WESTERN SWAMP TORTOISE

RECOVERY PLAN

ANNUAL REPORT

2004

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for

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NATURAL HERITAGE TRUST PROJECT 023175

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SUMMARY

Progress continued towards implementing the actions contained in the Western Swamp Tortoise Recovery Plan and implementation of most recovery actions continues to be on schedule. Highlights of the year included:

- Eighteen captive bred tortoises were released into the north west swamp at Mogumber Nature Reserve (including 10 survivors from the 2002 fire that had been recovering at the Perth Zoo) in August 2004. No tortoises were released at Twin Swamps or Ellenbrook Nature Reserves in 2004.
- A significant event was the capture of a hatchling of 2003, with a body mass of 23.2g, on the Midland Brick land directly to the west of Ellen Brook Nature Reserve in November 2004. This demonstrates that there must have been a breeding female on the block in 2002 and further underlines the suitability of this area for the Western Swamp Tortoise.
- Midland Brick have agreed to transfer the portion of their land containing existing Western Swamp Tortoise habitat for inclusion into the Ellen Brook Nature Reserve as one of their commitments for the environmental management of a clay mining project (not located near the Western Swamp Tortoise Nature Reserves). It is expected the transfer will be completed in 2005.
- Perth Zoo currently holds 182 tortoises comprising 23 breeding males, 23 breeding females and 136 other tortoises comprising hatchlings, juveniles, sub-adults and non-breeding adults. Forty-six hatchlings were obtained in 2004 from eggs laid in 2003.
- The Friends of the Western Swamp Tortoise Group was initiated with support from CALM, WWF and the Ellen Brook Catchment Group. The Friends Group now have a representative on the Recovery Team. The Group undertook a range of initiatives including the installation of artificial aestivating tunnels, habitat rehabilitation and revegetation works, educational activities, development of interpretational signage and materials, and promotion of the Recovery Program.
- Positive negotiations were held with the Westralian Airports Corporation regarding investigating the suitability of wetland areas within a zone designated for conservation at the northern portion of Perth Airport land for translocation of tortoises. Investigations are proposed over winter 2005 to assess the suitability for translocation of tortoises and to establish whether artificial hydrological maintenance is required.
- 2nd captive breeding facility at Adelaide Zoo was set up with a further two, two year old tortoises transferred from Perth Zoo to Adelaide.
- Groundwater was pumped to north west swamp in Twin Swamps Nature Reserve during winter 2004, as winter rains were insufficient to fill the swamps. The volume pumped was 5525kL.
- A rat control program at Twin Swamps Nature Reserve was expanded in 2004 with a further 60 stations installed.
- Prescribed burning was undertaken in one cell of Twin Swamps Nature Reserve in spring to minimise the area of the reserve burnt in a wildfire and the risk of significant numbers of tortoises being killed.
- An additional 60 artificial aestivating tunnels were installed at Mogumber and 60 tunnels were installed at Twin Swamps Nature Reserve with the assistance of the Friends of the Western Swamp Tortoise to encourage tortoises to aestivate below ground and reduce the risk of being killed in a wildfire.
- In 2004 another possible translocation site at Moore River Nature Reserve was investigated. This site shows significant promise, although some habitat manipulation may be required to make it suitable for the tortoise. More detailed investigations and monitoring will be undertaken in 2005 to ascertain its suitability as a translocation site and the feasibility and environmental acceptablity of undertaking any habitat modification.

There are a number of issues of concern, discussed below, for the Recovery program to address over the next three years.

Areas of habit are becoming increasingly arid, particularly at Twin Swamps Nature Reserve, where water supplementation is now required each winter to support the tortoise. The rate of bore production has decreased with a declining regional groundwater level. Some adult translocated tortoises are known to be laying eggs, but no hatchlings have been recorded at Twin Swamps to date. It is likely that hatchlings are perishing after hatching, prior to the swamps filling with winter rains. Artificial supplementation will be started earlier in the season to determine if this assists hatching survival. There is a need for a major hydrological study at Twin Swamps Nature Reserve, and consideration of future supplementation requirements.

Given the vulnerability of existing habitats, the Recovery Team considers there is a need to have five

established populations to secure the species future. The lack of suitable habitat is of concern. The potential fourth site identified for translocation at Moore River Nature Reserve requires further investigation. Hydrological modification may be required. A potential fifth site at Perth Airport requires investigation. This site may also require water supplementation to sustain the tortoise. Significant management costs to establish the populations, maintain suitable habitat, and control predators is likely.

The Ellen Brook fox proof fence requires replacement and the new section of habitat being transferred to the reserve by Midland Brick will require fox proof fencing.

Monitoring and research requirements are increasing as the new translocation sites are established. This monitoring and research is critical to address issues requiring adaptive management.

To achieve recovery an increase in funding is required for the next three years. Additional funding is being sought from both the Commonwealth and State Government's for this period.

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1. INTRODUCTION

The Western Swamp Tortoise Recovery Team first met in December 1990. It grew from the very successful Western Swamp Tortoise Captive Breeding Management Committee, which was set up in 1987 and which was a runner-up for the IBM 1990 Conservation Award.

At the end of 2004 Team membership was:

Mr Lyndon Mutter, CALM's Swan Coastal District Nature Conservation Coordinator, Chair
Professor Don Bradshaw, School of Animal Biology, The University of Western Australia
Dr Andrew Burbidge, Research Fellow, CALM Science Division
Mr Dean Burford, Perth Zoo
Dr Terry Fletcher, Perth Zoo
Dr David Groth, Department of Biomedical Science, Curtin University of Technology
Dr Gerald Kuchling, Chief Investigator. School of Animal Biology, The University of Western Australia
Mr Rod Martyn, CALM's Swan Coastal District
Ms Jacqui Maguire, CALM's Swan Coastal District, Executive Officer
Ms Kat Miller, National Threatened Species Network, World Wide Fund for Nature Australia
Mr Terry Morley, Adelaide Zoo
Mr Rosalind Murray, Swan Catchment Council
Ms Lesley Stone, Friends of the Western Swamp Tortoise

~~LYNDON, HAVE THE NEWER MEMBERS OF THE TEAM BEEN ENDORSED BY THE DNC?~~

During 2004 the Team met twice. While the Team works together on many projects, primary responsibilities have been established as follows:

Management of Nature Reserves and rehabilitation of habitat	CALM's Swan Coastal District (Rod Martyn, Jacqui Maguire, Lyndon Mutter)
Population monitoring data analysis	Andrew Burbidge
Reserve's water depth and quality	CALM's Swan Coastal District
Ecological studies and translocation	Gerald Kuchling, UWA Zoology Department
Captive breeding	Dean Burford, Perth Zoo, with advice from Gerald Kuchling
Conservation genetics	David Groth, Curtin University
Proposed translocation sites	CALM's Swan Coastal District, Gerald Kuchling and Andrew Burbidge

2. RECOVERY PLAN AND FUNDING

During 2003 the Western Australian Minister for the Environment approved a third edition of the Western Swamp Tortoise Recovery Plan for the period January 2003 to December 2007. It had been prepared and approved by the Executive Director of the Department of Conservation and Land Management and the Conservation Commission of WA in 2002.This edition replaced earlier editions.

The objective of the first and second editions of the Recovery Plan was to decrease the chance of extinction of the Western Swamp Tortoise by creating at least two wild populations and doubling the total number of individuals. Because of the species' low fecundity, slow growth rates and long time to sexual maturity the plan did not expect to achieve up listing from Endangered (old IUCN categories) or Critically Endangered (new IUCN categories) within the 10-year time frame of the Recovery Plan.

Four actions were prescribed in the first and second editions of the Recovery Plan:

1. Management of Ellen Brook Nature Reserve, and wild population.
2. Captive breeding.
3. Re-introduction to Twin Swamps Nature Reserve.
4. Education, publicity and sponsorship.

Implementing the actions was estimated to cost a total of $1 676 000 over the Recovery Plan's ten year period. Funding has mainly come from Environment Australia through the Natural Heritage Trust's

Endangered Species Program, Perth Zoo and CALM. Several sponsors have assisted with various aspects.

Funding from the Endangered Species Program was for five years and this period concluded at the end of 1997. In October 1997, the Recovery Team prepared a review of the Plan over the first five-year period and the revised second edition Recovery Plan for 1998-2002. In 1998, the Commonwealth Minister for the Environment arranged for an independent review of the implementation of the Plan to be carried out. Dr Hal Cogger (John Evans Fellow, Australian Museum, Sydney, and Conjoint Professor Faculty of Science and Mathematics, University of Newcastle), whose report was dated 14 April 1999, conducted the review. Dr Cogger stated *inter alia* 'In summary, the Recovery Plan was well planned and has been implemented so successfully that many of its 2002 goals have already been achieved. Logistical and ecological problems have arisen in the course of the project, and most have been appropriately and successfully addressed. The Recovery Team has operated effectively and has provided expertise critical to the success of the program.' Dr Cogger's recommendations to the Commonwealth Minister were provided in the 1999 Annual Report.

In May 1999, Environment Australia advised that continued funding would be provided under the NHT to support the implementation of the recovery plan. The amount provided for 1999/2000—$50,000—was significantly less than the amount requested by the Recovery Team. In 2000/2001 and 2001/2002, $100,000 was provided each year for implementation of the Recovery Plan**.** Funding under NHT1 expired in 2002/03 and in 2002, the Department of Conservation and Land Management applied for continuing funding as a priority project under the Swan Catchment Council's Regional bid under NHT2. $119,500 was provided under NHT2 for each of 2003/2004 and 2004/2005 towards the implementation of the Recovery Plan for this period.

A significant increase in funding is required for the next three years to achieve Recovery and address the issues of:

- increasing aridity of habitat areas (especially Twin Swamps Nature Reserve). The need to undertake a major hydrological study at Twin Swamps Nature Reserve and achieve future supplementation requirements,
- the need to establish and develop a fourth translocation site at Moore River Nature reserve,
- to investigate the establishment of a translocation site on Perth Airport land,
- to replace the aging Ellen Brook vermin proof fence and fence the new Midland Brick land being added to the reserve,

An application for NHT2 funding for $240 000 in 2005/2006 was submitted to the Regional Swan Catchment Council. The Council has only supported $120 000 of the bid.

2.1 Recovery Plan 2003-2007

The objectives of the third edition of the Recovery Plan - January 2003 to December 2007 are to decrease the chance of extinction of the Western swamp tortoise by creating at least three wild populations and increasing the total number of mature individuals to more than 50. Given the vulnerability of populations to increasing aridity, the Team has set an additional objective of establishing five wild populations. This objective will be reflected in the next Recovery Plan when the existing plan is reviewed.

Criteria for successful achievement of the Objective are:

- Complete extension of the Ellen Brook Nature Reserve to the west to include Western Swamp Tortoise habitat currently within private properties.
- An increase in the number of adult, sub-adult and juvenile (> 2 years old) tortoises at Ellen Brook Nature Reserve to more than 50 by 2007.
- Persistence of a population of more than 40 adult, sub-adult and juvenile (> 2 years old) tortoises at Twin Swamps Nature Reserve and reproduction (egg laying) of re-introduced tortoises demonstrated by 2007.
- The creation of a population from captive-bred animals at Mogumber Nature Reserve of more than 35 adult, sub-adult and juvenile (> 2 years old) tortoises by 2007.

- The maintenance of a captive population of at least 12 breeding adults producing at least 20 two-year-old animals each year.
- The creation of a second captive colony at another accredited Zoo in Australia.
- The creation of a semi-captive 'insurance' colony of at least 20 tortoises at the Harry Waring Reserve of UWA or some other site.
- The selection by the Recovery Team and endorsement by relevant authorities of a third suitable translocation site.

The criteria for failure to achieve the objective are:

- A decline in numbers of the Western Swamp Tortoise in the wild.
- Cessation or significant reduction (to less than 10 hatchlings per year) in captive breeding.
- The maintenance of more than 50% of the non-hatchling world population of *P. umbrina* in a single captive colony.

3. RECOVERY PLAN IMPLEMENTATION

Progress with the actions laid down in the third edition of the Recovery Plan is as follows.

3.1 Employment of Chief Investigator

A contract between the CALM and The University of Western Australia, to allow the continued half-time employment of Dr Kuchling, has continued on a yearly-renewable basis.

3.2 Management of Ellen Brook, Twin Swamps and Mogumber Nature Reserves

3.2.1 Management of Ellen Brook Nature Reserve

Routine management of the nature reserve continued as in past years.

Two 1080 baiting programs were undertaken. Construction of strategic bunding to provide additional wetland habitat in a degraded section of the reserve was undertaken.

The system of strategic firebreaks was maintained. No fires occurred on the reserve in 2004.

Repairs were made to the vermin proof fence involving 1.2 kilometres of skirt replacement in wetter areas.

Control of the weed *Watsonia* within the nature reserve continued with a major control program undertaken on the northern portion of the reserve, outside the vermin proof fence. Control of the weed Tambookie Grass was undertaken within the Vermin Proof compound. Slashing of African Lovegrass occurred in areas adjoining Great Northern Highway to reduce the risk of fire entering the reserve.

3.2.2 Management of Twin Swamps Nature Reserve

Reserve management of the nature reserve continued as in past years.

Two 1080 fox baiting programs were conducted.

The rat-baiting program continued, with a further 60 stations installed, funded by Tiwest. The program was initiated in response to previous data indicating possible predation of juvenile tortoises by rats. One hundred and sixty baiting stations have been placed in lines on the northern section of the reserve, which is most heavily used by the tortoises.

Prescribed burning was undertaken within the nature reserve. Further prescribed burns are planned in the north-east corner in the Spring of 2005/06. The fuel reduction program involves one third of the reserve, burnt on a 10-year rotational basis to establish internal low fuel areas to minimise the area of the reserve burnt in a wildfire and the risk of significant numbers of tortoises being killed. Burning is undertaken in spring when tortoises are located in the ponds and not threatened by the fire. Strategic

external and internal firebreaks were maintained. No wildfires occurred on the reserve during 2004.

Cape Tulip was controlled on all external and internal firebreaks. Control was extended into vegetation immediately adjoining the northern firebreak. Cape Tulip control is required by the Department of Agriculture as part of a local control containment strategy.

A further sixty artificial aestivating tunnels were installed on the reserve in 2004 bringing the total number of tunnels to one hundred and sixty eight.

Electrical repairs were undertaken on the groundwater-pumping bore.

Minor maintenance of the vermin proof fence was undertaken with approximately 400 metres of apron replaced in wetter areas. Two reserve signs were replaced at the nature reserve boundary. One kilometre of farm fence was also replaced on the northern boundary of the Reserve along Warbroook Road.

3.2.2.1 Pumping groundwater to maintain swamps and monitoring of food in swamps

Although 2004 was a year of above average winter rainfall, pumping of groundwater to north west swamp was required throughout winter to support the tortoise population. Refer to section 3.2.4 for rainfall graphs and data.

The Effect of the Groundwater Pump and of Earthworks at Twin Swamps Nature Reserve

Six artificial dams along the fence at TSNR dams provided at least some water from late June until early to mid November 2004. The groundwater pump into NW swamp was utilised constantly from 02 July until 10 November 2004 and water was available at NW swamp until mid November. However, no water flowed over from NW-swamp and N-swamp into the firebreak channel between N and NE swamp. NE-swamp (except for the artificial dam near the east fence) remained totally dry during 2004 (as had been the case in 2001 and 2002).

SE-swamp also remained totally dry in 2004, including the artificial depression, which provides some standing water in most years. Water was maintained at the NW swamp by groundwater pumping until 11 November 2004.

3.2.3 Management of Mogumber Nature Reserve

Baiting of the reserve with 1080 baits continued on a monthly basis through out 2004 to control foxes.

An additional sixty artificial aestivating tunnels were installed to encourage tortoises to aestivate below ground and reduce the risk of them being killed in a wildfire. The entire reserve was burnt by a large wildfire under extreme conditions on 20 December 2002. The impact on the population was significant and is discussed further in section 3.4.

The hydrological monitoring begun in 2002 was continued to determine whether the claypans are at risk from increasing salinity and to develop a water balance model. Adjacent areas to the east of the reserve have been affected by salinity in recent times. The monitoring, carried out by a consultant, was funded by the State Salinity Strategy. The study has determined that the habitat is not under any immediate threat of salinisation, but ongoing monitoring is required.

Water levels and the period of inundation continue to be monitored to determine the reserve's long-term suitability for the tortoise.

3.2.4 Water depth; water quality and invertebrate sampling

Water depths have been recorded at Ellen Brook and Twin Swamps Nature Reserves on an *ad hoc*

basis since 1972. Depths have been recorded, when possible, at Mogumber since 2000.

A project "*Invertebrate communities and water quality of wetlands significant for Western Swamp Tortoise conservation*" was approved for funding under CALM's Wetland Conservation Program 2004/05. The project leader is Dr Andrew Storey of UWA's School of Animal Biology. This project will analyse samples collected in 2004 with all available data from previous years. With additional support from the WST Recovery Program for the sampling of Moore River National Park (originally not included and budgeted for in the project proposal), the following swamps were sampled between 10 - 16 September 2004:

- seven artificial and two natural swamps at EBNR;
- five artificial, one natural, bore water supplemented swamp and one natural swamp at TSNR;
- three natural swamps at Mogumber NR;
- two artificial swamps at Harry Waring Marsupial Reserve; and
- three natural swamps at Moore River National Park.

All samples have been processed, but the analysis of the data and the historical overview is still under way. Preliminary results from Twin Swamps indicate that pH at NW swamp has been rising since 1999 and by 2002 was higher than ever recorded before pumping.

3.2.4.1 Water depth and rainfall data for ~~Twin Swamps and~~ Ellen Brook and Twin Swamps Nature Reserves

Swamp water levels at Ellen Brook Nature Reserve were recorded from 8 water depth gauges in 2004 and the following levels were recorded (in cm):

Date	1	2	3	4	5	6	7	8
20/05/2004	dry	1	-	5	14	29	dry	dry
27/05/2004	dry	0	-	dry	13	28	dry	dry
7/06/2004	6	10	22	30	21	39	18	23
13/06/2004	24	13	38	59	25	54	42	34
29/06/2004	20	8	32	50	24	52	32	32
4/07/2004	23	13	-	54	26	54	36	39
20/07/2004	28	9	-	-	-	-	-	-
8/08/2004	32	14	39	63	32	60	40	61
18/08/2004	39	21	44	79	55	65	51	84
29/08/2004	44	26	46	82	68	66	54	98
13/09/2004	42	25	40	75	63	62	47	92
19/10/2004	30	13	19	39	39	46	dry	76
28/10/2004	24	0	0	27	28	38	dry	50
3/11/2004	18	dry	-	-	-	-	-	-
4/11/2004	16	dry	dry	17	22	37	dry	38
7/11/2004	10	dry	dry	8	18	34	dry	31
14/11/2004	0	-	-	dry	14	32	-	24
21/11/2004	-	-	-	-	6	27	-	dry
22/11/2004	-	-	-	-	-	26	-	-

Swamp water levels at Twin Swamps Nature Reserve were recorded from 10 dams in 2004 and the following levels were recorded (in cm):

Date	NW	SW	E	SE	NE1	NE2	N1	N2	N3	N4
4/07/2004	0	0	0	dry	dry	dry	dry	dry	dry	dry
11/07/2004	4	dry	dry	dry	dry	dry	dry	dry	dry	dry
20/07/2004	6	dry	dry	dry	dry	dry	dry	dry	dry	dry
8/08/2004	9	dry	0	dry	dry	dry	dry	dry	dry	dry
18/08/2004	13	dry	1	dry	dry	dry	dry	dry	dry	dry
29/08/2004	19	dry	9	dry	dry	dry	dry	dry	dry	7.5
15/09/2004	17	dry	8	dry	dry	dry	dry	dry	dry	0
20/10/2004	14	dry	dry	dry	dry	dry	dry	dry	dry	0
7/11/2004	7	dry	dry	dry	dry	dry	dry	dry	dry	dry
10/11/2004	7	dry	dry	dry	dry	dry	dry	dry	dry	dry
12/11/2004	6	dry	dry	dry	dry	dry	dry	dry	dry	dry
13/11/2004	4	dry	dry	dry	dry	dry	dry	dry	dry	dry
14/11/2004	3	dry	dry	dry	dry	dry	dry	dry	dry	dry

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The nearest rainfall station currently keeping records is at Pearce RAAF base, where records have been kept since 1937, although they are incomplete. 2004 was a year of ~~above~~ ~~??~~ below average annual rainfall and records indicate:

- Annual average precipitation 1937 to ~~2003~~ 2004 = 679 mm.
- Mean winter rainfall (May to September inclusive) 1937 to 2004 = 542.9mm.
- Mean winter rainfall from 1937 to 1971 inclusive = 576.6mm
- Mean winter rainfall 1972 to 2004 inclusive = 525.0mm (Figure 1).
- In 2004 the total precipitation was 533.9mm and the May to September rainfall was 437.4mm (Figure 2).

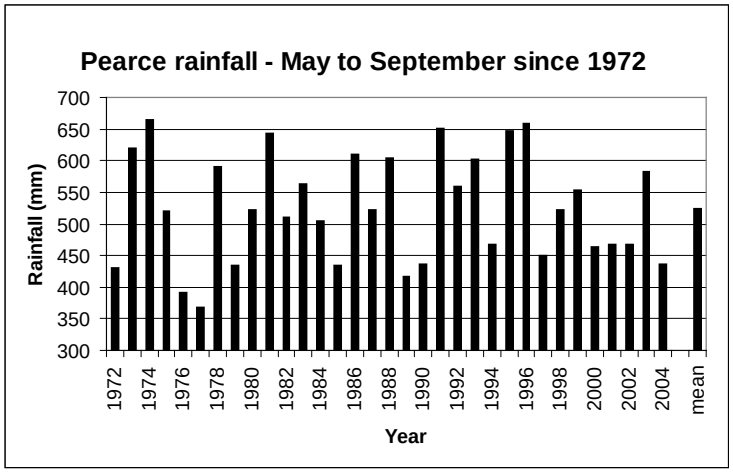

Figure 1. Mean winter rainfall 1972 to 2004 inclusive

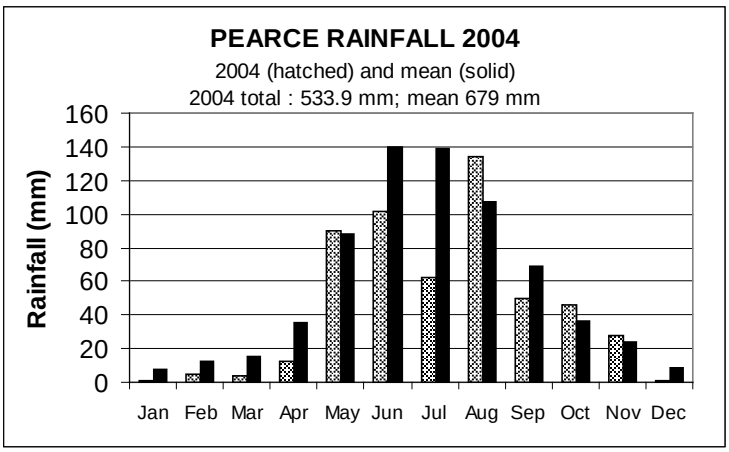

Figure 2. Total and mean precipitation for Pearce Rainfall Station 2004

3.2.4.2 Water depth and rainfall data for Mogumber Nature Reserve

Swamp water levels at Mogumber Nature Reserve were recorded at NW, SW and E swamps in 2004 and the following levels were recorded (in cm):

Date	Mogumber-NW	Mogumber-SW	Mogumber-E
29 May 2004	dry	dry	dry
13 June 2004	33.5	30.9	27.8
26 June 2004	30.6	27.8	25.2
20 July 2004	35.3		
08 Aug 2004	35.8	30.2	29.6
14 Aug 2004		32.3	31.4
29 Aug 2004	43.4	36.5	35
14 Sept 2004	41	33.2	32.4
20 Oct 2004	24.1	13.6	16.5
28 Oct 2004	20.5	1	8.5
01 Nov 2004	16	dry	Dry
05 Nov 2004	9.2		
07 Nov 2004	dry		

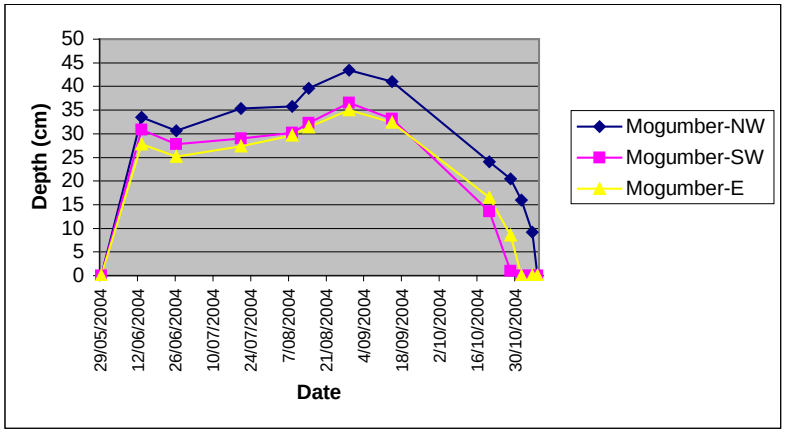

Figure 3. Water Depths at three swamps within Mogumber Nature Reserve 2004

Rainfall in 2004 was well below average, but some standing water was available until early November. Compared to 2003 the swamps retained water for about two weeks less.

Rainfall at Wannamal (the closest rainfall station to Mogumber Nature Reserve) shows that the area received 499 mm, which is below the mean of 595mm (See figure 4).

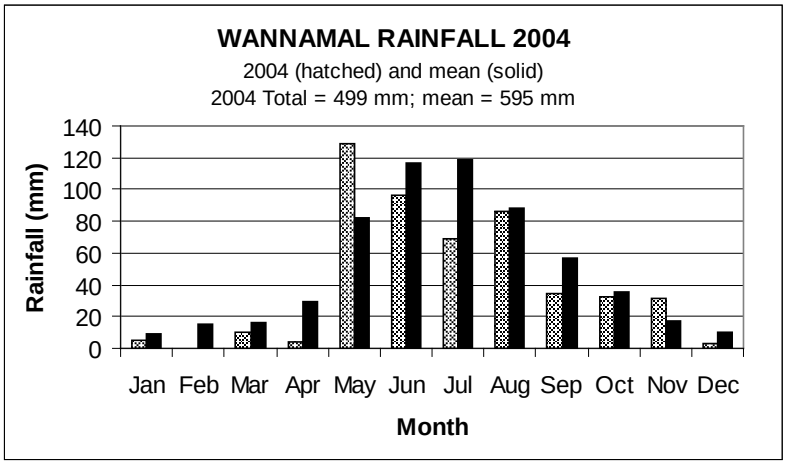

Figure 4. Total and mean precipitation for Pearce Rainfall Station 2004

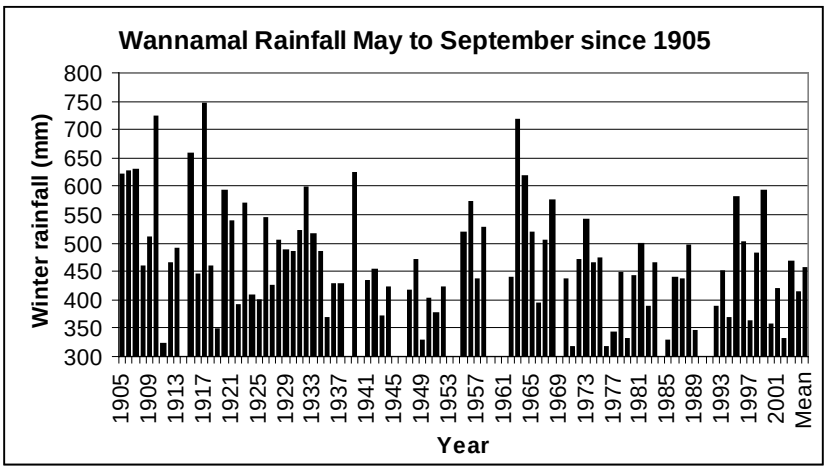

Figure 5. Rainfall from May to September for Wannamal since 1905

3.3 TORTOISE POPULATION MONITORING

Morphometric and locational data from animals captured or radio-tracked are entered onto cards or into notebooks in the field and transcribed to a card index and microcomputer database. Mark-and-recapture data are used to calculate the number of tortoises known to be alive (KTBA) each year and estimates of population size are made using the procedure of Manly and Parr (1968) and Manly (1969). Population structure data (adults, juveniles, hatchlings) are added manually. Population estimates calculated for 2004 are shown in ~~and in~~ Figures 6 and 7~~??~~.

3.3.1 Ellen Brook Nature Reserve

In 2004 the activities at Ellen Brook Nature Reserve (EBNR) focused on recapturing tortoises for the population estimates, on further evaluation of the suitability of the rehabilitated area (Reserve A42126) for Western Swamp Tortoises, and on comparing operational environmental temperatures between the Ellen Brook and Mogumber Nature Reserves during the aestivation period. There is a trend over the last decade that population numbers at EBNR are gradually increasing (see Figure 6.)

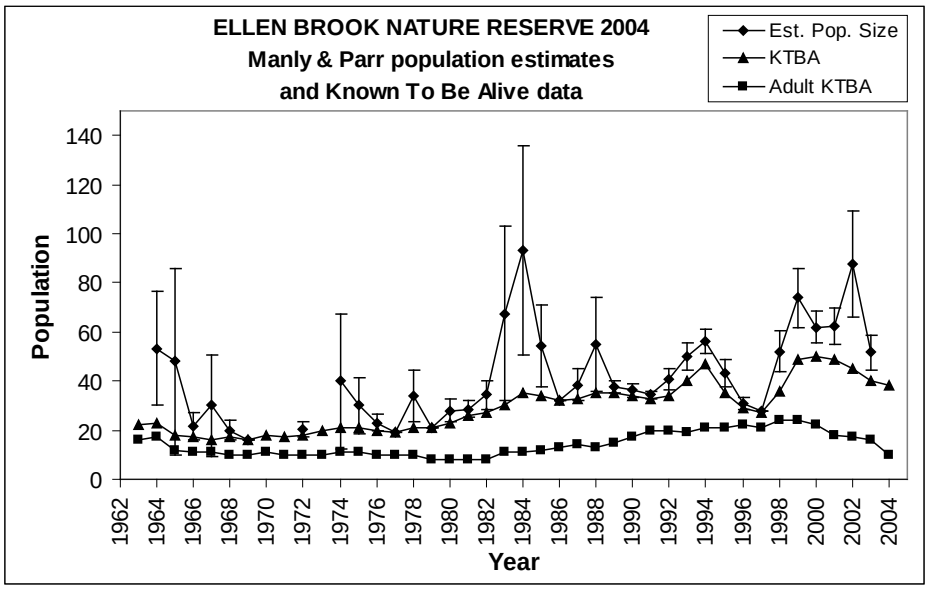

Figure 6. Population Estimates at Ellen Brook Nature Reserve

Note: KTBA - known to be alive. KTBA is significantly lower than actual population size for at least the most recent five (or so) years because of low sample size. The figures for those years are not a reliable estimate of actual population size.

To compensate for the reproductive output of EBNR females still kept at Perth Zoo (until the acquisition and protection of the habitat at the Midland Brick's block is accomplished), three captive bred hatchlings (mean body mass of 27.3g (±4.9SD)) were released at the southern block of EBNR on 18 August 2004. All three of those were recaptured on 08 November 2004 with a mean body mass of 36.5g (±6.1SD). Two of the hatchlings released in 2002 were also recaptured on 25 November with 52g and 76g. One hatchling each of the releases in 2001, 2000 and 1999 were also recaptured during November with body masses >100g. This demonstrates that growth rates of juveniles are satisfactory in the new, rehabilitated reserve area.

A hatchling of 2003 with a body mass of 23.2g was found on the Midland Bricks block to the west of EBNR near swamp gauge 3 on 05 November 2004. This demonstrates that there must have been a breeding female on the block in 2002 and that the habitat is suitable for hatchlings to survive aestivation and to grow up. Since this habitat area is not yet protected, the hatchling was released near gauge 1 inside EBNR. The capture of the juvenile underlines the significance of the habitat on private properties to the west of EBNR for Western Swamp Tortoise conservation.

In addition to the recaptured tortoises that were translocated during 1999, 2001, 2002, and 2004, and also the wild juvenile from the Midland Bricks block mentioned above, thirty-one resident tortoises were handled at EBNR during 2004. Ten of those were wild hatchlings from 2004. Evidently, 2004 was a good year for hatchlings of wild nests to reach the water and to start growing. This may be related to the fact that most swamps at Ellen Brook had some standing water from early June onwards
Five juveniles from the southern rehabilitated block of EBNR were equipped with radio-transmitters and Thermochron iButton temperature data loggers during November 2004 to record temperatures during aestivation over the summer of 2004/05. By December all five aestivated in tunnels or rabbit warrens.

3.3.1.1 Long-necked Tortoises at EBNR

A hatchling long neck tortoise *Chelodina oblonga* (9.5g) was found in an artificial pond inside ~~at~~ the fox-proof fence at Ellen Brook Nature Reserve on 04 November 2004. Long neck tortoises are rare in the *P. umbrina* habitat at EBNR and this was the first time a hatchling has been found, suggesting that nesting may have occurred inside the fox-proof fence. The hatchling was moved outside the fox-proof fence and into the adjacent Ellen Brook.

3.3.2 Twin Swamps Nature Reserve

At Twin Swamps Nature Reserve (TSNR), population data show a long and serious decline in tortoise numbers from 1964 to 1993. The increase in numbers from 1994 reflects the re-introduction of captive-bred animals from Perth Zoo. Data at TSNR since around 1998 are unreliable and not reflective of the true population size because of the typical low sampling success due to the considerable difficulty in capturing Western Swamp Tortoises. (See Figure 7)

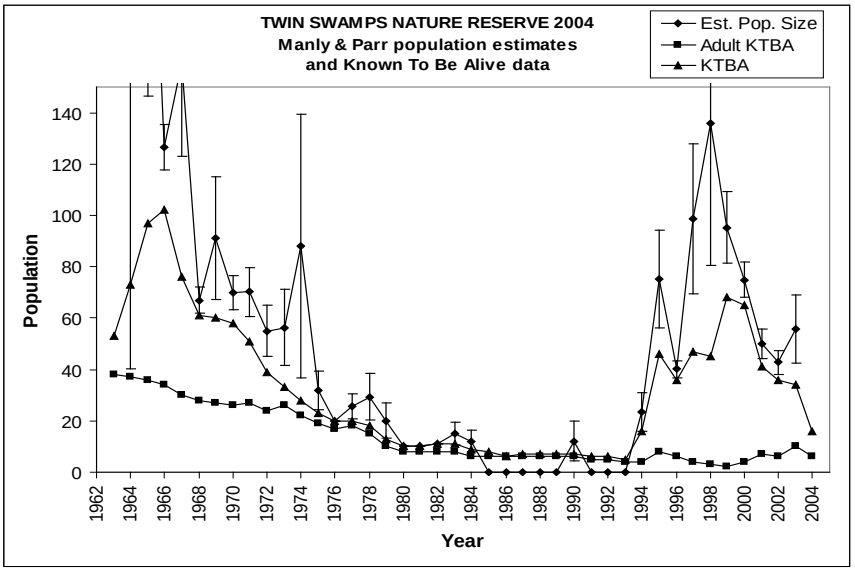

Figure 7. Population Estimates at Twin Swamps Nature Reserve

Note: KTBA - known to be alive. KTBA is significantly lower than actual population size for at least the most recent five (or so) years because of low sample size. The figures for those years are not a reliable estimate of actual population size.

No captive-bred *P. umbrina* were released at TSNR in 2004. Apart from the tortoises radio-tracked over the summer of 2003/2004, ten additional tortoises of previous releases were recaptured during 2004. Nine of those in addition to two of the previously radio-tracked tortoises were equipped with miniature temperature loggers and radio-transmitters during November/December to record temperatures during aestivation over the summer of 2004/05. ~~Two water-filled tortoise copper models were also equipped with temperature loggers. One of these models was placed into an artificial aestivation tunnel and the other under leaf litter under a dense *Regelia* bush.~~
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Aestivation - summer 2003/2004 at Twin Swamps

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Two *P. umbrina* had been equipped with transmitters and temperature loggers (logging the temperature every three hours) in November, one in December 2003 and two more plus one with a transmitter without logger on 08 January 2004, all while they were still active in water. In addition, temperature loggers were glued on two water-filled tortoise copper models, one of which was placed underground in an artificial aestivation hole about 50 cm wide in from its entrance and the other one on the ground under a dense *Regelia* bush. Of the three tortoises tracked since 2003, by January 2004 two had entered rabbit warrens and one (#345) stayed in a hole about 15cm underground, all three in *Regelia* bushland. Of the three tortoises equipped with transmitters in January 2004, by early March two were in rabbit warrens in *Regelia* bushland and one in an old monitor hole in an open, sunny area.

On 05 March 2004 the putrefied and smelly carcass of the subadult female *P. umbrina* #345 (197g, 105.3mm carapace length) was found on its back under *Regelia* regrowth about 9 metres south of its

previous aestivation hole. The right hind foot was dislodged, with the skin partly pulled off the digit bones, but apart from that no other external damage was apparent (e.g. gnawing on the shell), although the body was full of maggots and beetles. The previous aestivation hole was undamaged; it had not been excavated or enlarged. The temperature readings, as compared with the models, showed that the tortoise had been underground (in the hole) until 0200 hrs on 27 February, but that it was above the ground at 0500 hrs on 27 February 2004. At 1400 hrs that day the temperature reached 45.5ºC, indicating that at that time the tortoise must have been already dead. Since *P. umbrina* is generally not active during the night, the most likely explanation is that a nocturnal predator pulled the tortoise from its hole and killed it. ~~Most likely this would~~This may have been a relatively small mammal, with a rat or a bandicoot being the most likely candidate. Incidentally, the tortoise aestivated inside the rat poisoning station grid.

The four tortoises aestivating in rabbit warrens had moved above ground by mid-May and were than hiding on the surface under *Regelia* bushes. The individual in the monitor hole did the same by mid-June. The transmitters and loggers were recovered on 18 June 2004. At that time only one of the tortoises was in the water, in one of the artificial dams, all others were still hiding under bushes.

Aestivation - summer 2004/2005 at Twin Swamps

By late December 2004, ten of the eleven radio-tracked *P. umbrina* aestivated underground in rabbit warrens and one was in a smaller rabbit hole close to a warren. All were in *Regelia* bushland

3.3.3 Mogumber

Eighteen captive-bred juvenile tortoises were released in the NW swamp at Mogumber Nature Reserve on 14 August 2004. Major surveys for tortoises took place on 30 October and 01 November 2004 and eleven of the released tortoises were recaptured, in addition to five tortoises from previous releases. All those recaptured were equipped with radio-transmitters and miniature temperature loggers for tracking over the summer of 2004/05. They were released into the last water on 05 November. Two water-filled tortoise copper models were also equipped with temperature loggers with one placed into an artificial aestivation tunnel and the other under leaf litter under a low, dense bush (same sites as in the summer of 2003/04). The signal of one transmitter could not be found after 09 November and a second one was not recorded after 24 December2004. Thus, by the end of 2004 a total of fourteen tortoises were radio-tracked at Mogumber.

The eleven released tortoises, which were recaptured in late October, had grown well. The tortoises increased their body mass by 21% in 11 weeks, from a mean of 116.9g (±22.9SD) on 14 August to 141.5g (±27.0SD) by late October. This demonstrates the suitability of the swamp life at Mogumber for Western Swamp Tortoises. KTBA and Manly and Parr population estimates have not been calculated for the Mogumber population, as it is too soon since introductions commenced for meaningful figures to be produced (See Figure 8.).

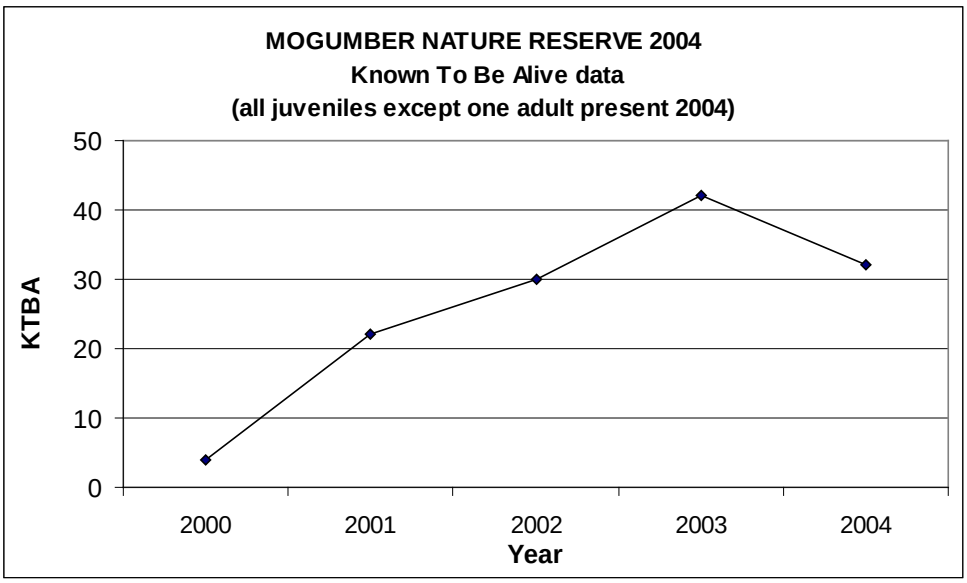

Figure 8. Population Estimates at Mogumber Nature Reserve

Aestivation - summer 2003/2004 at Mogumber

Of the twenty two tortoises tracked by 20 December 2003, three had shed their transmitters by 06 January 2004. Of the nineteen remaining tortoises with radio-transmitters, eleven (58%) were under leaf litter and/or in small holes less then 12cm deep underground, six (31.5%) were in holes >12cm underground and two (10.5%) were in the water in farm dams. Nine tortoises (37%), including two of those that shed transmitters, were outside the reserve on private property. Seven tortoises, plus the three that lost the transmitters, had moved and changed aestivation sites between 20 December and 06 January.

By 08 March 2004, seven tortoises had again moved changed their aestivation site, with one of them having lost its transmitter. By 13 April another tortoise in a farm dam had shed its transmitter and no signal could be received. The second tortoise in a farm dam was captured and found to be in good condition, but by late May it had moved out of the dam and was hiding under leaf litter. Three tortoises had shed their transmitters by 15 June and the transmitters were taken off nine live tortoises, which were still aestivating. These animals were released into water in NW-swamp. Four dead tortoises were recovered from the reserve, all of which had aestivated in small holes (two in old goanna holes) at depths of 7, 11.5, 11.5, and 13cm underground. One tortoise shell was totally disintegrated with the tortoise obviously being dead for a long time. One shell disintegrated during removal, one shell plus the hind limbs were intact, but nothing of head, neck and front limbs could be found, and one tortoise was intact and complete with the flesh still in decomposition.

Only one of the dead tortoises and five of the nine live ones had temperature loggers attached. It seems that overheating or desiccation may have been the main cause of death during aestivation in the summer of 2003/2004. Only limited shade had been available after the hot wildfire in December 2002 and, as in comparison to TSNR, most tortoises did not use deep underground holes for aestivation. A review of aestivation management at Perth Zoo revealed that, since new aestivation pens were constructed at Perth Zoo in 1998, the captive raised juveniles were used to aestivate under leaf litter and Eucalypt branches rather than in underground holes. Thus, over the years prior to 2003 the captive-bred tortoises may have been trained to use sub-optimal aestivation sites under leaf litter rather than underground holes. This may have been particularly problematic after the fire in the summer 2003/04 when only limited shade and leaf litter was available. There is obviously a lag effect of several years until training of captive juveniles in aestivation site choice can translate into better choices of re-introduced

animals.

On 26 June 2004 a seine net was pulled through the farm dam where the signal of a tortoise was lost in April. The tortoise #523 was recaptured without its transmitter and temperature logger, which it had shed. It was moved from the dam into NW swamp. It appeared that this tortoise had spent the whole summer and autumn in the farm dam and had grown significantly during that time. It increased its body mass by 51% from 129g on 23 November 2003 to 195g on 26 June 2004 and its carapace length by 17% from 90.7mm to 106.1mm. This is the first time a tortoise in the wild (although captive bred) has been recorded to spend the whole aestivation period in water, evidently feeding and growing well.

In conclusion, the tortoises at Mogumber Nature Reserve take longer to settle down for aestivation (stop moving) in early summer than those at EBNR and TSNR. Apart from the direct losses of tortoises in the fire in 2002, suboptimal aestivation habitat dispersal of tortoises on to private properties appears to be the main cause of loss of re-introduced tortoises at Mogumber Nature Reserve. This is in contrast to TSNR where mortality of re-introduced tortoises seems to be mainly related to predation by ravens and rats.

Aestivation - summer 2004/2005 at Mogumber

To address the problem of the choice of sub-optimal aestivation sites by many of the released tortoises at Mogumber, the Recovery Team decided that radio-tracked tortoises that are found at suboptimal sites be moved into artificial aestivation tunnels during late spring and early summer. The relocation of these tortoises was conducted to investigate if they can be trained to use better sites.

The water at Mogumber NW swamp disappeared in early November 2004. On 09 November fourteen radio-tracked tortoises stayed under leaf litter and one in an old goanna hole. Although eight tortoises had changed sites by 20 November, there were again fourteen under leaf litter and one in a goanna hole. Six of those tortoises (two of them were on adjacent private properties) were transferred into artificial aestivation tunnels. The following day, four of the six had left the tunnels and were again hiding under leaf litter nearby. An additional 7th tortoise (whose transmitter had to be replaced) was moved into an artificial tunnel on 21 November 2004. By 24 December, all of the first six tortoises were out of the tunnels and hiding under leaf litter, but the 7th still stayed in the artificial tunnel which had an extension at its end dug out by a goanna.

By 24/25 December, eight of the fourteen tracked tortoises were under leaf litter (57%), two in goanna holes, two in artificial tunnels (the one which had been moved there plus one who entered the tunnel on its own), and two in holes under tree trunks. The two tortoises in the goanna holes and three under leaf litter (one of which was on adjacent private property) were transferred to artificial aestivation tunnels. Thus, by Christmas 2004, seven, or 50% of the tracked tortoises, stayed or were placed into artificial aestivation holes.

3.4 CAPTIVE BREEDING

3.4.1 Breeding season

In total, 23 females laid ninety eggs, which produced forty-six hatchlings in 2004. The information recorded on the viability of eggs produced in 2004 was divided into two categories to display variations between the immature and mature breeding females. The viability of eggs produced in younger females rose from 36% to 47% in 2004. As expected the viability of the mature female eggs was higher than the immature females and remained approximately the same as last year (See table 3). Overall the hatchling rate reduced slightly from 70% in 2003 to 69% in 2004. This trend is expected to continue in the medium term.

Of the twenty-one females to lay, three females reproduced for the first time. Continuing the upward trend of females double clutching (ovulating twice in the season), an unprecedented five did so this year, two of which produced double clutches for the first time. In the previous 10 years only eight instances of double clutching had been recorded. Overall eight females have produced the thirteen double clutches. It was also noted that an unusual situation of larger second clutch than the first occurred in two of the females.

Table 1. Perth Zoo Captive Breeding

F/M I.D.	STATUS	EGGS PRODUCED	EGGS HATCHED
CZ1	Reproducing > 3 years	3	2
CZ2	"	4	4
Z3	"	5 (2 clutches)	3
4	"	4	3
70	"	3	3
164	"	2	2
184	"	3	3
196	"	4	0
199	"	3	3
221	"	3	3
256	"	3	3
341	"	5	2
380	"	4	4
387	"	4	3
TOTAL		**50**	**38 (76%)**
207	Reproducing < 4 years	2	2
245	"	2	1
261	"	4	2
272	"	3	0
318	"	3	3
324	"	2	0
439	"	1	0
TOTAL		**17**	**8 (47%)**

3.4.2 Releases

Twenty-one Western Swamp Tortoises were released into two nature reserves in 2004. (See table 2 below)

Table 2. Number of WST releases into reserves 2004

RESERVE	# RELEASED	STATUS
Mogumber	18	Juveniles
Ellenbrook	3	Hatchlings
Twin Swamps	0	-
TOTAL	21	

3.4.3 Health

Hatchling #743 suffered a pro-lapsed colon at age 3½ months. Until then health was normal and despite a successful re-insertion of the colon, growth ceased. A barium meal was administered and over several weeks x-rays followed it's path through the digestive tract. It's very slow passage indicates a condition which to this point remains undiagnosed.

As a result it will be withheld from aestivation this season.

3.4.4 Deaths

Only one death occurred during the year

#765: 53 days old. Hatchling from 2004. Cause of death unknown.

3.4.5 Transfers

A further two tortoises were transferred to Adelaide Zoo in 2004. They were two-year-old juveniles, which brings the total number of tortoises at the zoo to four. On the completion of the breeding and aestivation facilities, an additional two pairs of breeding age tortoises will also be transferred.

3.4.6 Aestivation

Aestivation tunnels have been placed in the pens this season in addition to the normal leaf litter. It is hoped the tortoises will become more familiar with the tunnels, which will increase the chance that they will be utilised in the reserves. Use of the aestivation tunnels in the reserves will help ensure the tortoises are less exposed to bushfire.

3.4.7 Status of Captive Colony

AGE/STATUS	NUMBER
04 HATCHLINGS	42
03 HATCHLINGS	27
02 HATCHLINGS	24
01 HATCHLINGS	10
00 HATCHLINGS	6
99 HATCHLINGS	1
98 HATCHLINGS	8
JUVENILES FROM LAND ADJACENT TO EBNR	4
ZOO-BRED SUB-ADULTS RETAINED FOR BREEDING	13
NON-BREEDING ADULT FEMALES	1
BREEDING MALES	23
BREEDING FEMALES	23
Total	**182**

3.5 TRANSLOCATIONS

3.5.1 Re-introduction to Twin Swamps and Mogumber Nature Reserves

In 2004 the focus at Twin Swamps Nature Reserve (TSNR) was on monitoring the tortoises, which were re-introduced in previous years, and at Mogumber Nature Reserve on comparing operational environmental temperatures.

No captive-bred *P. umbrina* were released at TSNR in 2004. Apart from the tortoises radio-tracked over the summer of 2003/2004, ten additional tortoises of previous releases were recaptured during 2004.

Eighteen captive-bred juvenile tortoises were released in the NW swamp at Mogumber Nature Reserve on 14 August 2004. Major surveys for tortoises took place on 30 October and 01 November 2004 and eleven of the released tortoises were recaptured, in addition to five tortoises from previous releases.

3.5.2 Translocation to additional sites

3.5.2.1 Selection of suitable translocation sites

Caversham

The water levels of the swamps at the RAAF Caversham property were not regularly surveyed during winter and spring 2004. Only the water level of the NW swamp was occasionally recorded, but the depth gauge from 1999 had disappeared. The swamp was dry on 07 June, but had some standing water on 14 June. The water had more or less disappeared by 01 November 2004, although there was still some water on the northern firebreak. It seems that the blockage of the drainage system has deteriorated and that the swamp now loses water relatively quickly once water stops draining in from the north. Despite this, the duration of swamp life would have been suitable for Western Swamp Tortoises.

Moore River National Park

A preliminary depth gauge was installed in W-swamp at Moore River National Park on 26 June 2004. On 29 August two more preliminary gauges were installed in the SE-swamp and NE-swamp. The following depths were recorded (in cm):

Date	Moore-W	Moore-SE	Moore-NE
26 June 2004	14.7		
29 Aug 2004	32.8	26.6	33.5
10 Sept 2004	29.3	25	30
14 Sept 2004		22	24.5
16 Sept 2004	26		
20 Oct 2004	6.5	3.1	0

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It appeared that in August the duration of standing water in the swamps was sub-optimal for Western Swamp Tortoises, particularly in spring. A possible reason for this is that water drains out of the reserve towards cleared land to the east.

Perth Airport

Positive negotiations were held with the Westralian Airports Corporation regarding investigating the suitability of wetland areas within a zone designated for conservation at the northern portion of Perth Airport land. Investigations are proposed over winter 2005 to assess the suitability for translocation of tortoises and to establish whether artificial hydrological maintenance is required.

Moore River Nature Reserve

In 2004 another possible translocation site at Moore River Nature Reserve was investigated. This site shows significant promise, although some habitat manipulation may be required to make it suitable for

the tortoise. More detailed investigations and monitoring will be undertaken in 2005 to ascertain its suitability as a translocation site and the feasibility of undertaking any habitat modification.

3.6 EDUCATION, PUBLICITY AND SPONSORSHIPS

3.6.1 Education and publicity

The Friends of the Western Swamp Tortoise Group undertook a range of initiatives in 2004, which included organising educational activities, development of interpretational signage and materials, and promotion of the Recovery Program. City of Swan included information and images of the WST on their calendar they produced for 2004 and The Southern Gazette newspaper published several stories on proposals related to the re-introduction of WST at the Perth Airport. In addition a number of articles on the WST were published in Green Corp and Ecoplan News Newsletters and other local newspapers. The Department conducted two PowerPoint presentations on the WST and recovery actions at meetings for the Swan Catchment Council and the Muchea Tree Farm.

3.6.2 Sponsorships

Sponsorships for 2004 included:

- an additional Wetlands Conservation Grant from Tiwest for $18 000, which was used for revegetation, aestivation tunnels, rat bait stations and interpretation material.
- The Friends of the WST received a $5000 Community Conservation Grant for on-ground works, including seedlings and revegetation projects;
- World Wide Fund for Nature (WWF) provided a Threatened Species Network Grant of $13 000 over 2 years. This funding was allocated to a range of on ground projects such as rehabilitation and protection work and also reprinting WST brochures and educational material.

ACKNOWLEDGEMENTS

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