MURDOCH UNIVERSITY
PERTH, WESTERN AUSTRALIA

Government of Western Australia

DEPARTMENT OF Conservation AND LAND MANAGEMENT
Conserving the nature of WA

The Status and Ecology of the *Pseudomys shortridgei* (Heath Mouse) in Southern Western Australia

Progress Report

Ecological Aspects of *Pseudomys shortridgei* (Heath Mice) in Southern Western Australia

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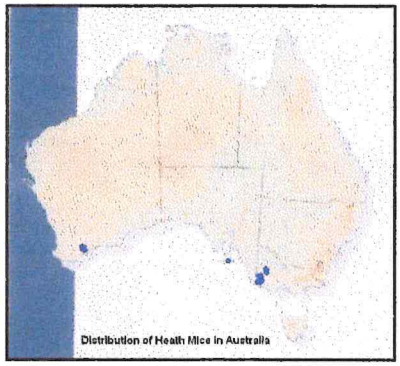
Introduction

Originally described in 1907 (Thomas) from a specimen collected near the locality of Woyerling (Shortridge 1936), approximately 150km south east of Perth WA, the heath mouse (*Pseudomys shortridgei*) was thought to be extinct in Western Australia, until in 1987 when the heath mouse was re-discovered in the Fitzgerald River National Park near the Western Australian town of Ravensthorpe (Baynes *et al.* 1987). Heath mice are known to also occur in western Victoria, in the Grampian State Forest, the Lower Glenelg National Park, Bats Ridge Fauna Reserve and the Mount Eccles National Park (Ovington 1978; Watts and Aslin 1981; Wells 1991). In 2000, a specimen collected from Flinders Chase NP on Kangaroo Island in 1967, was re identified as a Heath mouse but no other records from Kangaroo Island have been made. The heath mouse was once found through out the south west of Western Australia and south eastern Australia and has suffered a major decline in its distribution due the loss of habitat. The heath mouse has been listed as Vulnerable under Commonwealth EPBC Act 1999. It is also listed in the WA *Wildlife Conservation Act* 1950 as "fauna that is rare or likely to become extinct".



The majority of the ecological research on heath mice has focussed on the eastern populations (Happold 1976; Braithwaite *et al.* 1978; Cockburn 1978; Cockburn 1980; Cockburn et al. 1981; Meulman 1997; Woods and Kennedy 1997; Meulman and Klomp 1999; Meulman et al. 1999), with only three research papers being published from WA (Baynes et al. 1987; Cooper et al. 2003; Quinlan et al. 2004). This lack of information specific to the Western Australian populations, and several differences in environmental conditions between the two populations, has lead to the development of this study.

Heath mice in Victoria are most commonly found in diverse temperate heath with an average rainfall of above 600mm and have a preference for vegetation that is between 7-10 years post fire (Cockburn *et al.* 1981). In Western Australia heath mice appear to prefer older vegetation that is at least 20 years post fire (Quinlan et al. 2004), and sometimes as old as 40 years post fire (Baynes et al. 1987), in areas with an average rainfall just over 350mm. In both the western and eastern populations there is a preference for species rich and structurally complex heath. In 2001, honours student Kirsty Quinlin identified mixed heath communities on predominately lateritic soils as the preferred habitat of heath mice in Western Australia (Quinlan *et al.* 2004). Despite some variance in ecological requirements, differences in behaviour and the considerable distance between eastern and western populations the level of genetic divergence suggests it should be considered a single species. (Cooper *et al.* 2003)

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The aims of this study are to determine the ecology and distribution of this species in Western Australia, the densities at which they occur and their habitat preferences. Threatening processes will also be identified.

This study has one more year and this report identifies preliminary results and observations.

Methods

Study Sites: Initial surveys were conducted at sites where heath mice had been trapped since its rediscovery in 1987. These were Moir Track and Hamersley Drive (Fitzgerald River National Park), the Ravensthorpe Range, Bandalup Hill, Lake Magenta Nature Reserve and Dragon Rocks Nature Reserve. Dunn Rock Nature Reserve was also surveyed as it is within 100 km of three capture sites.

Trapping: Prior to any trapping, potential sites were identified using past capture records. Quinlin (Quinlan et al. 2004) identified mixed lateritic heath communities as the preferred habitat for heath mice in Lake Magenta NR. The initial survey included past capture sites and areas of species rich heath in which Elliott traps were set. The only population that was identified as suitable for a long term ecological study was found in the Lake Magenta Nature Reserve. A permanent trapping grid of 200 trap points was established along East Rd in Lake Magenta NR. The trap points were set 25m apart with 20 lines of 10 trap points. Traps were opened for between 3-4 nights. Each capture of a heath mouse was plotted and data on weight, sex, breeding condition and morphological measurements recorded. All captured animals were individually marked. Scats were collected for dietary analysis and tissue samples for genetic study were taken.

Table 1: Trapping effort for this study to determine distribution and ecology of Heath Mice in Western Australia

Date	Fieldtrip Location	Trap Nights	Comments
Nov 02	Ravensthorpe Region	1998	Preliminary search of past capture sites
Mar 03	Fitzgerald River NP	1100	No Heath Mouse Captures
Mar 03	Lake Magenta NR	320	2 Heath Mice Caught
May 03	Lake Magenta NR	1260	Radio Tracking of 5 Heath Mice
Jun 03	Ravensthorpe/Bandalup Hill	720	No Heath Mouse Captures
Oct 03	Dunn Rock/Dragon Rocks NR	1137	No Heath Mouse Captures
Nov 03	Lake Magenta NR	1422	East Rd Grid Established
Feb 04	Ravensthorpe/Bandalup Hill	994	No Heath Mouse Captures
Mar 04	Lake Magenta NR	1408	Radio Tracking of 8 Heath Mice
May 04	Lake Magenta NR	800	Increase in Heath Mouse Captures
Jun 04	Lake Magenta NR	800	Further Increase in Captures
Aug 04	Lake Magenta NR	860	Preliminary Veg Survey
Sep 04	Lake Magenta NR	800	Vegetation Survey
Oct 04	Fitzgerald River NP/Twertup	200	Second Heath Mouse Site Found
Nov 04	Lake Magenta NR	600	New Juveniles Caught
Dec 04	Lake Magenta NR	800	No New Juveniles Caught
Feb 05	Fitzgerald River NP/Twertup	680	Replicate Survey, Only 2 Re-captures
Mar 05	Lake Magenta NR	636	New sites tested, No Heath Mice
Apr 05	Lake Magenta NR	600	Stable population numbers
May 05	Lake Magenta NR	480	Replicate Population Density Experiment
May 05	Ravensthorpe/Fitzgerald River	900	Captured Heath Mice at Moir Track Sites
Total		18515	

Radio tracking: Two sessions of radio tracking have been conducted at East Road in the Lake Magenta NR during May 03 and March 04.

May 03 – Five individuals (4 male, 1 female) were fitted with radio collars (BioTrack). Positions were recorded twice daily with GPS and refuge types noted. Four heath mice were located on the East rd grid (Fig 1) and one was located in a patch of heath south of the East Rd grid.

March 04 – Eight heath mice located on the East road grid were fitted with radio collars and tracked for 8 nights (Fig 2). Positions were recorded using a GPS twice daily in the morning and the evening. The plant species and size of the refuge was noted for each position recorded.

Results

Regular trapping at the East Road site in Lake Magenta NR has resulted in the collection of a substantial data set. The population appears to be very stable with very few changes over the past 3 years. This is best illustrated by the known to be alive data (Fig 3) which shows a consistent population of between 21 and 27 animals since March 04.

The stability of the population and the consistent trapping of the majority of the individuals are also illustrated by Figure 4, with the same numbers of animal captured as known to be alive in the trapping area.

Preliminary results from the dietary analysis indicate a preference for leaf and stem material. There is fungal intake during wetter periods and some insect consumption through out the year. This is very similar to the results of studies conducted in Victoria where the Heath mouse has been classified as a generalist herbivore.

The vegetation description has been delayed due to the large number of plant species that need to be identified. Ninety two plant species were collected by the WA Wildflower society and sent to the WA herbarium for identification. The identification is scheduled to be completed by June/July 2005. The description of the habitat is scheduled to be completed by the end of 2005.

The sexual bias, as shown in Figure 6, between percentages of male and female heath mice is very similar to the results from Victoria. (WA) 64% male to 36% female (Vic) 66% male to 34% female bias. This gives a sex ratio of 1: 1.78 (female: male).

Preliminary home range analysis is indicating similar results to Eastern States studies but more data is needed for increased statistical vigour. These results confirm a distinct territoriality, with no overlap of home range between female heath mice, a very small overlap of home range of male heath mice and distinct male/female pairs that have almost 100% overlap (FIG 7 and Appendix).

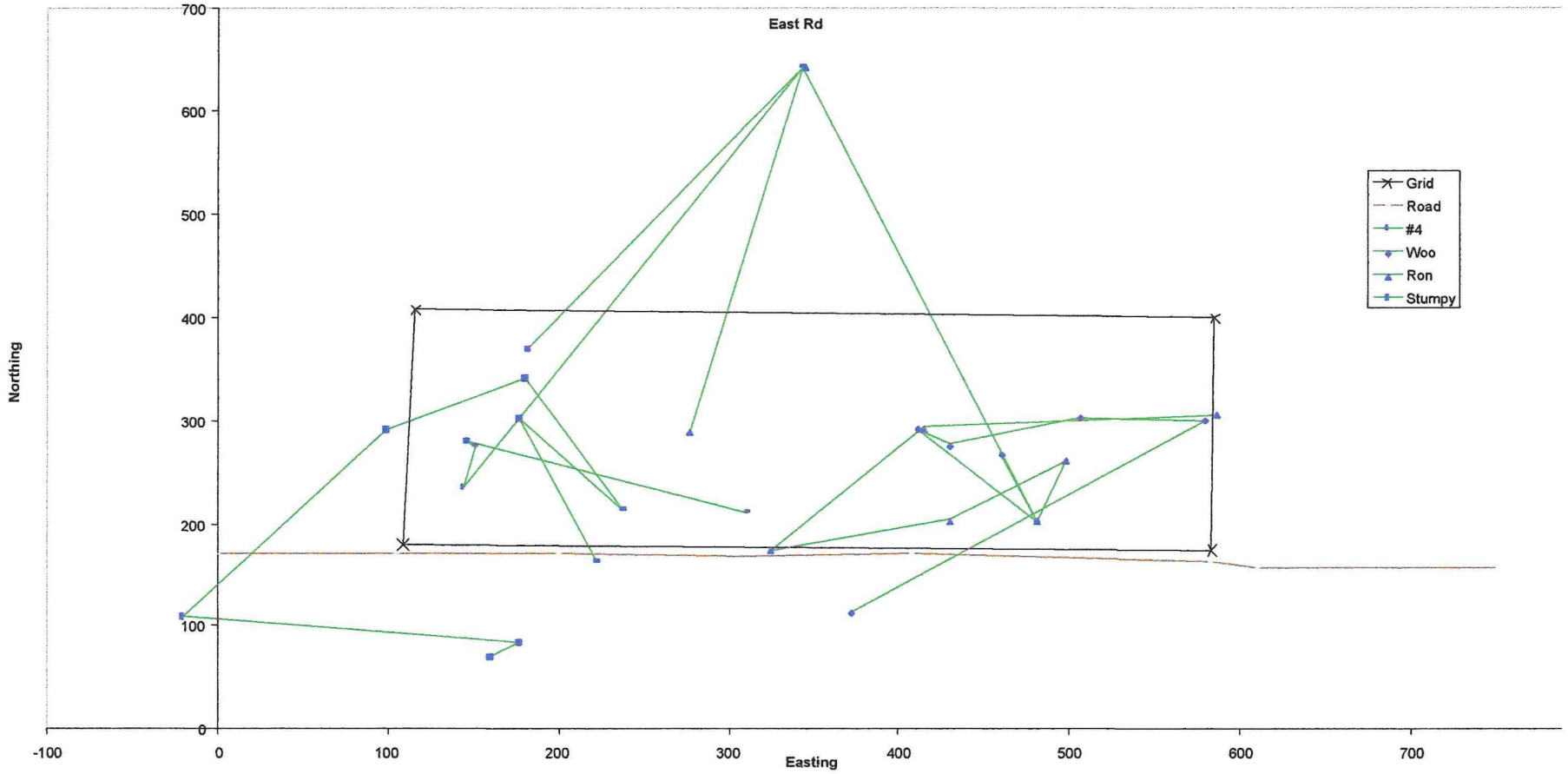

Figure 1 - Diagram of the movement of individual *P. shortridgei* during the May 03 radio tracking session at East Rd grid, Lake Magenta NR.

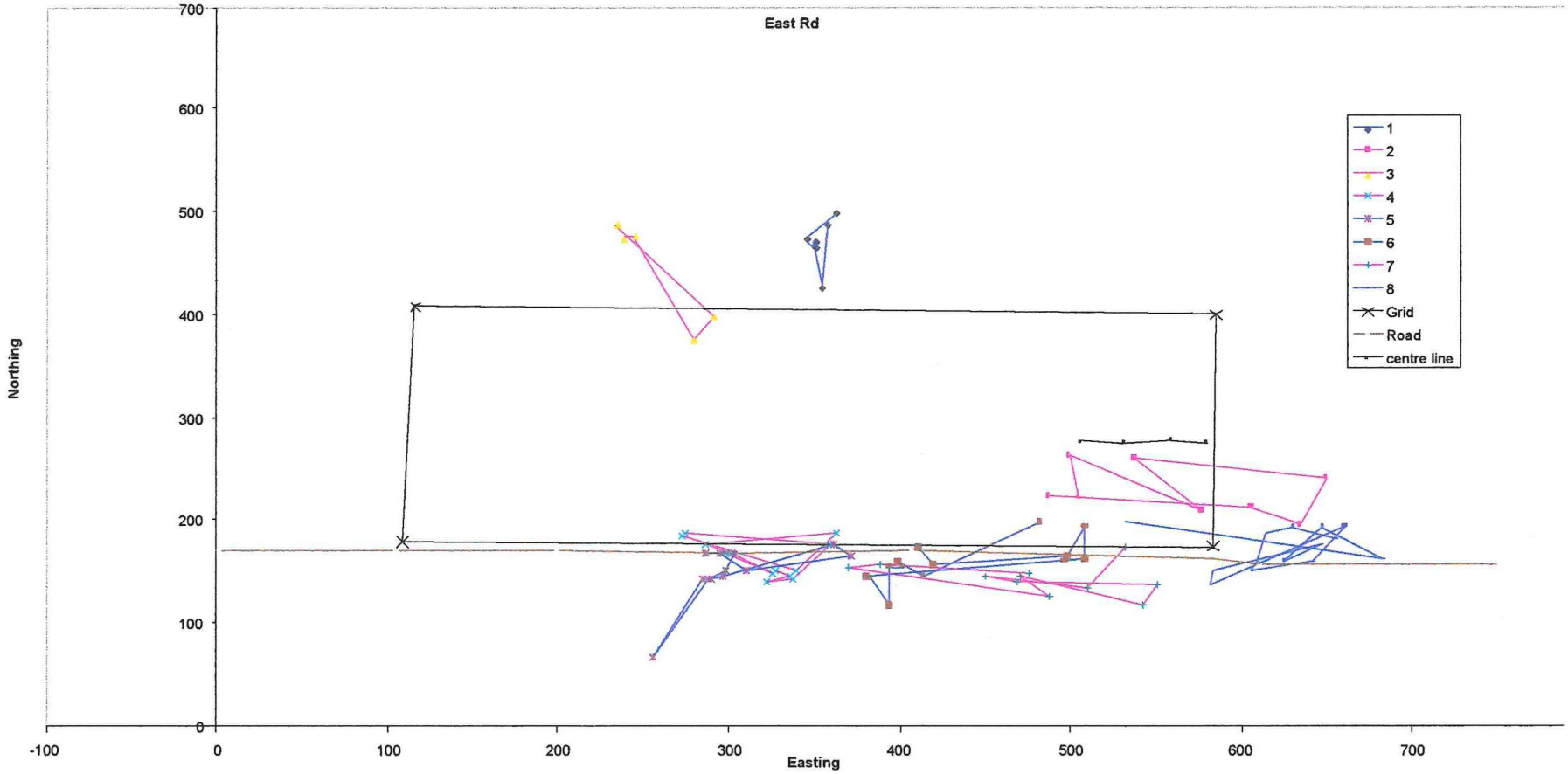

Figure 2 - Diagram of the movements of eight individual *P. shortridgei* during the March 04 radio tracking session at East Rd grid, Lake Magenta NR

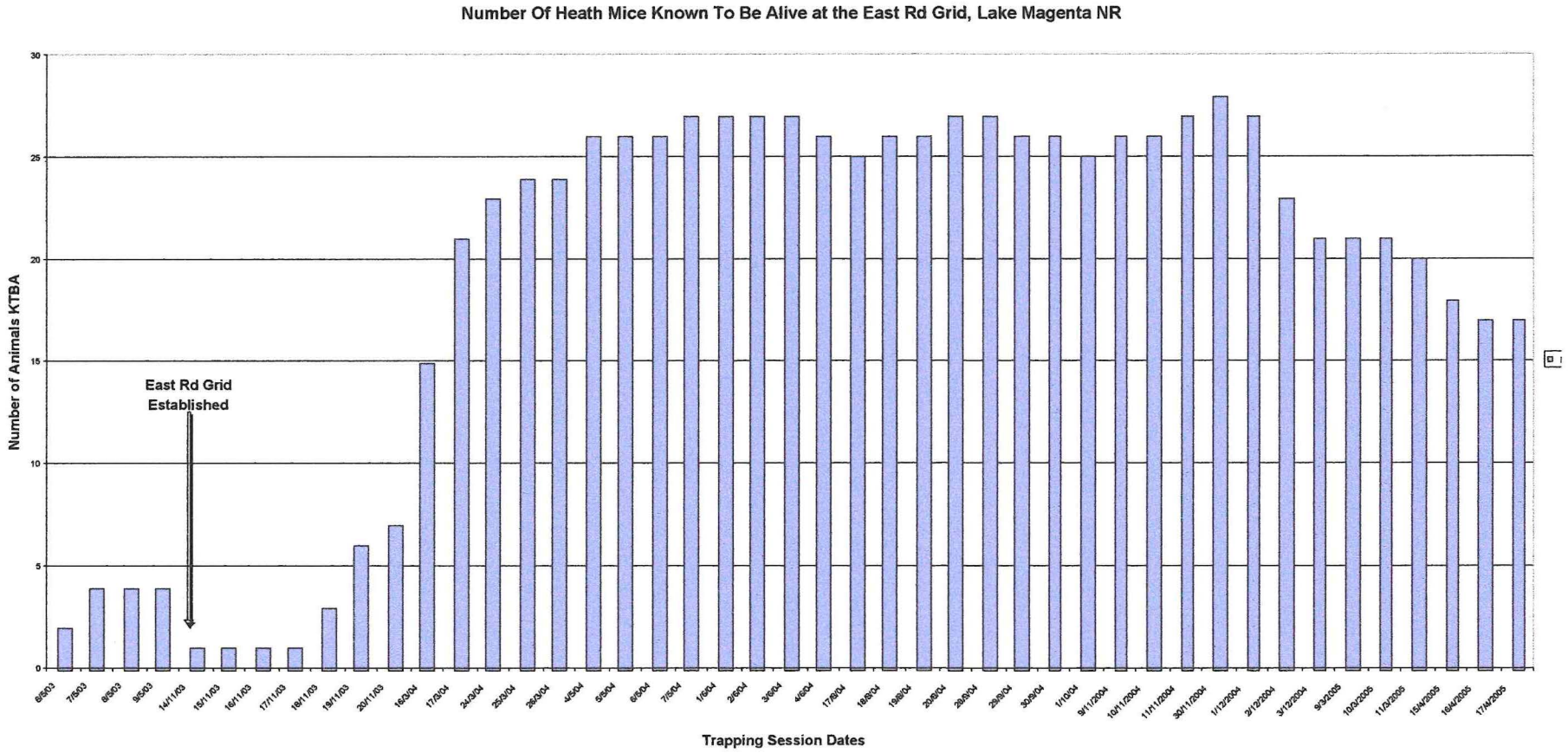

Figure 3 - The number of *P. shortridgei* known to be alive at East Rd grid, Lake Magenta NR

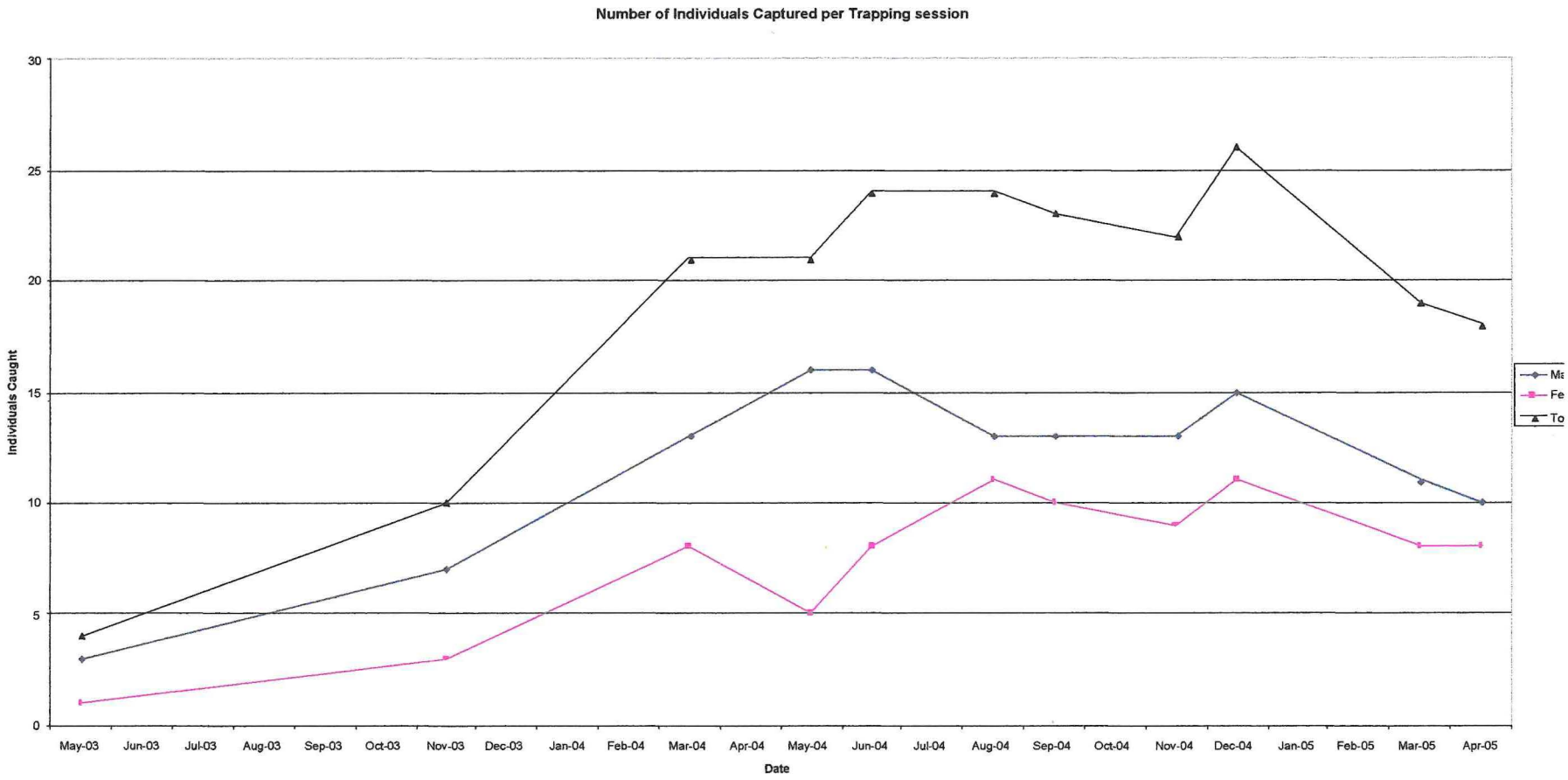

Figure 4 - Numbers of individual heath mice captured during each session at East Rd grid, Lake Magenta NR

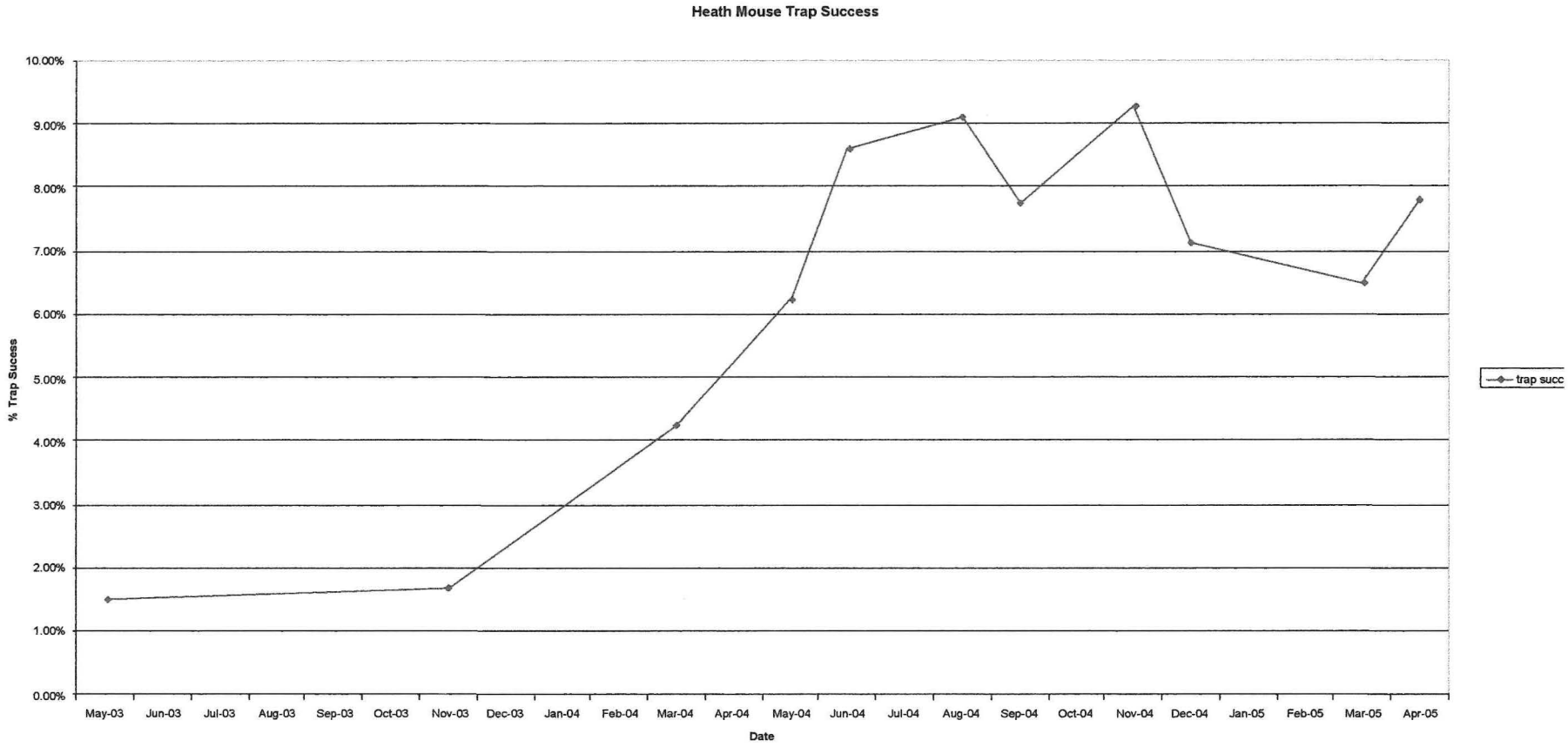

Figure 5 - Percentage trap success of P. shortridgei at East Rd grid in Lake Magenta NR

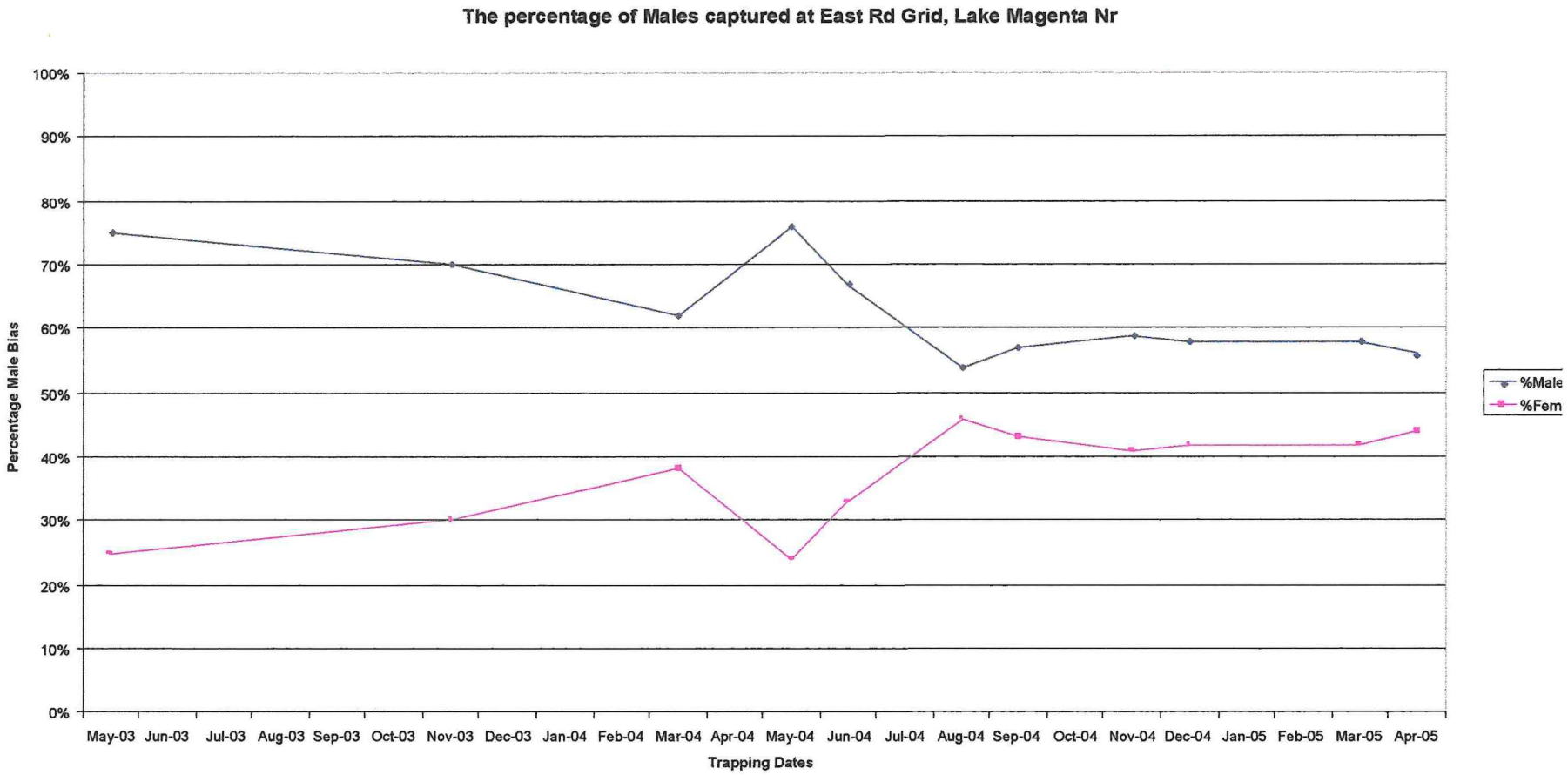

Figure 6 - Sexual bias exhibited by P. shortridgei at East Rd grid in Lake Magenta NR, displayed as a percentage

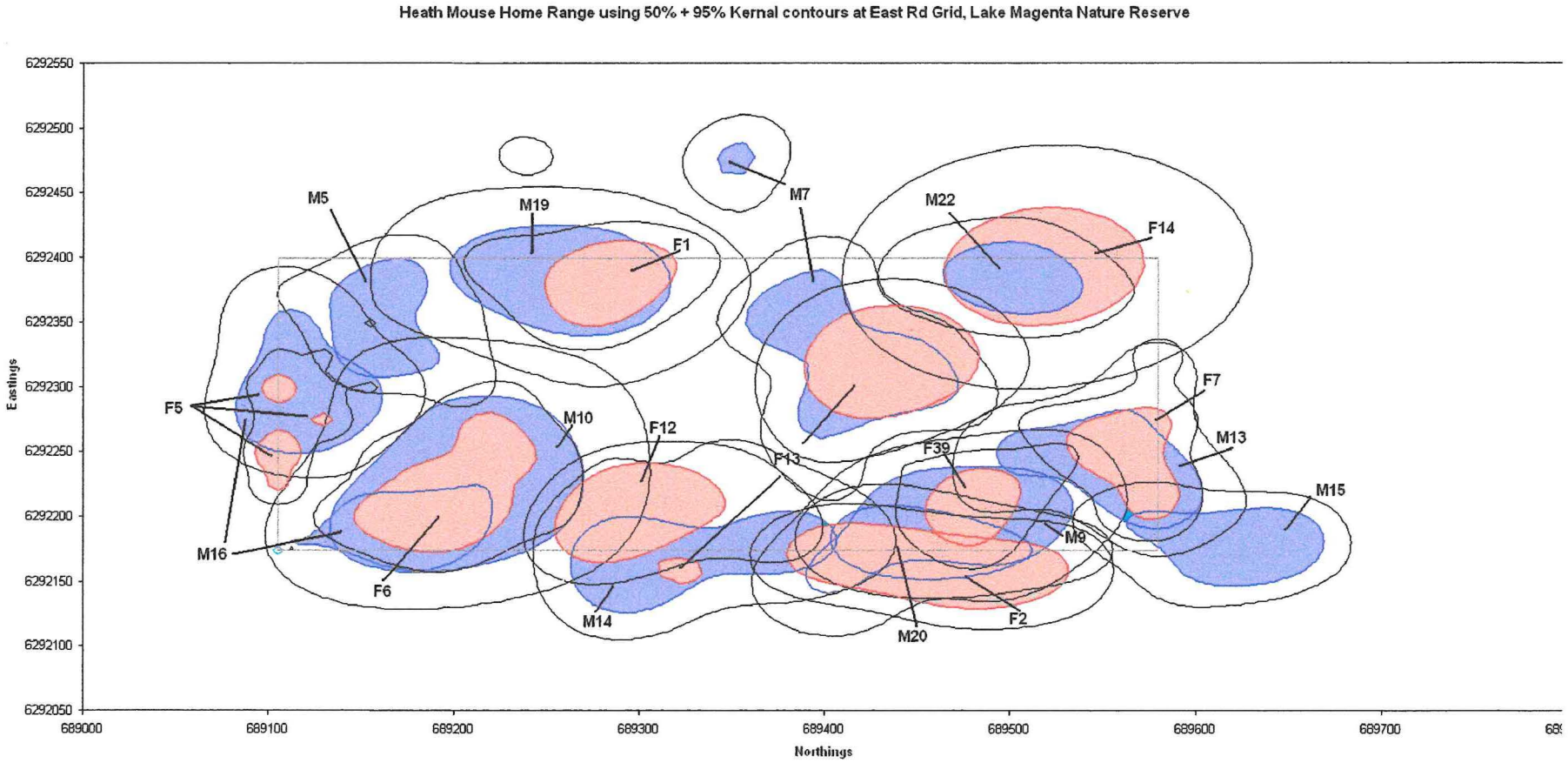

Figure 7 - Home range analysis of Trapping points and Radio Tracking points of Heath Mice using Kernel Contour (M = Male, F = Female)

Discussion

At this stage of the study several preliminary finding have been made regarding the animal's behaviour and ecology. Observations of *P. shortridgei* from this study show that they build multiple shallow burrows, usually dug under a low bush, in which they seek shelter. They utilise several burrows that may be visited by other Heath Mice, but not concurrently, with two types of burrow being recorded (Lined with nesting material and unlined). This differs considerable from the animals in Victoria which generally nest above ground, to the extent that in the Melbourne zoo's captive breeding program placed the nest boxes on top of the holding cages to help induce successful reproduction (Reiss 1996). In Lake Magenta NR, heath mice predominantly build their burrows under thick *Dryandra pteridifolia* clumps and if this was not available, such as in areas around Ravensthorpe, thick Banksia or even the root mass of Eucalypts are chosen as burrow building sites.

Preliminary results based on the Lake Magenta Nature Reserve site indicate heath mouse population densities of 1.95 ha^{-1}. This is obviously much lower than the heath mouse densities of up to of 6 ha^{-1} that are found in Victorian sites. It is unknown what is causing these lower densities though low productivity of the area, caused possibly by low rainfall, low soil nutrients or even high years since fire, is thought to be the cause for this difference.

The Diet of the heath mouse in WA appears at this stage to be very similar to the diet that has been observed in Victoria. The heath mouse is described in Victoria as filling the generalist herbivore niche because of it's preference for stem and leaf material with small amounts of insect and fungi (Braithwaite et al. 1978). This is consistent with preliminary data from this study although it is not known at this stage whether insect and fungi consumption is deliberate or incidental.

Heath mice in previous studies were never trapped in large numbers. This study has a peak trap success of just over 9% at Lake Magenta (Fig 5). It would appear that this site is close to optimum carrying capacity. The stability of this population and the low recruitment of new individuals may indicate that resident adults actively defend home territories from dispersing or transient individuals and/or have low reproductive capabilities. This is also displayed in Fig 7 and the diagram in the appendix. The relative stability of the population and the preliminary results from the home range analysis indicates that any offspring produced may need unoccupied suitable habitat nearby into which they can disperse, likewise established adults seeking refuge from the effects of disturbances such as clearing and fire may have to move considerable distances to find appropriate habitat.

Considerable effort has been made to establish the presence/absence of Heath Mice in Lake Magenta NR, Dunn Rock NR, Dragon Rocks NR, Fitzgerald River NP, Ravensthorpe Range and Bandalup Hill. This study has indicated that the heath mouse may be currently restricted to the Lake Magenta and Fitzgerald River vicinities.

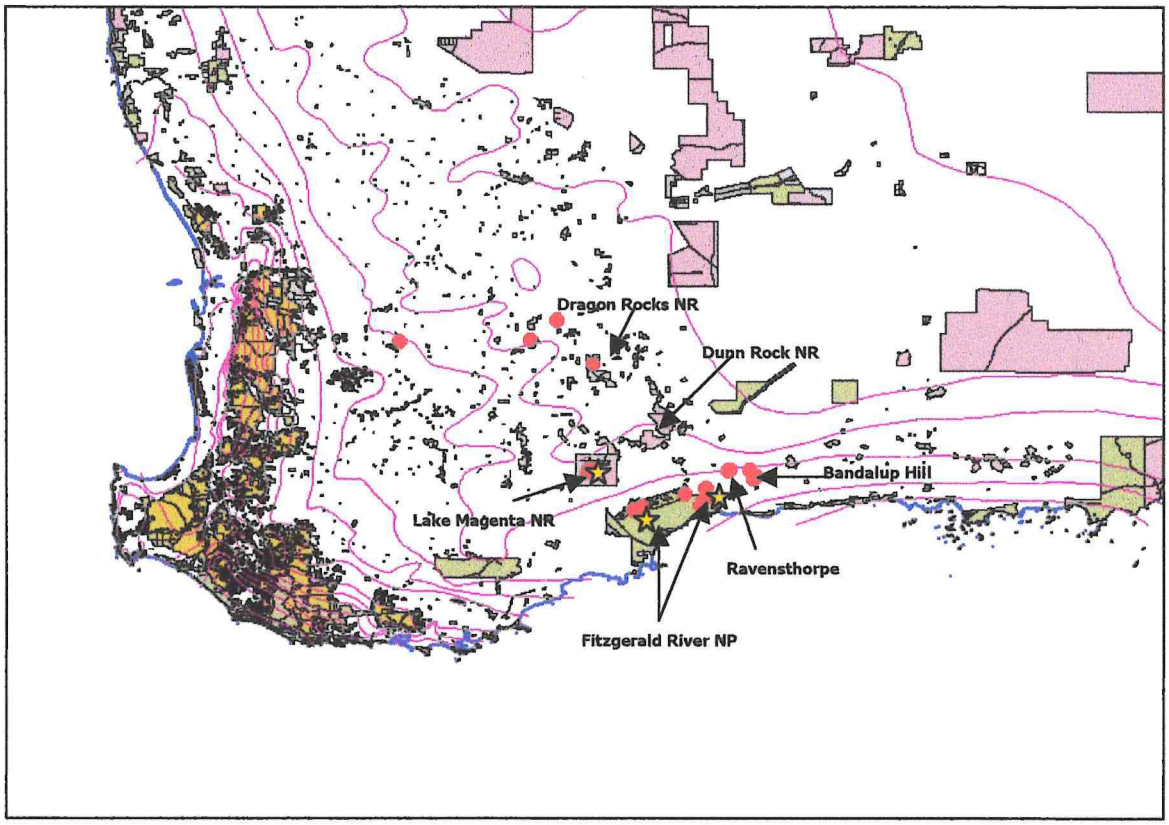

Figure 8 – Past captures (red circles) and captures from this study (yellow stars)

The continuing surveys in the region have resulted in identifying the broader occurrence of the Heath Mouse throughout Lake Magenta NR and two lower density populations in parts of the nearby Fitzgerald River NP. One individual has also recently been captured less than a kilometre north of the national park near the Phillips River. Observations from these sites indicate that whilst plant species may vary a thick vegetation structure below 60cm is an important habitat requirement. Further analysis is needed to prove this assumption. Home range size, strong habitat affinity, the ability to move large distances (100's m) and the territoriality of this species may explain why populations can exist in very hard to detect low densities. Large trapping grids and considerable trapping effort are required to detect the presence of heath mice.

Publicity

An article was published in Landscope magazine in 2003 (Johnson, B., and Costello, V. (2003) Heath mouse eludes searchers. *Landscope* **18(4),** pp 6-8

In July 2004 a poster was displayed at the 50th annual Australian Mammal Society conference held in Tanunda SA. A paper will be presented at the Australian Mammal Society conference which is being held in Albany WA in July 2005. This paper will focus on the distribution and densities of heath mice

Future Research

Fieldtrips have been planned for the rest of the year focussing on certain ecological aspects, vegetation surveys, new population surveys and continuation of monitoring the East Rd grid population.

The Geographic Information System (GIS) component of this project will commence from August 05 and will focus on the identification of preferred habitat and the prediction of new sites.

The last aspect of this study is the interpretation of the findings into a set of management recommendations for the Recovery Plan for *Pseudomys shortridgei*. This section is planned to begin in March 06 and will result in a set of recommendations that can be used by industry and government agencies.

Acknowledgements

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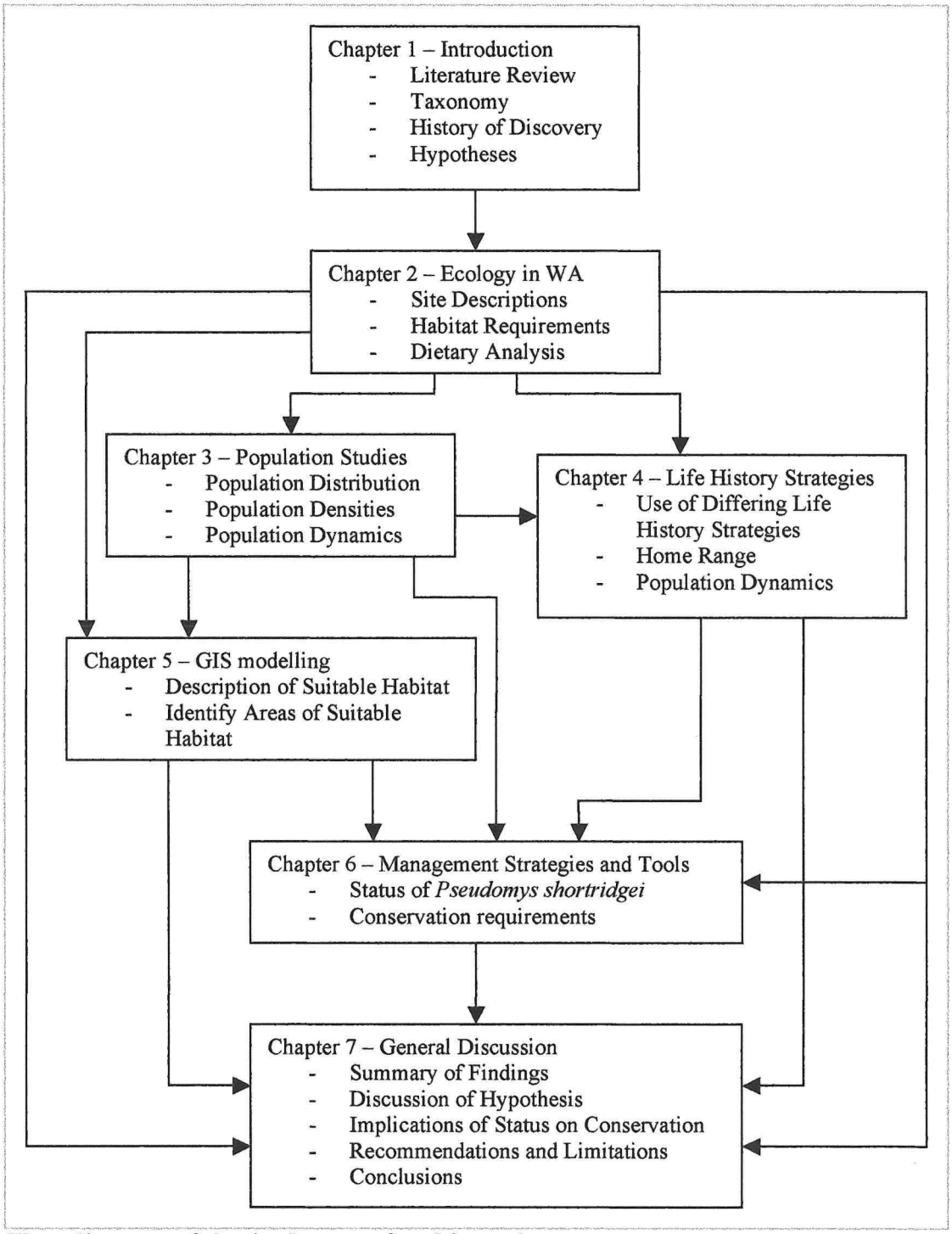

Flow diagram of thesis chapters for this project

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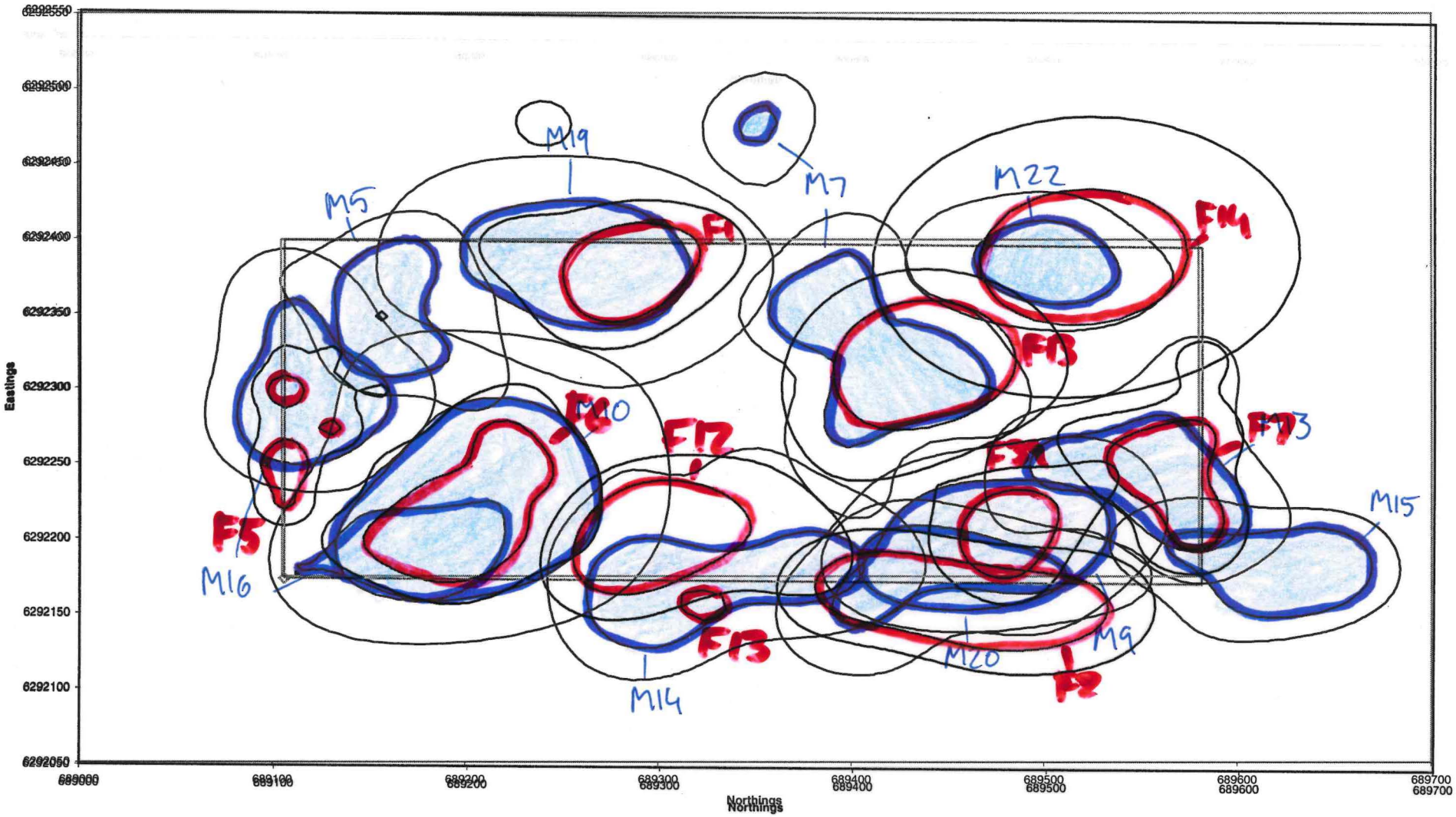
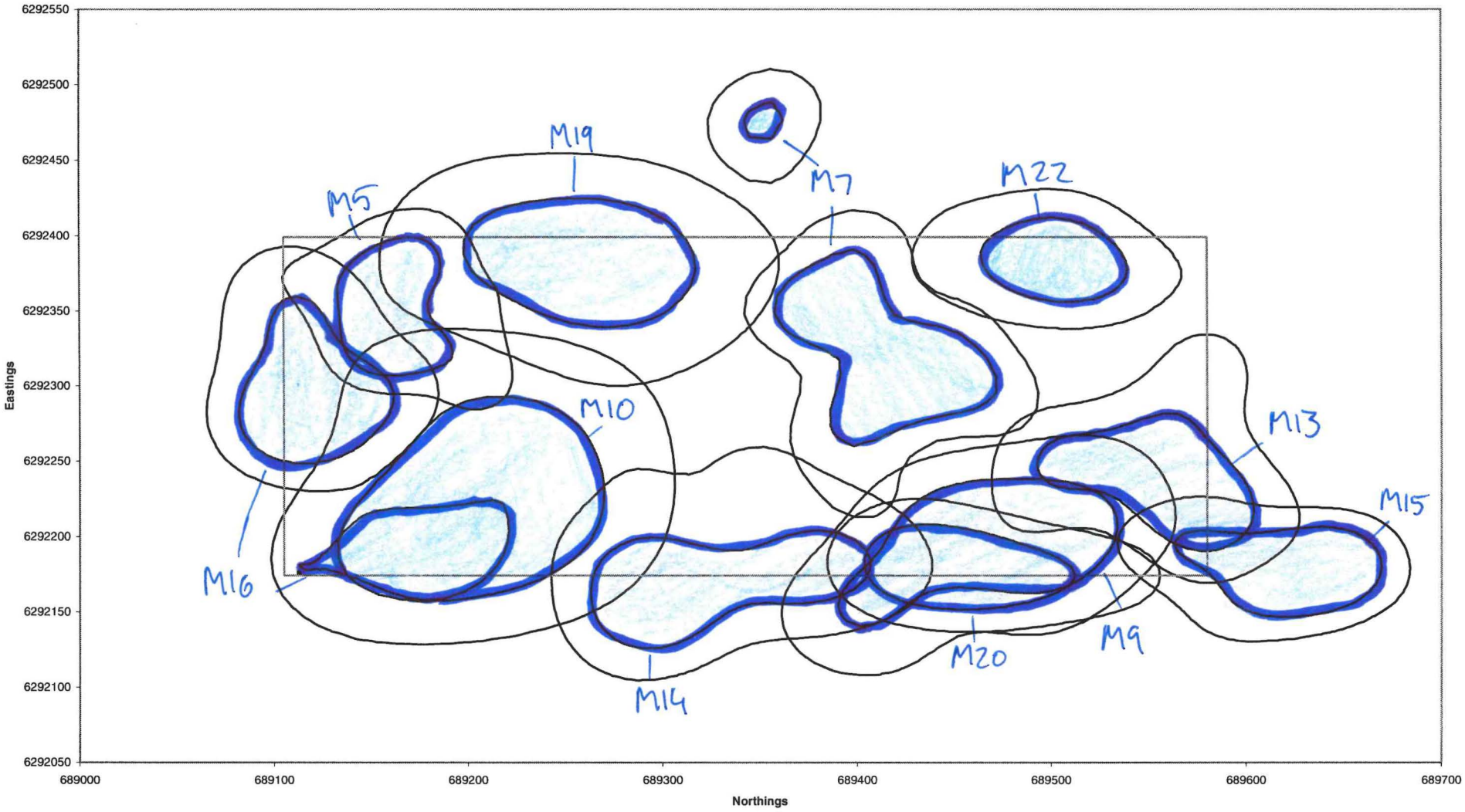
Male HM Home Range using 50% + 95% Kernal contours

Female HM Home Range using 50% + 95% Kernal contours



Male HM Home Range using 50% + 95% Kernal contours



Female HM Home Range using 50% + 95% Kernal contours