introduced at Dryandra to monitor population numbers and factors affecting the population more intensively. Firstly, groups of numbats were radio-collared to monitor their survival and to ascertain the principal causes of mortality. Secondly, an annual extra

driving survey, in April, was implemented (see below). Thirdly, bi-annual spotlighting surveys were implemented to detect and monitor fox presence. The health monitoring program (see below) should also reveal if unusually high levels of parasitic infection are present.

Driven surveys

The population at Dryandra has been monitored by an annual driven survey carried out in November-December. However, at the Recovery Team meeting in December 1994 it was resolved to carry out an additional driving survey at Dryandra in April each year for the next few years, because of the need to keep a closer watch on the population there given the recent decline in numbers. During 1995, therefore, driven surveys were carried out at Dryandra in April and November-December. The procedure is to drive along a set route of about 65 km during those times of day when numbats are active, six times over a period of two weeks, recording numbat sightings.

In addition, the annual driven survey was also carried out in Montague block in December 1995 to assess the effectiveness of the baiting regime there. Here, a set route of about 30 km is driven during those times of day when numbats are active, three times within a week, recording numbat sightings.

Results

Fifteen numbats were sighted during the April 1995 survey of the Dryandra main block, giving a sighting rate of 3.9 sightings per 100 km. During the November-December 1995 survey, 19 numbats were sighted, at a rate of 4.9 sightings per 100 km. Figure 1 shows the numbat sighting rates in November-December surveys in the main block since 1985. These sighting rates indicate that the decline of 1992/93 was short-term and that population numbers have probably stabilised, at a lower level than the maximum achieved in 1992. This supports the hypothesis that the numbat population outstripped resource availability in 1992 and that the decline was a consequent adjustment.

The sighting rate at Montague block in December 1995 was 13.6 sightings/100 km. As shown in Figure 1, the Montague sighting rate has risen steadily (with the exception of 1994), mirroring the rise at Dryandra but with a lag of about three years. If the hypothesis that the Dryandra population exceeded carrying capacity, and has now fallen to a more sustainable level is correct, the Montague population might be expected to experience a similar readjustment soon. In any case, the Montague results indicate that two-monthly baiting has been effective there, although it should be remembered that monthly baiting is in effect very close by in the Dryandra main block. We can say with some certainty that two-monthly baiting should be sufficient in the outer blocks of Dryandra while the monthly baiting regime is in force in the main block.

Monitoring of radio-collared animals at Dryandra

In April 1994, seven numbats were radio-collared at Dryandra for monitoring. Another 10 were collared in November-December 1994 and at the commencement of 1995, 12 numbats were still alive and transmitting. During the April 1995 driven survey another seven numbats were radio-collared. Each month every animal is located and either its movement monitored or it is sighted (usually in a log) to ascertain whether or not it is alive.

Results

Of the 19 numbats monitored at Dryandra during 1995, five were still alive and transmitting at the end of December (Table 1). Eight animals had suffered loss of signal, in common with many collared numbats at the reintroduction sites, a result of transmitter or battery failure (see below). One animal had been taken to Perth Zoo and has now become part of the breeding colony there. Five animals were found dead. Two had been taken by raptors, one by a carpet python, one was taken by an unknown predator (possibly a cat) and one was found dead with no signs of predation but too decomposed to allow a useful post-mortem.

The results of monitoring individual numbats have been clouded by the high rate of transmitter loss, as at the reintroduction sites. The deaths recorded indicated that no single source of mortality accounted for an unusually high number of individuals. The low mortality rate indicates that, if the decline of 1992/93 was driven by increased mortality, rather than decreased reproduction, this decline is not continuing. This supports indications from the results of the driven surveys that population numbers have stabilised since the decline.

Fox increase at Dryandra

Regular spotlighting surveys using three standard routes driven twice every six months have indicated that fox numbers are not rising. In June 1994, after a year of a lower intensity baiting regime at Dryandra (baits spread at 200 m, rather than at 100 m intervals along the baiting route), one fox was sighted during these surveys. Since the re-institution of the previous baiting regime, no foxes have been sighted on these surveys.

Perup

Driven surveys were carried over 261 km at Kingston to capture numbats for the study on the effects of logging. Three numbats were sighted, at a rate of 1.2 sightings per 100 km. This compares well with previous sighting rates at Perup (0.95 /100 km in December 1993 and 1.34 /100 km in February 1994). The population at Perup-Kingston appears to be at least stable, if not increasing, as indicated by the more widespread sighting reports from the region. With the cooperation of CALM Manjimup District staff, a series of three permanent survey routes has now been established in Perup and Kingston, and an annual February survey will commence in 1996.

Boyagin

Since the reintroduction of numbats to Boyagin Nature Reserve in 1985-87, monitoring of the resulting population has involved radio-tracking for the first 4 years, then diggings searches since 1989 to reveal the extent of colonisation of the reserve, and driven surveys since 1992. Diggings searches and driven surveys are now conducted each year in both the east and west blocks of the reserve (most numbats were released into the east block). In November 1995, diggings searches were carried out at 22 monitoring sites in numbat habitat in the east block, and an intensive diggings search (searches at 200 m intervals along most firebreaks) was carried out in the west block. The driven survey consisted of a circuit in each block driven six times (a total of 230 km in the east block and 195 km in the west block).

Results

The diggings searches showed that the east block had slightly fewer sites occupied in 1995 than in 1994. In the west block, however, significantly more sites were occupied than in 1994, and more areas of apparently suitable numbat habitat showed signs of numbat presence., This indicates that

the population was still expanding in 1995. Driven surveys bore this out, with an increase in sighting rate from 1.23 /100 km in 1994 to 3.08 /100 km in the west block in 1995. In the east block, there was a slight recovery from the drop to 1.73 /100 km in 1994 to 2.17 /100 km in 1995 (see Figure 1).

These data confirm the conclusion that the Boyagin population is self-sustaining, given that only three numbats have been released there since 1989. There is also an indication that the east block exceeded carrying capacity in 1993, and that there has been an adjustment since then to the current sustainable level. The numbat population in the west block still appears to be increasing.

Action 1.3.1. Effectiveness of silviculture guidelines

In February 1995, two numbats (a male and a female) were caught and radio-collared in areas due to be logged at Kingston State Forest, near Perup. They were radio-tracked intensively over the next two weeks in order to establish the size and location of their home ranges prior to logging. Night refuge logs were recorded and mapped. Logging has now proceeded in the areas where the numbats were resident. Post-logging refuges have been recorded and mapped. Both animals remained in the logged areas. Further intensive radio tracking was to have been carried out at intervals over the following 18 months. However, the signals from both animals were lost before this could be accomplished. The exercise will be repeated early in 1996 when survey will be carried out in Kingston coupes still to be logged.

Action 3. Translocation program

Action 3.1. Selection of reintroduction sites

With the cooperation of CALM staff from the Katanning District, selection for the release site at Dragon Rocks was finalised in November 1995. During a field trip to Dragon Rocks, a number of potential release sites were examined, and final selection was made using the following criteria:

1) presence of woodland;
2) presence of release, shelter and nest hollows;
3) significant distance from farmland.

The selected site was used for the release of animals translocated from Dryandra in November/December 1995.

Action 3.2. Exotic predator control

This action concerns fox control at numbat reintroduction sites in the translocation program. Current translocations under the Recovery Plan comprise those to Batalling Forest, Tutanning Nature Reserve and Dragon Rocks Nature Reserve. In addition, translocation to Karroun Hill NR has been suspended under the Recovery Plan until cat control can be implemented there, but fox control is continuing in order to protect the numbat population established by translocations between 1986 and 1993. Translocations to Karroun Hill are proposed in the Recovery Plan for 1997-1999. Fox control is also carried out when necessary at the fenced properties where numbat reintroductions are under way (Yookamurra and Karakamia).

Batalling and Tutanning

Fox control by baiting at Batalling (3-monthly) and at Tutanning (monthly) has been carried out under pre-existing programs during 1995, funded by CALM.

Karroun Hill

Fox control by aerial baiting with 1080 meat baits at a rate of 7.5 baits per km^2 over 40 000 ha surrounding the release site at Karroun Hill NR is carried out twice per year. During 1995, baiting flights were carried out on 4 April and 2 October with funding from this project.

Cyanide bait transects (two transects 5 km long, with bait stations at 200 m intervals according to the methodology of Algar and Kinnear 1992) were laid and monitored within the baited area at Karroun Hill for three nights between 31 January and 3 February 1995 to measure the effectiveness of the 1080 baiting regime. Despite the time elapsed since the previous aerial baiting on 5 October 1994, no foxes were killed and no signs of foxes were detected. This is indicative of the low numbers of foxes in that country at the present time.

Cyanide transects were used again at Karroun Hill in September 1995, but this time using three baits per station, two of which were the fox baits of Algar and Kinnear (1992) and the third a cat bait developed by Dave Algar, with a visual lure at each station. Transects were set up on 15 km of track and run for three nights. No baits were taken by either cats or foxes, and only one set of cat tracks was seen, between bait stations. Both cats and foxes appear to be currently at very low densities at Karroun Hill. The indication is that the years of fox baiting at Karroun Hill have not resulted in a greatly increased density of cats as had happened in more arid areas (Short 1994, Christensen and Burrows 1994). During 1996, another cat/fox survey will be carried out in March when prey (especially rabbits) is in short supply.

Dragon Rocks

Prior to the release of numbats at Dragon Rocks NR in November 1995, a program of fox control funded through this project commenced in September 1995. Until then, a less intensive baiting program was carried out on the reserve by CALM Katanning District under a WWFA-funded program to examine the effect of fox control on populations of the western mouse *Pseudomys occidentalis*.

On 29 September 1995, a combined ground and aerial baiting operation was carried out on the reserve, involving the distribution of dried meat baits containing 4.5 mg of 1080 at 100 m intervals along the reserve perimeter and 2000 baits from the air along lines 1 km apart at a rate of 6.25 baits/km^2. The new baiting regime for Dragon Rocks comprises two aerial baitings per year (in April and September) and six vehicle-based baitings spread between them, resulting in eight baitings per year. Baiting from the ground involves distributing baits at 100 m intervals along the perimeter and most internal tracks. Ground-only baiting was carried out during the weeks commencing 20 November and 11 December 1995.

Action 3.3. Initial translocation to Dragon Rocks NR

The reintroduction of the Numbat to Dragon Rocks NR was proposed in the Numbat Recovery Plan. A translocation site in the eastern wheatbelt was considered desirable in addition to jarrah forest and western wheatbelt sites order to provide more habitat diversity under which the species could continue to evolve. One of the problems encountered at Karroun Hill has been the lack of a

barrier to dispersal in the early stages of reintroduction, resulting in the loss of contact between some animals and the rest. Dragon Rocks is completely surrounded by farmland, and experience (e.g. at Boyagin NR) has shown that newly-released adults and dispersing young rarely cross farmland. A translocation proposal was prepared for this operation under CALM Policy Statement No. 29, covering the release of 20 numbats per year for at least three years at Dragon Rocks NR. and the translocation was approved by the Director of Nature Conservation. Dryandra was given as the source of animals in the first year, but the possible use in later years of animals from Perup or captive-bred stock was also foreshadowed.

During November and early December, twenty numbats were captured at Dryandra, fitted with radio-collars and released. Numbats were recaptured immediately before transfer to Dragon Rocks, thus minimising the time that animals were held before release. The first group, comprising 14 animals, was released at the selected release site at about 10 am on 30 November 1995. A further four animals were released on 6 December, and two more on 19 December 1995. The composition of the translocation group was four adult males, four juvenile males and twelve females.

Aerial and ground searches to locate the released numbats are scheduled for early January 1996, and monitoring will continue throughout the year.

Action 3.4. Monitoring of reintroduced populations

Most of the monitoring of reintroduced populations consisted of regular checking of radio-collared animals, and attempts to maintain functioning radio-collars on these animals.

Karroun Hill

No numbats were translocated to Karroun Hill NR in 1994, in accordance with the Numbat Recovery Plan. Two radio-collared females, both progeny of translocated females and unknown males, remained from the previous reintroduction project. In October 1994, the three young of one of these females were caught and collared, but the other female's litter evaded capture. Only two of the three young were located again, and both were victims of predation by raptors. During the year, the two adult females were also found dead, one taken by a raptor and the other by an unknown predator.

Over the last five years numbat diggings found outside the home ranges of radio-collared animals have been recorded during walks through the bush at Karroun Hill. The significant frequency of these and the high rate of reproduction by radio-collared females remote from known males indicates the existence of a numbat colony in the reserve, at least within a five kilometre radius of the release site. During the September 1995 cat/fox survey at Karroun Hill, numbat diggings were found in one of three areas searched. Further searches will be carried out in 1996.

Batalling

Batalling was the site of the major translocation effort in December 1994. This was the third year of translocation to this area. Twenty numbats were scheduled for release there and the availability of captive-bred young from Perth Zoo provided an opportunity to compare the survival of wild-caught versus captive-bred individuals in this kind of release. Consequently 10 wild-caught animals were translocated from Dryandra to Batalling on 1 December 1994. It was intended to release 10 zoo-bred numbats at about the same time, but only seven had achieved the minimum weight for collaring and release (350 g) by the proposed release date. These seven were released on 21 December 1994. The other three zoo-bred young were released at Batalling on 20 January 1995

after attaining the desired weight. In addition, five young born at Batalling had been collared in October 1994, and there was one remaining radio-collared adult from earlier releases.

The release site used in 1992 and 1993 was the section of Varis Road between Dons Road and Ernie Road in Batalling block. Since the first numbat release, the chuditch (*Dasyurus geoffroii*) population in this area has grown dramatically in response to fox baiting and during 1994 several radio-collared numbats were taken by chuditch. The high density of chuditch is a very local phenomenon, however, so in 1994/95 a new release site, where trapping studies (R. Brazell, pers. comm.) had shown that chuditch numbers were much lower, was used. This was in an adjacent area to the north of the first site, along Dons, Steed and Onion Roads in Godfrey and Hillman blocks.

The fate of 15 of the 26 animals collared since the beginning of October 1994 at Batalling is not known (Table 2) because their signals were lost (or in one case, the animal dropped its collar). Of these, nine were never located after release, despite five searches from the air extending 15 km in all directions and 20 km through the unbroken forest belt to the north. The two animals located furthest from the release sites were found 11.5 km and 10 km away, so it is conceivable that some may have moved outside the search area. It is more likely, however, that most of these transmitters failed. Another four numbats were located from the air in the general release area weeks after release but not found during subsequent ground searches. These animals should have established home ranges by this time, given our observations from earlier releases. It is likely that their transmitters failed between the air and ground searches, a period of days or, in one case, weeks. Seven animals were found alive and the remains of four more were found by ground searches after their transmitters were located from the air. Predation was the cause of the four deaths recorded. Two of these were taken by birds of prey, but in the other two cases it was not possible to determine whether the predator was a bird or a mammal.

The high rate loss of signals clouds the comparison of wild-caught versus zoo-bred animals, but the data available point to better survival of the wild-caught stock. All three zoo-bred young located had died, whereas only one of the six Dryandra animals located was dead. The comparison is further complicated, however, by the fact that those six Dryandra animals comprised two adults and four juveniles, whereas the zoo-bred animals were all juveniles and might therefore be expected to have a lower survival rate. The dead Dryandra animal was a juvenile.

During 1996, the monitoring program at Batalling will be extended through the commencement of diggings searches and driven surveys. It will be easier to assess the success of the Batalling reintroduction once the results of these exercises are available.

Tutanning

Loss of signals also plagued efforts to monitor the 1994 translocation to Tutanning (Table 2). The 1994 translocation plan involved the translocation of 15 numbats from Dryandra to Tutanning if the 1994 Dryandra driven survey showed that the population was recovering from the 1992/93 slump. With the discovery that the population was still at or just below the November 1993 level, the Tutanning translocation was discussed at the December Numbat Recovery Team meeting. During the year two young had been collared at Tutanning, and the presence of these animals as well as the availability of six or seven zoo-bred young for release was seen as a way to progress the Tutanning reintroduction without putting further pressure on the Dryandra population. Additional animals caught at Dryandra would instead be collared and released to provide further data on the rate and causes of mortality in the Dryandra population. One Dryandra animal had already been released at Tutanning in December 1994, and with the two site-bred young, one resident radio-collared adult and six zoo-bred young released on 20 January 1995, made a total of 10 radio-

collared animals in the reserve. Unfortunately only two of these animals have been located on the ground, and one was dead, taken by a fox or dog.

Monitoring the Tutanning reintroduction has been given a low priority until now due to the relatively small size of the reserve, the difficulty of diggings searches because of the high level of digging activity by woylies (*Bettongia penicillata*) and as driven surveys yield low sighting rates because of the low visibility in much of the reserve. However with extra resources available in 1996 through the funding of the Recovery Plan by ESP, a driven survey will be carried out in March to gain some indication of numbers and to radio-collar some animals for monitoring.

Yookamurra

The numbat population at Earth Sanctuaries' Yookamurra Sanctuary near Sedan in the Murray mallee area of South Australia was established through the translocation of five males and ten females from Dryandra to Yookamurra in November and December 1993. All had been fitted with radio-collars and a monitoring program was set up under CALM's protocol for the translocation. Between November 1993 and October 1994, four numbats were taken by raptors, one died from the pathological effects of an acanthocephalan infection, two dropped their collars and transmitters on three others failed. In March 1994, the six remaining females had been captured and 16 attached young were recorded, amongst five of the females (three litters of four, one of three and one of one).

In October 1994, attempts were made to catch and radio-collar the young. Only one young, a female, was caught as a result of this effort, although another young was sighted and two were found dead. Later that year, a young male was caught and radio-collared. During 1995, radio-collars on a number of adults failed, and only one radio-collared female remained in October. Her young were captured and radio-collared, but they were small for their age and the collars were too large. Three of the young dropped their collars during the first two weeks, and the fourth collar was found bearing scratches indicating raptor predation.

At this stage, it is difficult to assess the status of the population. The Yookamurra staff has been urged to carry out a diggings search to determine the areas of the sanctuary currently being used by numbats.

Karakamia

On 8 December 1994, an adult male and two female numbats were released, fitted with radio-collars, at Karakamia, a property of 180 ha surrounded by a Yookamurra-style fence at Gidgegannup near Perth. One of the females dropped her collar on or shortly before 30 December 1995 and the other female's collar ceased transmitting between 12 and 17 February 1995. The second female was recaptured on 25 May 1995, carrying four young, and recollared. On 18 October 1995 she was recaptured and the three young found with her were collared. One of young has since been found dead with raptor marks on the collar but its head mysteriously crushed from one side. Currently four numbats are being radio-tracked. As the male has been spending time in the uncollared female's former area during the lead-up to the mating season, it is most likely that she is still there.

All indications at this stage are that the Karakamia reintroduction is going well.

Action 4. Disease survey and health monitoring of all populations

Faecal samples have been collected from numbats in all populations where animals are being handled. These are stored in formalin for parasitological examination, with particular emphasis on detection of eggs belonging to the acanthocephalan species found to have killed a number of numbats in or from the Dryandra population. A health monitoring protocol for the translocated numbats is currently being developed.

Since November 1994, all animals translocated from Dryandra either to Perth Zoo or to reintroduction sites have been wormed by injection with Ivomectin.

Action 5. Captive breeding

After the success of the captive breeding program in 1994 (32 young born and 19 successfully raised to weaning) the 1995 breeding season was disappointing. Two young survive from a total of five born in February. This result may be partly due to the high production of young in 1994. Some of the young were weaned late and females may not have had time to return to breeding condition before being put in with males, whose breeding capability falls off in February. Breeding protocols are currently being reviewed.

During 1995, additions to the captive colony from the wild (Dryandra) comprised five animals: one adult female with 4 pouch young (on 5 July 1995) and a juvenile male with a fractured leg (24 November 1995). Releases to the wild in 1995 comprised nine captive-bred animals on 20 January 1995 (3 females to Batalling and 3 males, 3 females to Tutanning). A further seven captive-bred animals had been released at Batalling on 21 December 1994 (six males and one female).

Seven animals died during the year. These comprised two old adult males, one captive-born female young which died while under general anaesthesia for blood sampling, three captive-born pouch young and one of the wild-born young of the female brought in from Dryandra.

As at the end of the year, the zoo colony comprised five males and seven females.

Action 6. Public awareness, education

Two lectures and various publicity exercises outlining the Numbat Recovery Plan have been given by CALM staff since March 1995. Perth Zoo Education staff prepared a poster on the recovery programs for numbat, chuditch and western swamp tortoise, with input from CALM and University of WA, for the York Earthcare Festival on 2 April 1995. Tony Friend gave a talk on numbats and the Numbat Recovery Program at the same event.

The Royal Australian Mint selected the numbat as the subject of the first of four commemorative coins and this was launched at the Melbourne Coin and Banknote Fair in July 1995. In association with this release, the Mint is appealing to the numismatic community to make donations to the Numbat Recovery Program. Through consultation with ESU and the Mint, it was decided to fund a project aimed at raising community awareness of the numbat recovery program, particularly targeting the rural areas where numbats occur, either as original or reintroduced populations. This project will see the production and dissemination of a brochure and sighting report sheet and the coordination of district-based volunteer involvement.

ACKNOWLEDGMENTS

Thanks are due to all those involved in the various aspects of the Numbat Recovery Plan Implementation during 1995. Within CALM Science and Information Division, Neil Thomas, Mike Scanlon and Michelle McGovern have been indefatigable in the field. Thanks are due to our many volunteers, especially Scott Munro, who put in four weeks in November-December. Brian Macmahon and staff at CALM Pingelly and Narrogin have faithfully maintained baiting regimes at Dryandra, Boyagin and Tutanning. Greg Ferguson (CALM Narrogin) assisted with the numbat survey and translocation. At Perup-Kingston, the baiting program has been coordinated by Tim Foley of CALM Manjimup and at Batalling, the Operation Foxglove aerial baiting program has been supplemented by ground baiting by Rob Brazell and other officers from CALM Collie, who have also provided other support for the Batalling numbat reintroduction. Baiting and other support at Dragon Rocks have been provided by staff of CALM Katanning District. At Perth Zoo, the efforts of John Arlidge and Dick Whitford deserve particular mention. I would also like to thank Mick McCracken of Yookamurra and André Schmitz of Karakamia for their efforts in monitoring numbats on those properties and for providing reports on the animals' progress. This program receives financial assistance from the Australian Nature Conservation Agency under the Endangered Species Program.

REFERENCES

Algar, D., and Kinnear, J.E. (1992). Cyanide baiting to sample fox populations and measure changes in relative abundance. Pp. 135-8 in P. O'Brien and G. Berry (eds) "Wildlife Rabies Contingency Planning in Australia". (Bureau of Rural Resources Proceedings No. 11). Australian Government Printing Service: Canberra.

Christensen, P.E.S. and Burrows, N.D. (1994). "Project Desert Dreaming: the reintroduction of mammals to the Gibson Desert, Western Australia", Pp 199-207 in M. Serena (ed.) "Reintroduction Biology of Australian and New Zealand Fauna". Surrey Beatty & Sons: Chipping Norton..

Friend, J.A. (1990). The Numbat *Myrmecobius fasciatus* (Myrmecobiidae): history of decline and potential for recovery. *Proceedings of the Ecological Society of Australia* 1990, **16** : 369-377.

Friend, J.A. (1994). Recovery Plan for the Numbat, 1995-2004. Report to the Australian Nature Conservation Agency under Project 351, Endangered Species Program. Department of Conservation and Land Management, Perth.

Friend, J.A. (in press). Protecting endangered fauna from introduced predators. in B. Diekman (ed) "Unwanted Aliens? - Australia's Introduced Animals". Nature Conservation Council of NSW, Sydney.

Kinnear, J. (1990). Trappings of success. *Landscope* **5** : 35-40.

Kinnear, J.E., Onus, M.L. and Bromilow, R.N. (1988). Fox control and rock-wallaby population dynamics. *Australian Wildlife Research* **15** : 435-50.

Short, J., Turner, B., Parker, S. and Twiss, J. (1994). Reintroduction of endangered mammals to mainland Shark Bay: a progress report. Pp 183-188 in M. Serena (ed.) "Reintroduction Biology of Australian and New Zealand Fauna". Surrey Beatty & Sons: Chipping Norton.

Table 1. Results of monitoring radio-collared numbats at Dryandra over the period January-December 1995.

Origin	Collared	Known dead	Signal lost	Alive and transmitting	At Perth Zoo
DRYANDRA					
Collared at 1 January 1995	12	2	5	5	
Collared during 1995	7	3	2	1	1
Total	**19**	**5**	**7**	**6**	**1**

Table 2. Results of monitoring radio-collared numbats at reintroduction sites over the period October 1994-December 1995.

Site and origin	Collared	Known dead	Signal or collar lost	Alive and transmitting
BATALLING				
Resident	1	0	1	0
Young bred on site 1994	5	1	4	0
Translocated from Dryandra	10	1	9	0
Translocated from Perth Zoo	10	3	7	0
Total	**26**	**5**	**21**	**0**
TUTANNING				
Resident	1	0	1	0
Young bred on site 1994	2	0	2	0
Translocated from Dryandra	1	0	1	0
Translocated from Perth Zoo	6	2	4	0
Total	**10**	**2**	**8**	**0**
KARROUN HILL				
Resident	2	2	0	0
Young bred on site 1994	3	2	1	0
Total	**5**	**4**	**1**	**0**
YOOKAMURRA				
Resident	5	0	2	3
Young bred on site 1994	2	0	2	0
Young bred on site 1995	4	1	3	0
Total	**11**	**1**	**7**	**3**
KARAKAMIA				
Translocated from Dryandra	3	0	1	2
Young bred on site 1995	3	1	0	2
Total	**6**	**1**	**1**	**4**

Figure 1. Numbat sighting rates during driven surveys at Dryandra Woodland (main block and Montague block) and at Boyagin Nature Reserve (east and west blocks). Note that these graphs only demonstrate trends within each site: because of variation in visibility between sites, it is not possible to compare sighting rates at different locations. Thus the denser vegetation at Boyagin results in lower sighting rates than at Dryandra.

Numbat Sighting Rate

at Dryandra and Boyagin