Wilson Inlet Foreshore & Mt Hallowell Reserves

Fauna Survey

2011

A report produced by

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for the

Shire of Denmark

Acknowledgements

This survey gave me an opportunity to re-explore some of my favourite places and a chance to extend my knowledge of its wildlife. I have thoroughly enjoyed every minute of surveying and hope that this report is beneficial to anyone who has an interest in Denmark and its wildlife. Many people have assisted in some way with this project and I would like to take this opportunity to thank some of them: Yvette Caruso (Shire of Denmark) for securing funding and the provision of reserve maps and management reports; Karlene Bain, Shaun McHenry, Roslyn Burnside, Jason Fletcher and Jackie Manning (Deptartment of Environment & Conservation) who all provided advice on use of traps, trap hygiene, animal care, and why so many Bush Rats and no Antechinus; my boys, Kieran and Liam, who accompanied me on surveys through near impenetrable coastal scrub, up and down Mt Hallowell and endured cold nights setting up traps. Also, for suffering my enthusiasm for all newly found frogs or lizards, my frustration and despair over missed photographs or computers which do not behave and my joy over finally getting that honey possum photo. Finally, to all of the creatures of Denmark who posed beautifully for photographs or put up with being handled while I draw belly markings or head scales. To those animals that remained elusive "I will get you next time". To anyone who has helped who I have not mentioned by name – Thank you.

Cover page: Tiger Snake (*Notechis ater occidentalis*) photographed by P. Gillespie in Foreshore Reserve R 24452.

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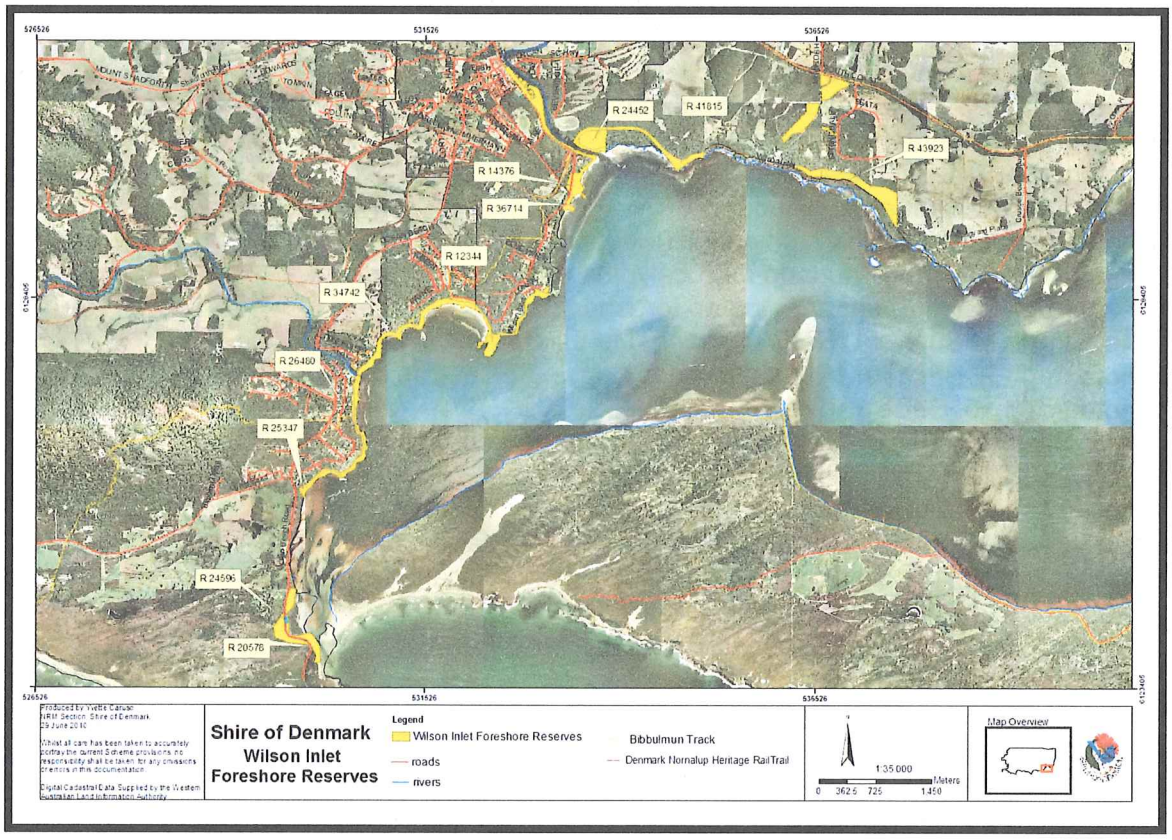
1.0 Introduction

The following fauna survey was conducted from June 2010 to June 2011 and covers the Mt Hallowell Reserve and Wilson Inlet Foreshore Reserves. Amphibians, reptiles and mammals although not bats, as no mist netting was conducted, were included in the survey. The reserves are located within approximately 10km of Denmark on the south coast of Western Australia. The landforms and soil types of the survey area are diverse ranging from granite outcrops and associated clay slopes, to a variety of estuarine deposits and deep coastal sands. The dominant flora reflects this diverse underlying geology with hillsides of karri, jarrah and marri forest to jarrah, marri, Banksia woodlands with pockets of Casuarina, Melaleuca wetlands and Agonis flexuosa open woodland on coastal dunes.

Figure 1. Showing location of Reserves



A complete list of reserves and their vesting is presented in Table 1.

Table 1. Wilson Inlet Foreshore Reserves included in the survey.

Reserve	Area (ha)	Purpose	Description
R 43923	33.2	Foreshore Management	Inlet boundary dune system dominant vegetation Eucalyptus marginata, Corymbia calophylla & Casuarina spp woodland.
R 41815	8.4	Heritage Trail	Inlet riparian vegetation dominant species Corymbia calophylla & Agonis flexuosa.
R 24452	6.9	Recreation	Riparian, wetland and heath complex of Eucalyptus marginata woodland, Melaleuca raphiophyla wetland & Beaufortia sparsa heath.
R 14376	13.8	Parklands and Recreation	Riparian zone of inlet and Denmark River Eucalyptus diversicolor open forest with Melaleuca raphiophylla wetlands
R 36714	1.2	Recreation	Riparian zone of inlet and Denmark River Eucalyptus diversicolor open forest with Melaleuca raphiophylla wetlands
R 22248		Govt. Requirements	Ironstone ridge and granite outcrops dominated by Eucalyptus marginata, Corymbia calophylla.
R 12344 & 28993	9.4	Recreation	Granite outcrops to inlet with Eucalyptus diversicolor, Agonis flexuosa, Eucalyptus marginata & Melaleuca spp mixed woodland
R 34742	13.5	Recreation	Inlet Riparian zone with Eucalyptus diversicolor, Corymbia calophylla on higher ground with Melaleuca priessiana, Taxandria juniperina wetlands
R 26480	8.8	Recreation	Inlet Riparian zone with Eucalyptus diversicolor, Corymbia calophylla on higher ground with Melaleuca priessiana, Taxandria juniperina wetlands
R 25347 & 43490	3.8	Foreshore Management	Inlet Riparian zone with Melaleuca spp wetlands
R 24596		Parking Facilities	Limestone and coastal dune systems dominated by Agonis flexuosa woodland
R 20578	13.1	Camping	Limestone and coastal dune systems dominated by Agonis flexuosa woodland

Table 2. Mt Hallowell Reserves

Reserve	Area (ha)	Purpose	Description
R 12182	123.6	Recreation	The Mt Hallowell Reserves represent a variety of topographic ranges and soil types from granitic outcrops through clay slopes to deep sand and peat swamps. The higher slopes particularly on the Eastern and Southern sides are dominated by Eucalyptus diversicolor with pockets of Casuarina spp while the lower slopes and Northern slopes are more typically Eucalyptus marginata, Corymbia calophylla, Banksia grandis, Banksia ilicifolia and Casuarina spp.
R 14959	242.8	Recreation	
R 30080	27	Recreation	
R 38844	56.3	Recreation	
R 18077	8.4	Timber	
R 2897	6.8	Vacant Crown Land	

2.0 Climate

The South Coast of Western Australia experiences a Mediterranean-type climate with cool, wet winters and warm to hot, dry summers. Denmark resides in an area which receives an annual rainfall of approximately 1200mm and has annual evaporation rates of 1000mm.

3.0 Geology

The geology of the Southwest of Western Australia can be traced back to the Archaean over 2,500 million years ago when the granitic bedrock of the Yilgarn plateau was formed. Denmark lies within the younger Albany –Fraser Orogen, which is formed mainly of Proterozoic (2,500 ma to 545 ma), granitic and gneissic bedrock. This more general description was expanded by Semeniuk in 1998 and renamed the coastal unit "Albany Headlands and Inlets" to the D'Entrecasteaux-Albany Coastal Zone. Described as "a complex of headlands, rocky shores, inlets, deltas, barrier dunes, and local monadocks". This bedrock of the D'Entrecasteaux-Albany Coastal Zone is overlain with more recent sediments formed during the Tertiary and Quaternary periods. During this time the earth experienced a series of glacial and interglacial phases. The sediments are thus the result of a variety of processes. During glacial periods sea levels were lower and climate drier resulting in deposition of aeolian (wind blown), desertic dune quartz sand. While during interglacial periods onshore winds formed calcareous sand mounds over the more ancient bedrock (V & C Semeniuk 1998). During these interglacial periods the Wilson Inlet Foreshore reserves would have been under the sea. Thus the Quaternary deposits are a mixture of alluvial, estuarine and aeolian deposits of sand, clay and limestone.

4.0 Flora

The complex geology of the area results in a high diversity of flora. The study area comprises: Melaleuca spp & Taxandria juniperina swamps and seasonal wetlands; Eucalyptus marginata, Corymbia calophylla and Banksia spp woodlands; Agonis flexuosa open woodland; through to Eucalyptus diversicolor forests interspersed with granite outcrops.

Photograph P. Gillespie.

Photograph 1. Agonis flexuosa woodland.

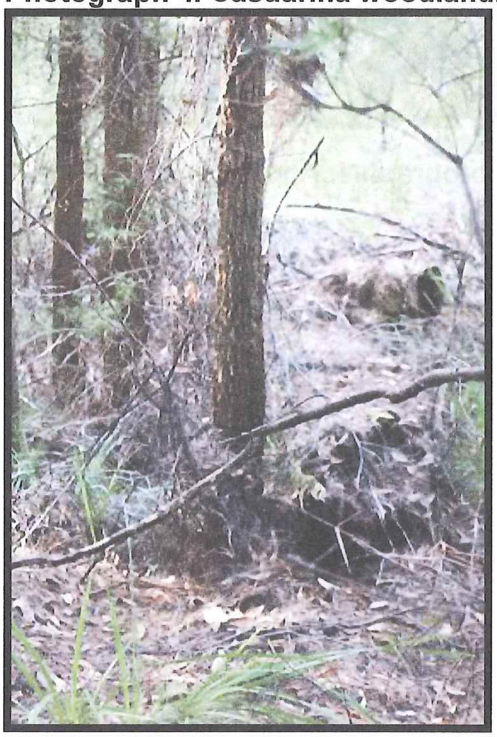
Photograph P. Gillespie.

Photograph 2. Foreshore wetland.

Photograph 3. Karri forest.

Photograph P. Gillespie.

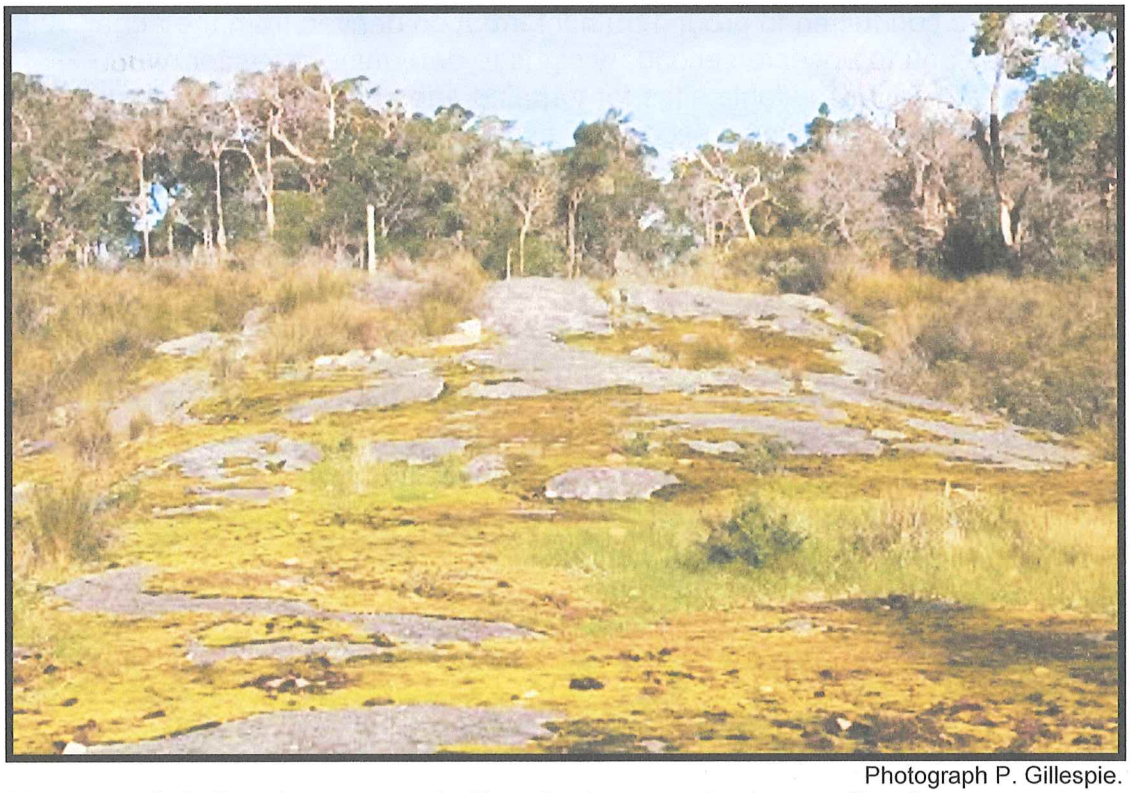
Photograph 4. Casuarina woodland.



Photograph P. Gillespie.

Photograph P. Gillespie.

Photograph 5. Melaleuca raphiophylla wetland.



Photograph P. Gillespie.

Photograph 6. Granite outcrop in Eucalyptus marginata woodland.

5.0 Methods

A variety of methods were employed to locate and identify fauna within the reserves. Traps, remote cameras, calls, secondary signs and direct observation all contributed to the final list of fauna.

5.1 Background check

An initial literature survey was conducted from reserve reports and management plans, previous museum surveys and government species lists. The Department of Environment and Conservation's Nature Map was used to identify species which may occur within a 10 km radius of Denmark. Western Australian Museum surveys, local shire management reports and a variety of other literature was reviewed to see which species are thought to occur within the study area. These are presented in the Bibliography. There are no Threatened Ecological Communities listed within the study area. A list of species form these sources is presented in Table 4. It should be noted that this list includes species from the surrounding area and not exclusively from within the reserves surveyed.

5.2 Aerial photos

Aerial photographs were examined to identify major flora and habitat types with each reserve. Diverse, small or unusual landforms or pockets of atypical flora were also identified. From these initial survey transects were determined.

5.3 Preliminary surveys

Surveys were conducted to ground truth information derived from the aerial photographs and to observe secondary signs to determine areas for more vigorous examination, suitable sites for trapping and possible remote camera locations. Direct observations, secondary signs and calls were recorded on site during these surveys.

5.4 Equipment

A variety of equipment was employed to locate and identify species within the study area. Traps, including Elliot, cage, pitfall and camera were setup in suitable locations where secondary signs indicated the presence of animals. Photographs were taken to assist in identification and to provide a record for future surveys. Results from these were mapped on a Geographic Information System. Description of equipment and procedures for each type of trap is detailed below.

5.4.1 Elliot Traps

Elliot traps were set in habitat suitable for small mammals and where secondary signs such as diggings, scats or tracks indicated their presence. Traps were set in the evening and checked the following morning. Traps were not open during the day and repeated trapping was not carried out in the same location to reduce the risk of repeatedly trapping and thus unnecessarily stressing, the same individual. Traps were not set on cold nights where the forecast was for a temperature below 10° C. On cool nights material, usually dry grass, was placed within the trap so that animals could insulate themselves from the cold metal of the trap. Care was taken to place sufficient food within the trap so that animals trapped early in their foraging would not go hungry that night given that they are not released until the following morning and may not forage again until the next night. Animals caught in the traps were identified on sight and released on location. Where possible animals were not handled unnecessarily as many would leave the trap voluntarily.

Photograph P. Gillespie

Photograph 7. Elliot trap near log on foreshore

Photograph P. Gillespie.

Photograph 8. Bush rat (*Rattus fuscipes*) in Elliot trap.

Photograph P. Gillespie.

Photograph 9. Bush rat (*Rattus fuscipes*) leaving Elliot trap.

5.4.2 Cage Traps

A 'Sheffield' style trap was used for medium size mammals such as the Brushtail Possum. The trap measurements were 300mm high by 300mm wide with an overall length of 900mm. Care was taken in selecting trap locations to reduce the risk of trapped animals being bitten by large ants. A cover was placed over part of the trap to provide shelter from wind and rain. As for the Elliot traps, a reasonably large amount of food was supplied to reduce the chances of animals going hungry on the nights they were trapped. The trap was set in the evening and checked the following morning. Similar precautions to the Elliot traps were taken to avoid repeatedly trapping the same animals.

5.4.3 Pitfall Traps

A pitfall trap was utilised where the landforms were suitable. The trap consisted of a plastic trap approximately 450mm deep and 250mm square at the top. A 15m long 200mm high netting fence was erected to guide animals into the trap. For much of the study area this was not practically possible. The trap was left at the same location for 7 days and checked morning and evening so that animals were not left in the trap for extended periods of time. Loose plant material was placed in the bottom of the trap to provide shelter for trapped individuals. Trapped animals were identified on location and released on site.

Photograph P. Gillespie.

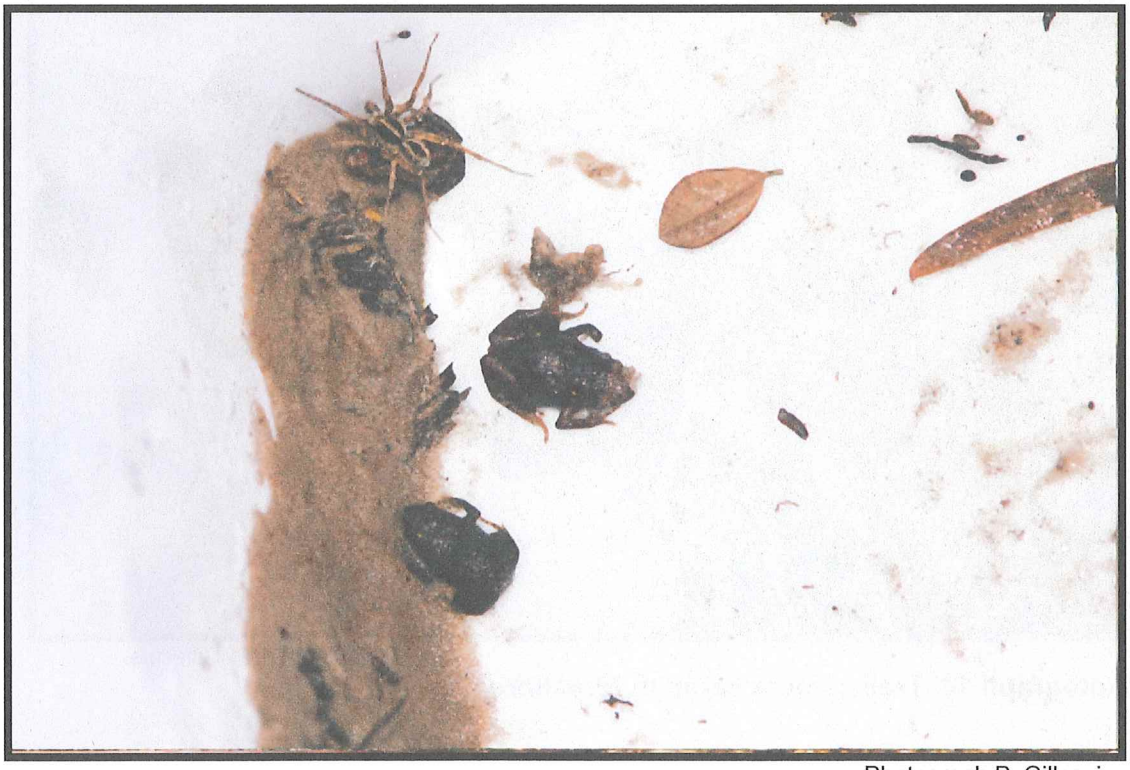
Photograph 10. Cage trap on Mt Hallowell.

Photograph P. Gillespie.

Photograph 11. Brushtail possum (*Trichosurus vulpecula*) in cage trap on Mt Hallowell.

Photograph P. Gillespie.

Photograph 12. Pitfall trap in coastal dunes.



Photograph P. Gillespie.

Photograph 13. Frogs caught in pitfall trap.

5.4.4 Camera Traps

A Bushnell remote trail camera was purchased during the latter part of the survey to see if some of the animals thought to be present, but that had not been sighted or trapped, could be recorded. The camera was used in many of the reserves and usually set for a few nights at a time. Generally it was placed where secondary signs indicated the presence of animals. It was set either without attractants or with a variety of attractants.

5.4.5 Attractant

A wide variety of attractants were used for Elliot and Sheffield traps as well as the remote trail camera. Oats, peanut butter, bacon, apple, honey, banana, and sultanas or combinations of the above were provided. Honey was withdrawn from the list for the traps after it was found to attract large numbers of ants which were considered to be both a deterrent to animals entering the trap or may harm a trapped animal.

Photograph P. Gillespie.

Photograph 14. Trail camera setup in foreshore wetland.

Photograph P. Gillespie.

Photograph 15. Brushtail possum (*Trichosurus vulpecula*) caught on trail camera.

Photograph P. Gillespie.

Photograph 16. Quenda caught on trail camera.

5.4.6 Camera

A Canon EOS 100 camera with 20mm-105mm and 100mm-300mm EOS zoom lenses was used to record animals where possible. Initially images were recorded on film, developed and then scanned to disk. Later a Canon EOS 550D digital camera was purchased to both improve the resolution of images and the ease of recording and reproduction.

5.4.7 GIS

All mapping was carried out on "Map Window" a freely available GIS platform. Locations of observations were determined from aerial photographs correlated with on ground records. Accuracy for the Wilson Inlet Reserves is estimated to within 10m while those for the Mt Hallowell reserve are accurate to within 20m. This provide information sufficient to allow those interested in locating species to find them at these sites. Shape files generated and supplied in digital format include information regarding method of observation. To avoid excessive amounts of data once species had been identified several times at a particular location no further records where included.

5.5 Daylight Surveys

Daylight surveys were conducted to identify secondary signs and direct observations of animals. Where animals were thought to be present, but could not be observed at the time, observation sights were established. Observation from such sites may involve waiting for extended periods of time (hours) to observe shy species. Where possible photographs were used to record species seen.

Photograph P. Gillespie.

Photograph 17. Western Swamp Skink (*Lissolepis luctuosa*).

5.6 Spotlight Surveys

Spotlight surveys were conducted at night to observe nocturnal species.

Photograph P. Gillespie.

Photograph 18. Honey possum (*Tarsipes rostratus*) feeding.

Photograph P. Gillespie.

Photograph 19. Western Pygmy Possum or Mundarda (*Cercartetus concinnus*).

5.7 Scats, tracks, trails & other signs.

A wide variety of secondary signs were used to either identify animals directly or the likely presence of animals. Tracks, scats, skeletal remains, scratches on trees, runs, diggings and calls were all used. Care was taken not to record the presence of animals just from a single secondary sign unless positive identification could be established. Easily identifiable signs such as kangaroo and bandicoot tracks or kangaroo and brushtail possum scats were considered sufficient for positive identification. Similarly, frogs calls such *a Limnodynastes dorsalis, Crinia georgiana, Crinia glauerti* or *Litoria moorei* are sufficiently distinctive to provide positive identification. For most species either further secondary signs or direct observation was required before recording the presence of a particular species. In some cases direct observation required secondary signs to provide confirmation of species as in the case of morphologically similar species such as *Crinia pseudoinsignifera and Crinia subinsignifera*. Where secondary signs such as frog calls where heard only once and appeared to indicate the presence of species which are not thought to be present in the study area such as *Crinia insignifera* or *Geocrinia lutea* these have not been recorded.

Photograph P. Gillespie.

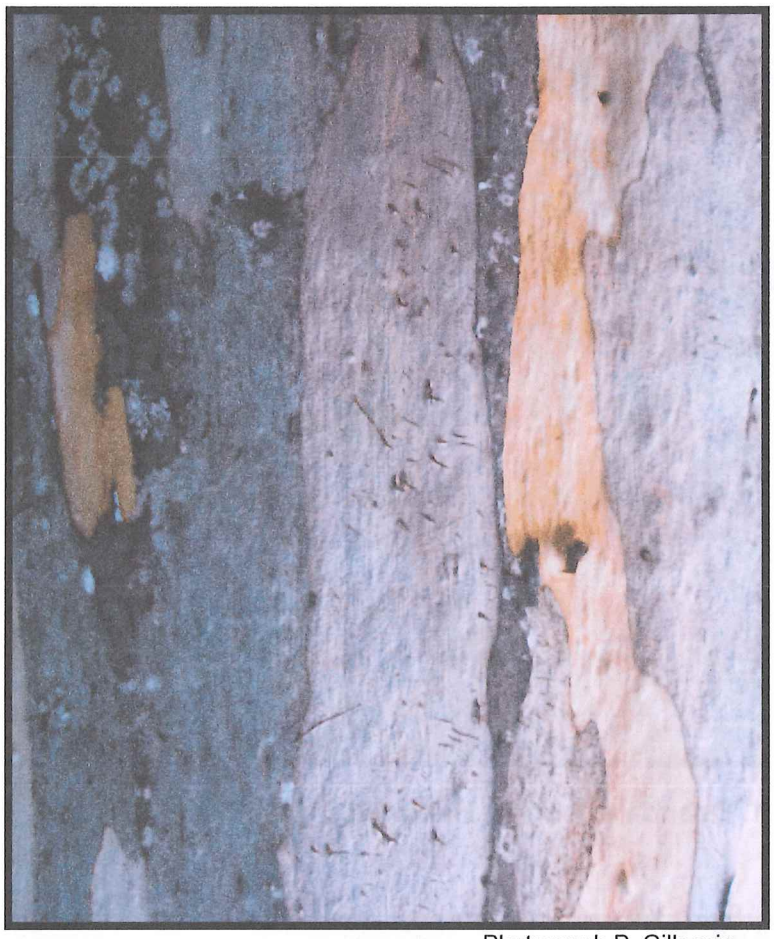
Photograph 20. Quenda tracks in soft mud.

Photograph P. Gillespie.

Photograph 21. Quenda run on Mt Hallowell.

Photograph P. Gillespie.

Photograph 22. Brushtail Possum scats in moss on fallen tree.



Photograph P. Gillespie.

Photograph 23. Brushtail Possum scratches on Karri tree.

Photograph P. Gillespie.

Photograph 24. Quenda diggings in foreshore reserve.

5.8 Handling

Where possible unnecessary handling of animals was avoided. In some cases catching animals such as small frogs or lizards was necessary to enable positive identification. Gentle handling and identification carried out on site minimised any risk of harm. This was particularly important with skinks as they may shed their tails if handled incorrectly. This is thought to be a defensive mechanism which allows the animal to escape while the potential predator is distracted by the still wriggling although now detached tail. Although skinks suffer no long term harm from such behaviour they lose bone, muscle tissue and fat reserves and presumably are more at risk from infection until they have healed. After handling hands were washed with water to reduce the risk of transmitting potentially harmful organisms between individuals. This was considered particularly important with frogs which suffer a variety of skin pathogens. Traps were washed with water and a mild bleach solution after trapping to both reduce the risk of disease transmission through urine or faecal matter and to remove the odour of previously trapped animals.

Photograph P. Gillespie.

Photograph 25. Young Quenda remain calm if handled gently.

Photograph P. Gillespie.

Photograph 26. Skinks require careful handling to avoid tail shedding.

5.9 Identification

Most identification was confirmed by reviewing a variety of literature sources, a list of which is provided in the bibliography. For frogs the primary source was "Field Guide to Frogs of Western Australia". Most reptiles were identified from "Reptiles and Amphibians of Australia" although skinks were primarily identified from "Lizards of Western Australia Part 1 Skinks". All identification was conducted onsite with field drawings and photographs being used for further review where necessary. Where animals were either seen only briefly or where positive identification was not possible no presence has been recorded. For instance Photograph 27 shows tracks believed to belong to a small mammal about the size of a Bush Rat, however despite repeated attempts to trap or capture an image of the animal no further evidence was found. The tracks are similar to those found recently in similar dune systems to the west of Denmark, but as yet no positive identification of the animal has been possible. The photographs presented are hoped to be of sufficient quality to provide future reference and if necessary amended identification where experts in that particular field may deem appropriate. All care has been taken not to include records of species where there is some doubt. No reported observations from other individuals have been included in the results of this report. Records from other sources displayed in Table 3 have not been confirmed by this author. For consistency nomenclature follows the Australian Faunal Directory 2010. This means that for some species, such as the Western Crowned Snake, which is referred to within the literature under a variety of names, there maybe some confusion. It is refered to within my results as *Drysdalia coronata* after *(Schlegel, 1837),* despite a number of sources such as (Storr 1982) and recent DNA studies which place it within the genus Elapognathus (Keogh, Scott & Scanlon 2000).

Similarly: the Marbled Gecko *Phylodactylus marmoratus* is *Christinus marmoratus*; the Western Swamp Skink sometimes placed in the *Egernia* genus is *Lissolepis luctuosa*; and the Western Three-lined Skink is *Acritoscincus trilineata* rather *than Tiliqua trilineata* or *Leiolopisma trilineatum*.
To avoid confusion I have changed the alternative names from previous studies shown in Table 3. Common names tend to follow the same source although I use aboriginal names for many of the mammal species such as Quenda for the Southern Brown Bandicoot and Mardo for the Yellow-footed Antechinus.

Photograph P. Gillespie.

Photograph 27. Unusual tracks in coastal dunes.

6.0 Results

6.1 Reserves

Records from this survey are presented in Table 3. Most of the species thought to be present within the study area were found during this study and the majority of these are also represented in the Photographic Record. Some species such as Kangaroos, Tiger Snakes and Bandicoots were found throughout the study area in a wide variety of habitats. Others such as *Metacrinia nichollsi* were habitat specific. Most species were identified from a wide variety of signs, such as tracks, scats, diggings and direct observations. There were a few species which were only observed from remains such as the Antechinus and Brush-Tailed Phascogale. There were a few species which were not observed during this study which are almost certainly present. Dunnarts were not observed within the Mt Hallowell reserve although the habitat is suitable.

There are several possible explanations for this: Much of the habitat is dense and observations of small mammals within the understorey is difficult; The large study area, with several difficult to access areas, provides sufficiently large areas of habitat which could support dunnarts; and the trapping regime was not sufficient to reveal the presence of dunnarts. In looking at these more closely, certainly the dense understorey makes observation of small mammals problematic not only is it not possible to view much of the forest floor, runs and scats cannot generally be seen, and any animals present have taken evasive action due to the noise of moving through such vegetation long before the observer gets close. Areas which are difficult to access are unlikely to be responsible for the lack of positive observations as similar habitat was surveyed extensively and dunnarts, if present, would have also been in these areas. Trapping was carried out on Mt Hallowell in a variety of habitats. The most commonly trapped animals being Bush Rats. These are likely to be trapped first being relatively abundant and bold and may reduce the chances of trapping other small mammals (personal communication J. Fletcher 2010). Pitfall traps, which typically are the most successful method of trapping dunnarts, were set on Mt Hallowell but only at a couple of locations due to lack of suitable terrain for this type of trap. These areas may have contained dunnarts but were not the highest value Dunnart habitat. Also, in further examination of Dunnart trapping it has been found that traps of 400mm deep were much less successful than those of 600mm deep (Ward 2009). The trap used was 450mm deep and although loose plant material was placed in bottom of the trap to reduce the capacity of animals such as Dunnarts to escape, found to be successful with mice, it maybe that this was not a sufficiently deep trap to hold any individuals which fall into it. Chuditch have been listed as occurring on Mt Hallowell as well as an unconfirmed report from South Coast Hwy near the Denmark Golf Course. No confirmed sign of Chuditch was recorded although there was evidence of predation on swans along the inlet close to the golf course. Scats were collected but without further forensic examination it was not possible to differentiate these from that of a Fox. Fox tracks and calls were recorded from this reserve and so it was thought to be a much more likely candidate. Ringtail Possums have been listed in the "Mt Hallowell Reserve Management Plan 1995" but were not observed during this study. Neither were areas of suitable habitat of sufficient size to support populations of Ring-tailed Possums identified on Mt Hallowell. There is an area of suitable habitat to support a population of Ring-tailed Possums in and surrounding Reserve 20578. However, despite extensive ground surveys and the use of a trail camera, no direct observation or secondary sign was identified. Some species are relatively easily found due to being diurnal or having loud distinctive calls, while others are cryptic and rarely seen. Without intensive study into the likelyhood of detecting a particular species it is not possible to accurately determine the relative abundance of species. The results, therefore, only indicate the presence of species rather than relative abundance.

6.2 Additional results from surrounding areas

Several species were observed in areas adjacent to the study area and almost certainly occur within it. These are presented at the end of the species list and have been included on the maps where possible. All of these records are included in the shape files. Such species include Bardick (*Eclipses curta*) found at Lights Beach by Shire Ranger, and the Chain-striped South-west Ctenotus (*Cteontus catenifer*). Although bats were not included in the survey they were seen in all of the reserves. However, identification was not possible except in one case where an individual was recorded in *Eucalyptus* diversicolor forest near Mt Hallowell. It is likely that this species, believed to be Beccari's Free-tail bat (*Mormopterus beccarii*), occurs within the reserve.

Photograph P. Gillespie.

Photograph 28. Beccari's Free-tail bat (*Mormopterus beccarii*).

6.3 Species Identified

Reptiles

Class: Reptilia (Reptiles)
Order: Squamata (Lizards & Snakes)

Family: Gekkonidae (Geckos)
Species: ***Christinus marmoratus*** (Marbled Gecko)

Family: Scincidae (Skinks)
Species: ***Acritoscincus trilineatus*** (Western Three-lined Skink)
Ctenotus labillardieri (Common South-west Ctenotus)
Egernia kingii (King Skink)
Egernia napoleonis (South-western Crevice-skink)
Hemiergis peronii subsp. peronii (Lowlands Earless Skink)
Lissolepis luctuosa (Western Mourning Skink)
Menetia greyii (Common Dwarf Skink)
Tiliqua rugosa (Bobtail)

Family: Elapidae
Species: ***Drysdalia coronatus*** (Crowned Snake)
Notechis ater occidentalis (Tiger Snake)
Pseudonaja affinis subsp. affinis (Dugite)
Echiopsis curta (Bardick)

Amphibians

Class: Amphibia (Amphibians)
Order: Anura (Frogs)

Family: Hylidae (Tree frogs)
Species: ***Litoria adelaidensis*** (Slender Tree Frog)
Litoria moorei (Motorbike Frog)

Family: Myobattrachidae (Southern Frogs)
Species: ***Crinia georgiana*** (Quacking Frog)
Crinia glauerti (Rattling Froglet)
Crinia pseudoinsignifera (Bleating Froglet)
Crinia subinsignifera (South Coast Froglet)
Geocrinia leai (Ticking Frog)
Metacrinia nichollsi (Forest Toadlet)

Family: Limnodynastidae
Species: ***Heleioporus eyrei*** (Moaning Frog)
Limnodynastes dorsalis (Western Banjo Frog)

Mammals

Class: Mammalia
- Family: Burramyidae
  - Species: ***Cercartetus concinnus*** (Western Pygmy-possum, Mundarda)
- Family: Canidae
  - Species: ***Vulpes vulpes*** (Red Fox)
- Family: Dasyuridae
  - Species: ***Antechinus flavipes*** (Yellow-footed Antechinus, Mardo)
  - ***Phascogale tapoatafa subsp. tapoatafa*** (Southern Brush-tailed Phascogale, Wambenger)
- Family: Felidae
  - Species: ***Felis catus*** (Cat)
- Family: Leporidae
  - Species: ***Oryctolagus cuniculus*** (Rabbit)
- Family: Macropodidae
  - Species: ***Macropus fuliginosus*** (Western Grey Kangaroo)
- Family: Muridae
  - Species: ***Hydromys chrysogaster*** (Water Rat)
  - ***Mus musculus*** (House Mouse)
  - ***Rattus fuscipes*** (Bush rat)
  - ***Rattus rattus*** (Black rat)
- Family: Peramelidae
  - Species: ***Isoodon obesulus subsp. fusciventer*** (Southern Brown Bandicoot, Quenda)
- Family: Phalangeridae
  - Species: ***Trichosurus vulpecula subsp. vulpecula*** (Common Brushtail Possum)
- Family: Tarsipedidae
  - Species: ***Tarsipes rostratus*** (Honey Possum, Noolbenger)

Species from adjacent Areas

Reptiles

Class: Reptilia (Reptiles)
- Order: Squamata (Lizards & Snakes)
  - Family: Scincidae (Skinks)
    - Species: ***Ctenotus catenifer*** (Chain-striped South-west Ctenotus)
  - Family: Elapidae
    - Species: ***Echiopsis curta*** (Bardick)

Mammals

Class: Mammalia
- Family: Molossidae
  - Species: ***Mormopterus beccarii*** (Beccari's Free tail-bat)

Species by Reserve

Table 4. Species by Reserve

Scientific Name	Common Name	Reserve ID														
		43923	41815	24452	14376	36714	29426	22248	12344	28993	34742	26480	25347	24596	20578	MtH
Frogs																
Crinia georgiana	Quacking Frog	X		X	X			X		X		X	X			X
Crinia glauerti	Clicking Frog	X		X				X		X	X	X	X		X	
Crinia pseudoinsignifera		X		X								X	X			X
Crinia subinsignifera		X						X		X	X		X			X
Geocrinia leai	Ticking Frog	X		X	X			X		X	X	X			X	X
Heleioporus eyrei	Moaning Frog			X								X				
Heleioporus inornatus	Whooping Frog															
Limnodynastes dorsalis	Western Banjo Frog			X	X							X			X	
Litoria adelaidensis	Slender Tree Frog			X								X				
Litoria moorei	Motorbike Frog	X										X				
Metacrinia nichollsi	Forest Toadlet															X
Pseudophryne guentheri	Crawling Toadlet															X
Mammals																
Antechinus flavipes	Yellow-footed Antechinus, Mardo											X				X
Cercartetus concinnus	Western Pygmy-possum, Mundarda											X				
Felis catus	Cat			X												
Hydromys chrysogaster	Water-rat				X											
Isoodon obesulus	Southern Brown Bandicoot, Quenda	X		X	X			X	X	X	X	X				X
Macropus fuliginosus	Western Grey Kangaroo	X		X	X			X		X					X	X
Mormopterus beccarii	Beccari's Freetail Bat															
Mus musculus	House Mouse											X				
Phascogale tapoatafa	Brush-tailed Phascogale, Wambenger											X				X
Pseudocheirus occidentalis	Western Ringtail Possum															
Oryctolagus cuniculus	Rabbit	X		X				X				X				
Rattus fuscipes	Western Bush Rat			X					X		X				X	X
Rattus rattus	Black Rat											X				
Tarsipes rostratus	Honey Possum, Noolbenger			X												
Trichosurus vulpecula	Common Brushtail Possum							X		X	X					X
Vulpes vulpes	Red Fox			X								X			X	X
Reptiles																
Acritoscincus trilineatus	Western Three-lined Skink	X		X												X
Christinus marmoratus	Marbled Gecko							X				X				X
Ctenotus catenifer	Chain-striped South-west Ctenotus														X	
Ctenotus labillardieri	Common South-west Ctenotus	X		X				X		X		X				X
Drysdalia coronatus	Crowned Snake											X				X
Echiopsis curta	Bardick															
Egernia kingii	King's Skink															X
Egernia napoleonis	South-western Crevice-skink															X
Lissolepis luctuosa	Western Swamp Skink			X												
Elapognathus minor	Short-nosed Snake															
Hemiergis peronii subsp. peronii	Lowlands Earless Skink	X		X				X		X		X				X
Lerista microtis subsp. microtis	South-western Slider															
Menetia greyii	Common Dwarf Skink														X	
Notechis ater occidentalis	Tiger Snake	X		X	X							X			X	X
Pseudonaja affinis subsp. affinis	Dugite											X				X
Tiliqua rugosa	Bobtail Skink											X			X	

7.0 Threats & Future Management

There are a number of threats to the fauna of the foreshore reserves and Mt Hallowell it is however, beyond the scope of this study to do more than identify observed threats and provide cautionary information regarding future management. Habitat loss is one of the major threatening processes affecting native animals in the Southwest of Western Australia. Kitchener (1982, cited in Bradshaw 2006) noted that of all animals groups studied, mammals have shown the greatest departure from their original richness since the fragmentation of landscape of South-Western Australia. Fragmentation of landscape and loss of habitat are listed as threatening processes for Quenda by the Department of Environment and Conservation. While Fougere (2000) states "habitat destruction is the clear determinant of wildlife survival". Many of the reserves surveyed are small (less than 20 ha), and for many species such as Quenda and Western Grey kangaroos their observed abundance appears to be due to offsite food sources such as golf courses, adjacent agricultural land or suburban gardens. For other species fragmentation of ecological communities may lead to species loss where individuals are unable to move between key food supplies. The loss of key species within ecosystems results in a decline of the whole system. Habitat loss is not confined to the loss of flora species, frequent burning or removal of old logs may result in a lack of den sites for species such as Chuditch, while loss of dead trees with hollows may impact on species such as the Brush-tailed Phascogale and Brush-tailed Possum. Fire regimes, inappropriate clearing and disease such as dieback all lead to habitat loss. For some species and reserves such as the Honey Possum population within reserves R 24452 and R 41815 inappropriate prescription burning regimes in adjacent reserves with similar habitat (R 12232), which result in either both reserves being burnt at the same time or an insufficient time gap, may result in the loss of this species from that area. A burning regime thus needs to ensure that regeneration of the neighbouring habitat is given sufficient time to provide both food and suitable nesting sites. Where suitable habitat is restricted to a small area and isolated from similar habitat fire regimes may need to be sufficiently long to ensure that populations have re-established . Similarly if dieback, a disease caused by the soil-bourne microscopic water mould *Phytophthora cinnamomi*, should spread to the small *Banksia spp* populations on Mt Hallowell it may not be possible for animals to find another suitable habitat without having to cross large areas of open country if at all. Habitat loss also leads to an increase in the risk of predation by introduced species such as foxes and cats. Several feral animals were observed during the survey including cats, foxes, black rats, house mice and rabbits. Generally, although seen as major threats to native animals these species do not appear to be having a major impact where the native habitat is intact. An example of this is the reserves R 24452 and R 41815 which contain populations of Honey Possums, Quenda, Bush Rats and Brush-tailed Possums even though foxes and feral cats were observed and have, presumably, been present within these areas for decades. The habitat provides sufficient shelter from predators for native animals to survive. This is in keeping with the lack of documented evidence of cats leading to local extinction of any native species on the mainland (Walton & Richardson (eds) 1989) where the habitat is intact. However, post burn conditions with a lack of suitable shelter, exacerbated by the lack of unburnt adjacent habitat, may result in high levels of predation from introduced species and potentially local extinction.

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http://spatial.agric.wa.gov.au/wetlands/

Appendix A

Table 4. Results from previous surveys

Scientific Name	Common Name	1	2	3	4	5
Crinia georgiana	Quacking Frog	X	X	X		
Crinia glauerti	Clicking Frog	X				
Geocrinia leai	Ticking Frog	X	X	X		
Heleioporus eyrei	Moaning Frog	X	X	X	X	
Heleioporus inornatus	Whooping Frog		X	X		
Limnodynastes dorsalis	Western Banjo Frog	X	X	X	X	
Litoria adelaidensis	Slender Tree Frog	X	X	X	X	
Litoria moorei	Motorbike Frog	X	X	X	X	
Pseudophryne guentheri	Crawling Toadlet		X	X		
Bettongia penicillata	Woylie					X
Antechinus flavipes	Yellow-footed Antechinus					X
Cercartetus concinnus	Western Pygmy-possum, Mundarda	X	X			X
Dasyurus geoffroii	Western Quoll, Chuditch	X		X		X
Felis catus	Cat					X
Hydromys chrysogaster	Water-rat	X	X	X		X
Isoodon obesulus	Southern Brown Bandicoot, Quenda	X		X	X	X
Macropus fuliginosus	Western Grey Kangaroo	X		X		X
Macropus irma	Western Brush Wallaby	X		X	X	X
Mus musculus	House Mouse	X		X	X	X
Nyctophilus geoffroyi	Lesser Long-eared Bat	X				
Nyctophilus gouldi	Gould's Long-eared Bat	X				
Phascogale tapoatafa	Southern Brush-tailed Phascogale	X	X			X
Pseudocheirus occidentalis	Western Ringtail Possum					X
Oryctolagus cuniculus	Rabbit					X
Rattus fuscipes	Western Bush Rat	X		X	X	X
Rattus rattus	Black Rat	X		X	X	X
Setonix brachyurus	Quokka	X				X
Sminthopsis gilberti	Gilbert's Dunnart	X				
Sminthopsis griseoventer	Grey-bellied Dunnart	X	X	X	X	
Tachyglossus aculeatus	Echidna					X
Tarsipes rostratus	Honey Possum, Noolbenger	X	X	X		X
Trichosurus vulpecula	Common Brushtail Possum	X				X
Vespadelus regulus	Southern Forest Bat	X				
Vulpes vulpes	Red Fox			X		X
Acritoscincus trilineatus	Western Three-lined Skink					X
Christinus marmoratus	Marbled Gecko	X				X
Ctenotus catenifer	Chain-striped South-west Ctenotus	X	X	X	X	
Ctenotus labillardieri	Common South-west Ctenotus	X	X	X	X	
Drysdalia coronatus	Crowned Snake	X	X	X		X
Echiopsis curta	Bardick					
Egernia kingii	King's Skink	X	X	X	X	X
Egernia napoleonis		X	X	X		X
Egernia pulchra		X	X	X		
Elapognathus minor	Short-nosed Snake	X	X	X		
Hemiergis gracilipes		X				
Hemiergis peronii subsp. peronii		X	X	X	X	X
Lerista microtis subsp. microtis		X	X	X	X	
Lissolepis luctuosa	Western Swamp Skink	X	X	X		
Menetia greyii			X	X		
Notechis ater occidentalis	Tiger Snake	X				X
Pseudonaja affinis subsp. affinis	Dugite	X				X
Rhinoplocephalus bicolor	Square-nosed Snake					X
Sphenomorphus australis			X	X		
Tiliqua occipitalis	Western Bluetongue		X	X		
Tiliqua rugosa					X	X
Varanus rosenbergi	Heath Monitor	X	X	X	X	X

1. Nature Map 10 km radius of denmark
2. W.A. Museum surveys prior to 1950
3. W.A. Museum surveys 1950-1975
4. W.A. Museum surveys 1986
5. Shire of Denmark Mt Hallowell Management Plan

Photograph P. Gillespie.

Photograph 29. Western Three-lined Skink (*Acritoscincus trilineatus*)

Photograph P. Gillespie.

Photograph 30. Young Bobtail Skink (*Tiliqua rugosa*).

Photograph P. Gillespie.

Photograph 31. Quenda (*Isoodon obesulus*) at Poison Pt Reserve.

Photograph P. Gillespie.

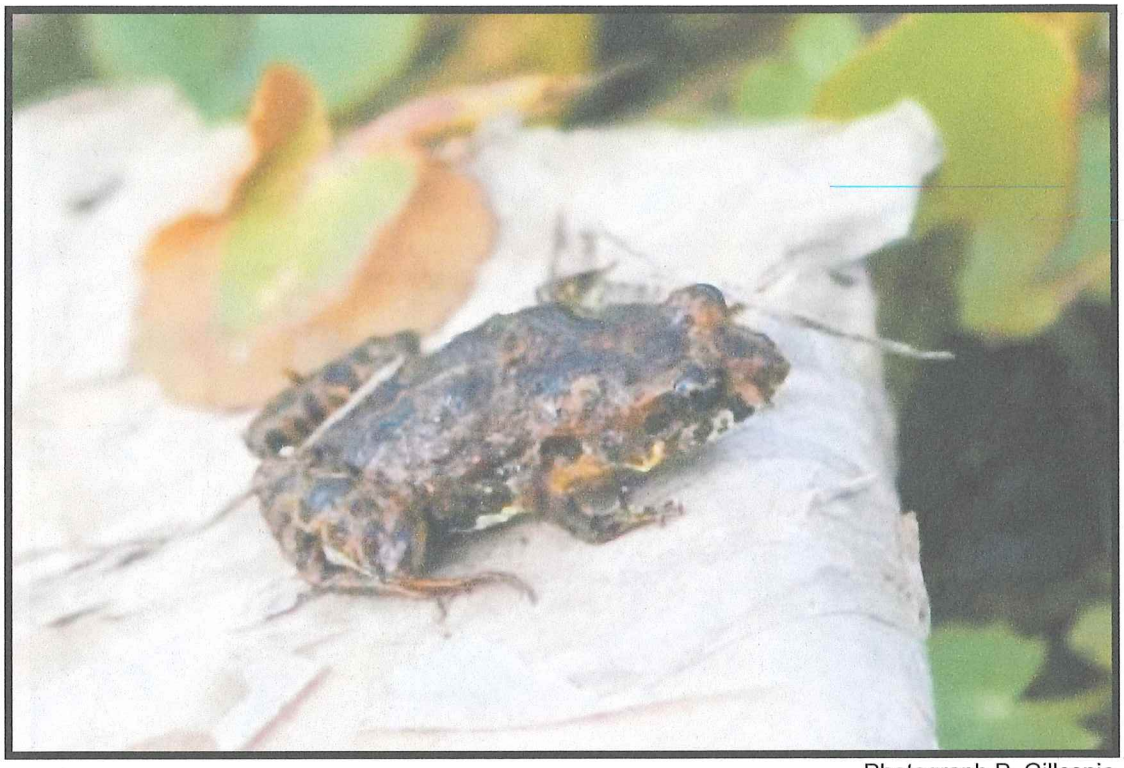
Photograph 32. Bardick (*Echiopsis curta*) in coastal heath.

Photograph P. Gillespie.

Photograph 37. ***Crinia georgiana*****.**

Photograph P. Gillespie.

Photograph 38. ***Crinia glauerti*****.**



Photograph P. Gillespie.

Photograph 39. *Crinia pseudoinsignifera* on paperbark in R 24452.

Photograph P. Gillespie.

Photograph 40. *Crinia pseudoinsignifera* in R 36714.

Photograph P. Gillespie.

Photograph 41. Chain-striped South-west Ctenotus (*Ctenotus catenifer*).

Photograph P. Gillespie.

Photograph 42. Common South-west Ctenotus (*Ctenotus labillardieri*).

Photograph P. Gillespie.

Photograph 43. Fox (*Vulpes vulpes*) scats Hallowell.

Photograph P. Gillespie.

Photograph 44. Fox (*Vulpes vulpes*) tracks on coastal dunes.

Photograph P. Gillespie.

Photograph 45. Frog eggs believed to be *Metacrinia nichollsi*.

Photograph P. Gillespie.

Photograph 46. *Heleioporus eyrei*.

Photograph P. Gillespie.

Photograph 47. *Geocrinia leai* in R 22248.

Photograph P. Gillespie.

Photograph 48. *Geocrinia leai* on Mt Hallowell.

Photograph P. Gillespie.

Photograph 49. *Heleioporus eyrei*.

Photograph P. Gillespie.

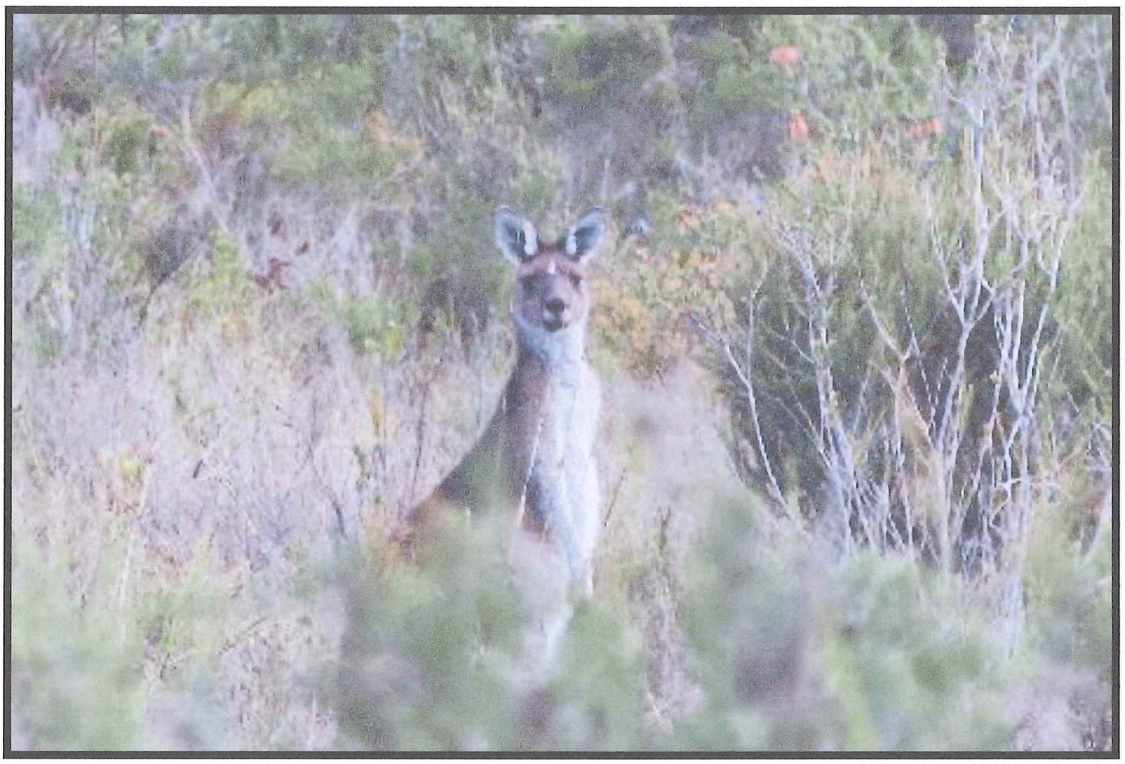
Photograph 50. Lowlands Earless Skink (*Hemiergis peronii*) on Mt Hallowell.

Photograph P. Gillespie.

Photograph 51. Kangaroo (*Macropus fuliginosus*) scats in R 24452

Photograph P. Gillespie.

Photograph 52. Kangaroo (*Macropus fuliginosus*) tracks on Mt Hallowell.



Photograph P. Gillespie.

Photograph 53. Kangaroo (Macropus fulignosus).

Photograph P. Gillespie.

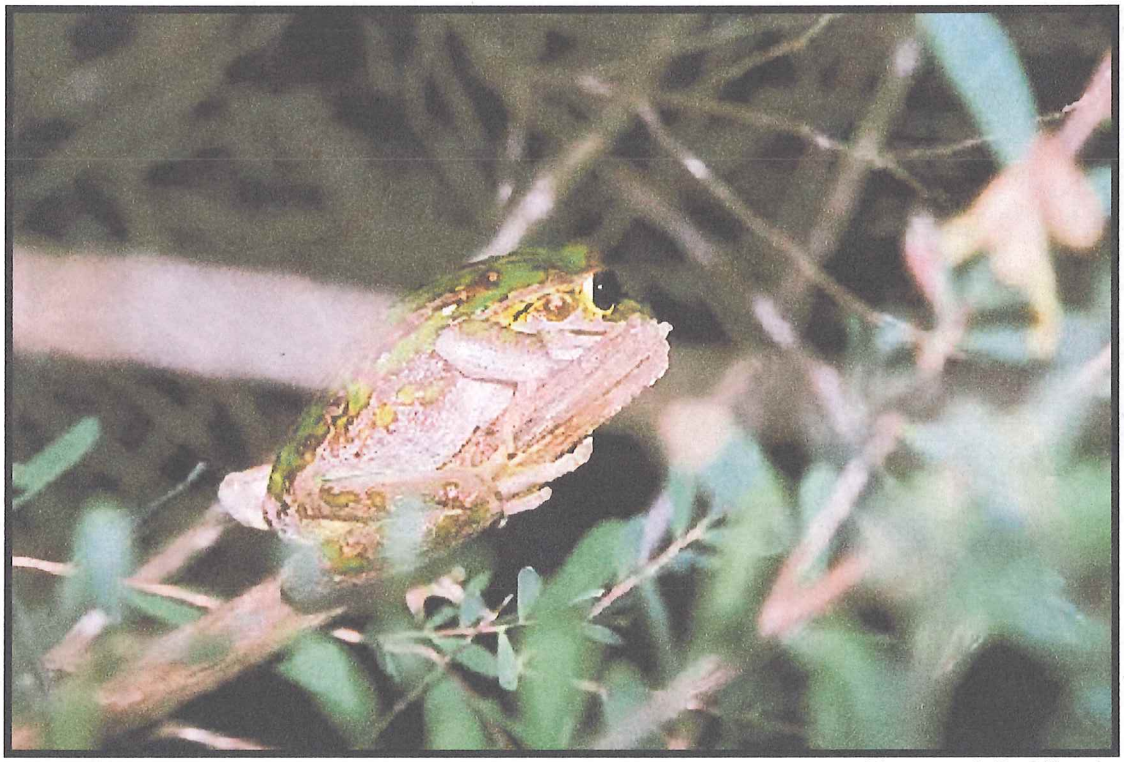
Photograph 54. Western Swamp Skink (*Lissolepis luctuosa*) in R 24452

Photograph P. Gillespie.

Photograph 55. Slender Tree Frog (*Litoria adelaidensis*).

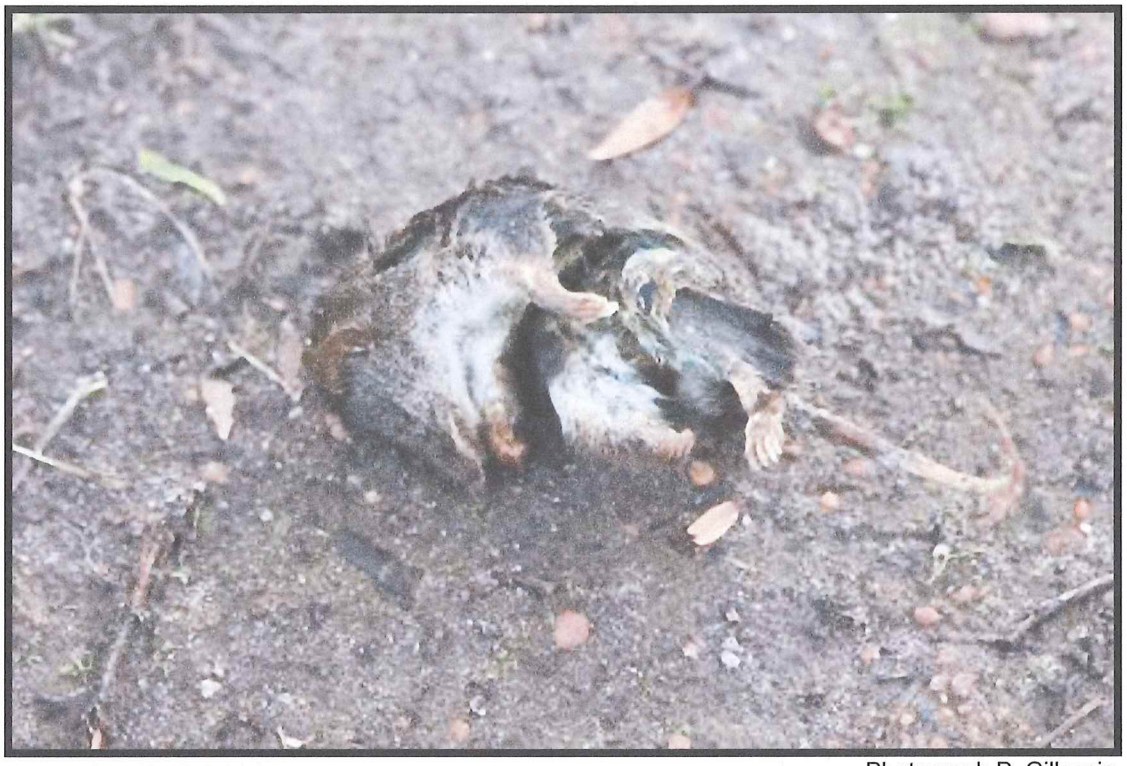
Photograph P. Gillespie.

Photograph 56. Motorbike Frog (Litoria moorei).



Photograph P. Gillespie.

Photograph 57. Motorbike Frog (Litoria moorei) colour variation.



Photograph P. Gillespie.

Photograph 58. Dead Yellow-footed Antechinus or Mardo (*Antechinus flavipes*).

Photograph P. Gillespie.

Photograph 59. Common Dwarf Skink (*Menetia greyii*).

Photograph P. Gillespie.

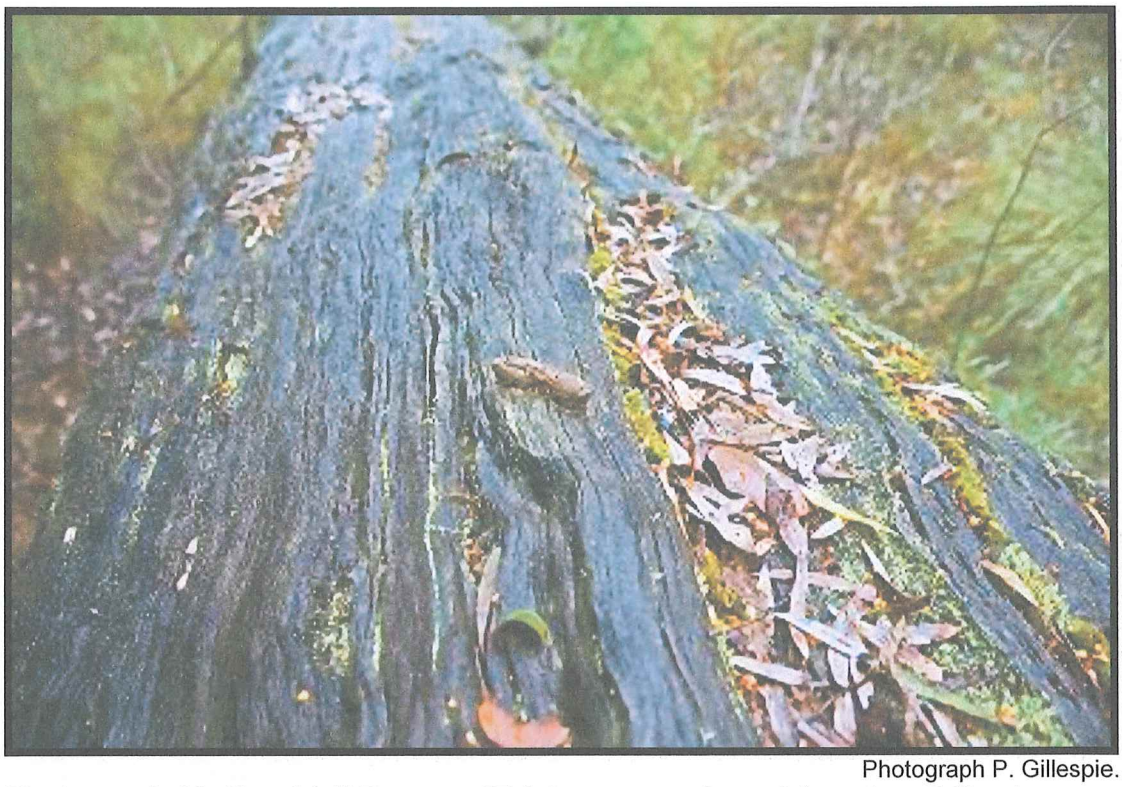
Photograph 60. *Metacrinia nichollsi* on Mt Hallowell.

Photograph P. Gillespie.

Photograph 61. *Metacrinia nichollsi* showing typical belly spots.

Photograph P. Gillespie.

Photograph 62. Quenda (*Isoodon obesulus*) caught on trail camera.



Photograph P. Gillespie.

Photograph 63. Brushtail Possum (*Trichosurus vulpecula*) scat on fallen tree.

Photograph P. Gillespie.

Photograph 64. Typical Rabbit (*Oryctolagus cuniculus*)digging in R 43923

Photograph P. Gillespie.

Photograph 65. Rabbit (*Oryctolagus cuniculus*) jaw bone.

Photograph P. Gillespie.

Photograph 66. Rabbit (*Oryctolagus cuniculus)* in R 29426.

Wilson Inlet Foreshore & Mt Hallowell Reserves

Fauna Survey

2011

A report produced by

Patrick Gillespie

for the

Shire of Denmark

Acknowledgements

This survey gave me an opportunity to re-explore some of my favourite places and a chance to extend my knowledge of its wildlife. I have thoroughly enjoyed every minute of surveying and hope that this report is beneficial to anyone who has an interest in Denmark and its wildlife. Many people have assisted in some way with this project and I would like to take this opportunity to thank some of them: Yvette Caruso (Shire of Denmark) for securing funding and the provision of reserve maps and management reports; Karlene Bain, Shaun McHenry, Roslyn Burnside, Jason Fletcher and Jackie Manning (Deptartment of Environment & Conservation) who all provided advice on use of traps, trap hygiene, animal care, and why so many Bush Rats and no Antechinus; my boys, Kieran and Liam, who accompanied me on surveys through near impenetrable coastal scrub, up and down Mt Hallowell and endured cold nights setting up traps. Also, for suffering my enthusiasm for all newly found frogs or lizards, my frustration and despair over missed photographs or computers which do not behave and my joy over finally getting that honey possum photo. Finally, to all of the creatures of Denmark who posed beautifully for photographs or put up with being handled while I draw belly markings or head scales. To those animals that remained elusive "I will get you next time". To anyone who has helped who I have not mentioned by name – Thank you.

Cover page: Tiger Snake (*Notechis ater occidentalis*) photographed by P. Gillespie in Foreshore Reserve R 24452.

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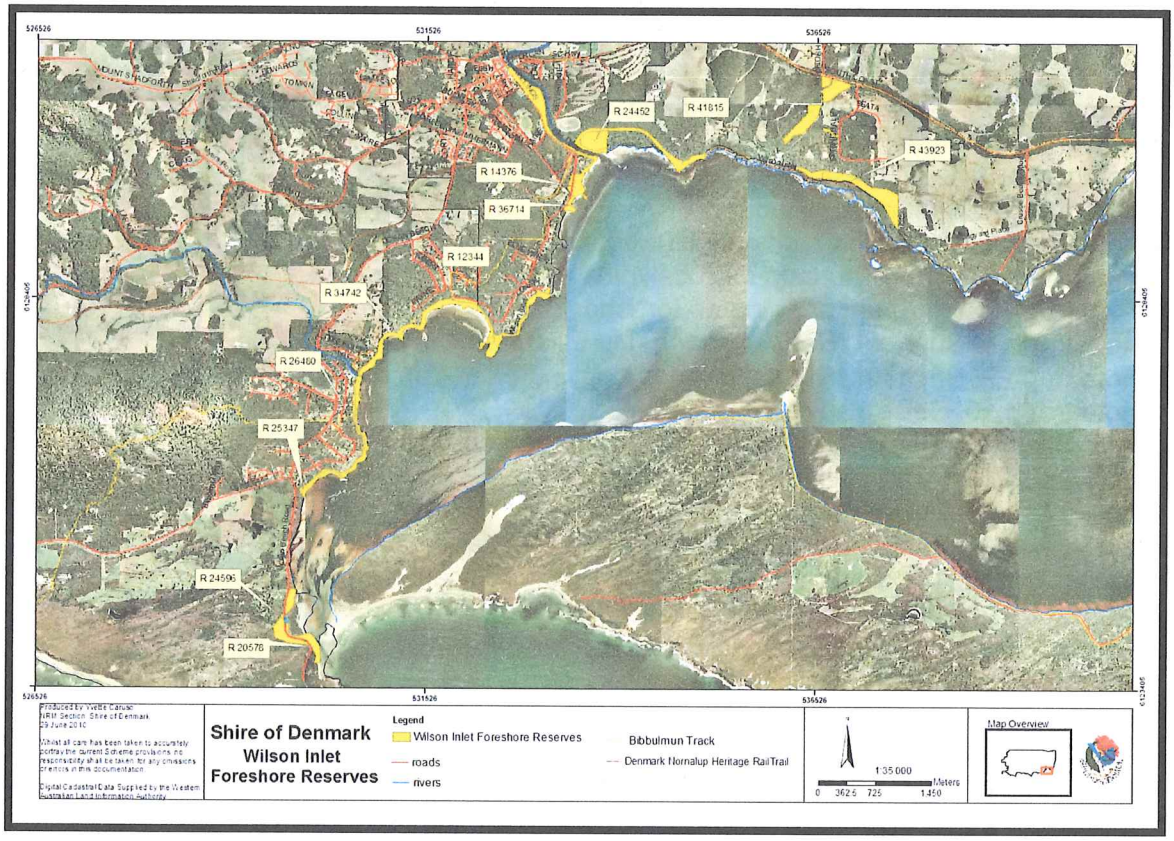
1.0 Introduction

The following fauna survey was conducted from June 2010 to June 2011 and covers the Mt Hallowell Reserve and Wilson Inlet Foreshore Reserves. Amphibians, reptiles and mammals although not bats, as no mist netting was conducted, were included in the survey. The reserves are located within approximately 10km of Denmark on the south coast of Western Australia. The landforms and soil types of the survey area are diverse ranging from granite outcrops and associated clay slopes, to a variety of estuarine deposits and deep coastal sands. The dominant flora reflects this diverse underlying geology with hillsides of karri, jarrah and marri forest to jarrah, marri, Banksia woodlands with pockets of Casuarina, Melaleuca wetlands and Agonis flexuosa open woodland on coastal dunes.

Figure 1. Showing location of Reserves



A complete list of reserves and their vesting is presented in Table 1.

Table 1. Wilson Inlet Foreshore Reserves included in the survey.

Reserve	Area (ha)	Purpose	Description
R 43923	33.2	Foreshore Management	Inlet boundary dune system dominant vegetation Eucalyptus marginata, Corymbia calophylla & Casuarina spp woodland.
R 41815	8.4	Heritage Trail	Inlet riparian vegetation dominant species Corymbia calophylla & Agonis flexuosa.
R 24452	6.9	Recreation	Riparian, wetland and heath complex of Eucalyptus marginata woodland, Melaleuca raphiophyla wetland & Beaufortia sparsa heath.
R 14376	13.8	Parklands and Recreation	Riparian zone of inlet and Denmark River Eucalyptus diversicolor open forest with Melaleuca raphiophylla wetlands
R 36714	1.2	Recreation	Riparian zone of inlet and Denmark River Eucalyptus diversicolor open forest with Melaleuca raphiophylla wetlands
R 22248		Govt. Requirements	Ironstone ridge and granite outcrops dominated by Eucalyptus marginata, Corymbia calophylla.
R 12344 & 28993	9.4	Recreation	Granite outcrops to inlet with Eucalyptus diversicolor, Agonis flexuosa, Eucalyptus marginata & Melaleuca spp mixed woodland
R 34742	13.5	Recreation	Inlet Riparian zone with Eucalyptus diversicolor, Corymbia calophylla on higher ground with Melaleuca priessiana, Taxandria juniperina wetlands
R 26480	8.8	Recreation	Inlet Riparian zone with Eucalyptus diversicolor, Corymbia calophylla on higher ground with Melaleuca priessiana, Taxandria juniperina wetlands
R 25347 & 43490	3.8	Foreshore Management	Inlet Riparian zone with Melaleuca spp wetlands
R 24596		Parking Facilities	Limestone and coastal dune systems dominated by Agonis flexuosa woodland
R 20578	13.1	Camping	Limestone and coastal dune systems dominated by Agonis flexuosa woodland

Table 2. Mt Hallowell Reserves

Reserve	Area (ha)	Purpose	Description
R 12182	123.6	Recreation	The Mt Hallowell Reserves represent a variety of topographic ranges and soil types from granitic outcrops through clay slopes to deep sand and peat swamps. The higher slopes particularly on the Eastern and Southern sides are dominated by Eucalyptus diversicolor with pockets of Casuarina spp while the lower slopes and Northern slopes are more typically Eucalyptus marginata, Corymbia calophylla, Banksia grandis, Banksia ilicifolia and Casuarina spp.
R 14959	242.8	Recreation	
R 30080	27	Recreation	
R 38844	56.3	Recreation	
R 18077	8.4	Timber	
R 2897	6.8	Vacant Crown Land	

2.0 Climate

The South Coast of Western Australia experiences a Mediterranean-type climate with cool, wet winters and warm to hot, dry summers. Denmark resides in an area which receives an annual rainfall of approximately 1200mm and has annual evaporation rates of 1000mm.

3.0 Geology

The geology of the Southwest of Western Australia can be traced back to the Archaean over 2,500 million years ago when the granitic bedrock of the Yilgarn plateau was formed. Denmark lies within the younger Albany –Fraser Orogen, which is formed mainly of Proterozoic (2,500 ma to 545 ma), granitic and gneissic bedrock. This more general description was expanded by Semeniuk in 1998 and renamed the coastal unit "Albany Headlands and Inlets" to the D'Entrecasteaux-Albany Coastal Zone. Described as "a complex of headlands, rocky shores, inlets, deltas, barrier dunes, and local monadocks". This bedrock of the D'Entrecasteaux-Albany Coastal Zone is overlain with more recent sediments formed during the Tertiary and Quaternary periods. During this time the earth experienced a series of glacial and interglacial phases. The sediments are thus the result of a variety of processes. During glacial periods sea levels were lower and climate drier resulting in deposition of aeolian (wind blown), desertic dune quartz sand. While during interglacial periods onshore winds formed calcareous sand mounds over the more ancient bedrock (V & C Semeniuk 1998). During these interglacial periods the Wilson Inlet Foreshore reserves would have been under the sea. Thus the Quaternary deposits are a mixture of alluvial, estuarine and aeolian deposits of sand, clay and limestone.

4.0 Flora

The complex geology of the area results in a high diversity of flora. The study area comprises: Melaleuca spp & Taxandria juniperina swamps and seasonal wetlands; Eucalyptus marginata, Corymbia calophylla and Banksia spp woodlands; Agonis flexuosa open woodland; through to Eucalyptus diversicolor forests interspersed with granite outcrops.

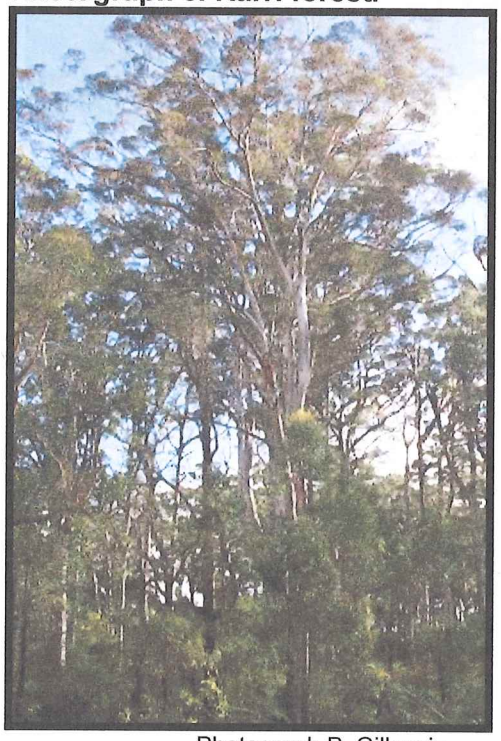
Photograph P. Gillespie.

Photograph 1. Agonis flexuosa woodland.

Photograph P. Gillespie.

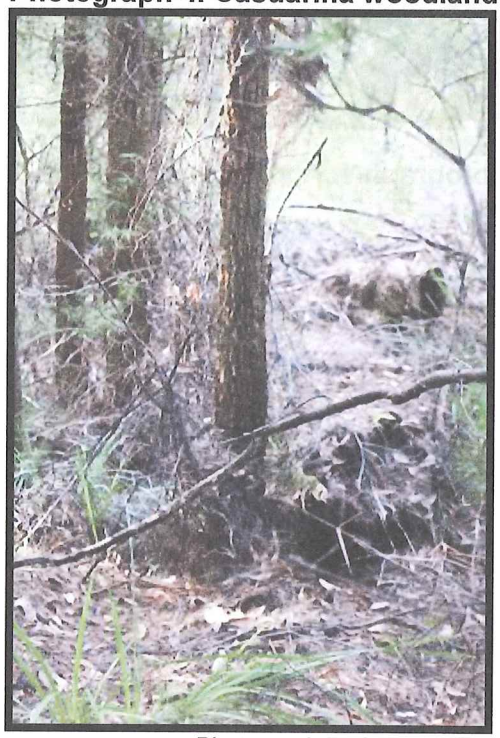
Photograph 2. Foreshore wetland.

Photograph 3. Karri forest.



Photograph P. Gillespie.

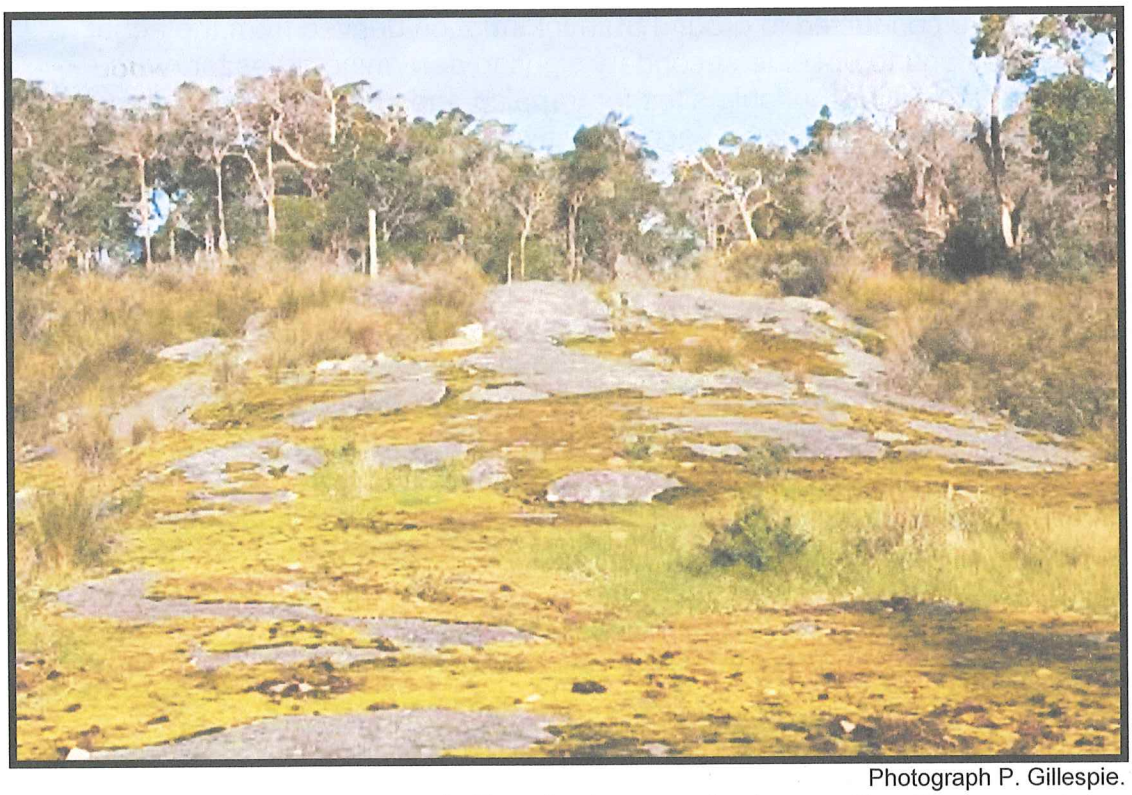
Photograph 4. Casuarina woodland.



Photograph P. Gillespie.

Photograph P. Gillespie.

Photograph 5. Melaleuca raphiophylla wetland.



Photograph P. Gillespie.

Photograph 6. Granite outcrop in Eucalyptus marginata woodland.

5.0 Methods

A variety of methods were employed to locate and identify fauna within the reserves. Traps, remote cameras, calls, secondary signs and direct observation all contributed to the final list of fauna.

5.1 Background check

An initial literature survey was conducted from reserve reports and management plans, previous museum surveys and government species lists. The Department of Environment and Conservation's Nature Map was used to identify species which may occur within a 10 km radius of Denmark. Western Australian Museum surveys, local shire management reports and a variety of other literature was reviewed to see which species are thought to occur within the study area. These are presented in the Bibliography. There are no Threatened Ecological Communities listed within the study area. A list of species form these sources is presented in Table 4. It should be noted that this list includes species from the surrounding area and not exclusively from within the reserves surveyed.

5.2 Aerial photos

Aerial photographs were examined to identify major flora and habitat types with each reserve. Diverse, small or unusual landforms or pockets of atypical flora were also identified. From these initial survey transects were determined.

5.3 Preliminary surveys

Surveys were conducted to ground truth information derived from the aerial photographs and to observe secondary signs to determine areas for more vigorous examination, suitable sites for trapping and possible remote camera locations. Direct observations, secondary signs and calls were recorded on site during these surveys.

5.4 Equipment

A variety of equipment was employed to locate and identify species within the study area. Traps, including Elliot, cage, pitfall and camera were setup in suitable locations where secondary signs indicated the presence of animals. Photographs were taken to assist in identification and to provide a record for future surveys. Results from these were mapped on a Geographic Information System. Description of equipment and procedures for each type of trap is detailed below.

5.4.1 Elliot Traps

Elliot traps were set in habitat suitable for small mammals and where secondary signs such as diggings, scats or tracks indicated their presence. Traps were set in the evening and checked the following morning. Traps were not open during the day and repeated trapping was not carried out in the same location to reduce the risk of repeatedly trapping and thus unnecessarily stressing, the same individual. Traps were not set on cold nights where the forecast was for a temperature below 10° C. On cool nights material, usually dry grass, was placed within the trap so that animals could insulate themselves from the cold metal of the trap. Care was taken to place sufficient food within the trap so that animals trapped early in their foraging would not go hungry that night given that they are not released until the following morning and may not forage again until the next night. Animals caught in the traps were identified on sight and released on location. Where possible animals were not handled unnecessarily as many would leave the trap voluntarily.

Photograph P. Gillespie

Photograph 7. Elliot trap near log on foreshore

Photograph P. Gillespie.

Photograph 8. Bush rat (*Rattus fuscipes*) in Elliot trap.

Photograph P. Gillespie.

Photograph 9. Bush rat (*Rattus fuscipes*) leaving Elliot trap.

5.4.2 Cage Traps

A 'Sheffield' style trap was used for medium size mammals such as the Brushtail Possum. The trap measurements were 300mm high by 300mm wide with an overall length of 900mm. Care was taken in selecting trap locations to reduce the risk of trapped animals being bitten by large ants. A cover was placed over part of the trap to provide shelter from wind and rain. As for the Elliot traps, a reasonably large amount of food was supplied to reduce the chances of animals going hungry on the nights they were trapped. The trap was set in the evening and checked the following morning. Similar precautions to the Elliot traps were taken to avoid repeatedly trapping the same animals.

5.4.3 Pitfall Traps

A pitfall trap was utilised where the landforms were suitable. The trap consisted of a plastic trap approximately 450mm deep and 250mm square at the top. A 15m long 200mm high netting fence was erected to guide animals into the trap. For much of the study area this was not practically possible. The trap was left at the same location for 7 days and checked morning and evening so that animals were not left in the trap for extended periods of time. Loose plant material was placed in the bottom of the trap to provide shelter for trapped individuals. Trapped animals were identified on location and released on site.

Photograph P. Gillespie.

Photograph 10. Cage trap on Mt Hallowell.

Photograph P. Gillespie.

Photograph 11. Brushtail possum (*Trichosurus vulpecula*) in cage trap on Mt Hallowell.

Photograph P. Gillespie.

Photograph 12. Pitfall trap in coastal dunes.

Photograph P. Gillespie.

Photograph 13. Frogs caught in pitfall trap.

5.4.4 Camera Traps

A Bushnell remote trail camera was purchased during the latter part of the survey to see if some of the animals thought to be present, but that had not been sighted or trapped, could be recorded. The camera was used in many of the reserves and usually set for a few nights at a time. Generally it was placed where secondary signs indicated the presence of animals. It was set either without attractants or with a variety of attractants.

5.4.5 Attractant

A wide variety of attractants were used for Elliot and Sheffield traps as well as the remote trail camera. Oats, peanut butter, bacon, apple, honey, banana, and sultanas or combinations of the above were provided. Honey was withdrawn from the list for the traps after it was found to attract large numbers of ants which were considered to be both a deterrent to animals entering the trap or may harm a trapped animal.

Photograph P. Gillespie.

Photograph 14. Trail camera setup in foreshore wetland.

Photograph P. Gillespie.

Photograph 15. Brushtail possum (*Trichosurus vulpecula*) caught on trail camera.

Photograph P. Gillespie.

Photograph 16. Quenda caught on trail camera.

5.4.6 Camera

A Canon EOS 100 camera with 20mm-105mm and 100mm-300mm EOS zoom lenses was used to record animals where possible. Initially images were recorded on film, developed and then scanned to disk. Later a Canon EOS 550D digital camera was purchased to both improve the resolution of images and the ease of recording and reproduction.

5.4.7 GIS

All mapping was carried out on "Map Window" a freely available GIS platform. Locations of observations were determined from aerial photographs correlated with on ground records. Accuracy for the Wilson Inlet Reserves is estimated to within 10m while those for the Mt Hallowell reserve are accurate to within 20m. This provide information sufficient to allow those interested in locating species to find them at these sites. Shape files generated and supplied in digital format include information regarding method of observation. To avoid excessive amounts of data once species had been identified several times at a particular location no further records where included.

5.5 Daylight Surveys

Daylight surveys were conducted to identify secondary signs and direct observations of animals. Where animals were thought to be present, but could not be observed at the time, observation sights were established. Observation from such sites may involve waiting for extended periods of time (hours) to observe shy species. Where possible photographs were used to record species seen.

Photograph P. Gillespie.

Photograph 17. Western Swamp Skink (*Lissolepis luctuosa*).

5.6 Spotlight Surveys

Spotlight surveys were conducted at night to observe nocturnal species.

Photograph P. Gillespie.

Photograph 18. Honey possum (*Tarsipes rostratus*) feeding.

Photograph P. Gillespie.

Photograph 19. Western Pygmy Possum or Mundarda (*Cercartetus concinnus*).

5.7 Scats, tracks, trails & other signs.

A wide variety of secondary signs were used to either identify animals directly or the likely presence of animals. Tracks, scats, skeletal remains, scratches on trees, runs, diggings and calls were all used. Care was taken not to record the presence of animals just from a single secondary sign unless positive identification could be established. Easily identifiable signs such as kangaroo and bandicoot tracks or kangaroo and brushtail possum scats were considered sufficient for positive identification. Similarly, frogs calls such *a Limnodynastes dorsalis, Crinia georgiana, Crinia glauerti* or *Litoria moorei* are sufficiently distinctive to provide positive identification. For most species either further secondary signs or direct observation was required before recording the presence of a particular species. In some cases direct observation required secondary signs to provide confirmation of species as in the case of morphologically similar species such as *Crinia pseudoinsignifera and Crinia subinsignifera*. Where secondary signs such as frog calls where heard only once and appeared to indicate the presence of species which are not thought to be present in the study area such as *Crinia insignifera* or *Geocrinia lutea* these have not been recorded.

Photograph P. Gillespie.

Photograph 20. Quenda tracks in soft mud.

Photograph P. Gillespie.

Photograph 21. Quenda run on Mt Hallowell.

Photograph P. Gillespie.

Photograph 22. Brushtail Possum scats in moss on fallen tree.

Photograph P. Gillespie.

Photograph 23. Brushtail Possum scratches on Karri tree.

Photograph P. Gillespie.

Photograph 24. Quenda diggings in foreshore reserve.

5.8 Handling

Where possible unnecessary handling of animals was avoided. In some cases catching animals such as small frogs or lizards was necessary to enable positive identification. Gentle handling and identification carried out on site minimised any risk of harm. This was particularly important with skinks as they may shed their tails if handled incorrectly. This is thought to be a defensive mechanism which allows the animal to escape while the potential predator is distracted by the still wriggling although now detached tail. Although skinks suffer no long term harm from such behaviour they lose bone, muscle tissue and fat reserves and presumably are more at risk from infection until they have healed. After handling hands were washed with water to reduce the risk of transmitting potentially harmful organisms between individuals. This was considered particularly important with frogs which suffer a variety of skin pathogens. Traps were washed with water and a mild bleach solution after trapping to both reduce the risk of disease transmission through urine or faecal matter and to remove the odour of previously trapped animals.

Photograph P. Gillespie.

Photograph 25. Young Quenda remain calm if handled gently.

Photograph P. Gillespie.

Photograph 26. Skinks require careful handling to avoid tail shedding.

5.9 Identification

Most identification was confirmed by reviewing a variety of literature sources, a list of which is provided in the bibliography. For frogs the primary source was "Field Guide to Frogs of Western Australia". Most reptiles were identified from "Reptiles and Amphibians of Australia" although skinks were primarily identified from "Lizards of Western Australia Part 1 Skinks". All identification was conducted onsite with field drawings and photographs being used for further review where necessary. Where animals were either seen only briefly or where positive identification was not possible no presence has been recorded. For instance Photograph 27 shows tracks believed to belong to a small mammal about the size of a Bush Rat, however despite repeated attempts to trap or capture an image of the animal no further evidence was found. The tracks are similar to those found recently in similar dune systems to the west of Denmark, but as yet no positive identification of the animal has been possible. The photographs presented are hoped to be of sufficient quality to provide future reference and if necessary amended identification where experts in that particular field may deem appropriate. All care has been taken not to include records of species where there is some doubt. No reported observations from other individuals have been included in the results of this report. Records from other sources displayed in Table 3 have not been confirmed by this author. For consistency nomenclature follows the Australian Faunal Directory 2010. This means that for some species, such as the Western Crowned Snake, which is referred to within the literature under a variety of names, there maybe some confusion. It is refered to within my results as *Drysdalia coronata* after *(Schlegel, 1837),* despite a number of sources such as (Storr 1982) and recent DNA studies which place it within the genus Elapognathus (Keogh, Scott & Scanlon 2000).

Similarly: the Marbled Gecko *Phylodactylus marmoratus* is *Christinus marmoratus*; the Western Swamp Skink sometimes placed in the *Egernia* genus is *Lissolepis luctuosa*; and the Western Three-lined Skink is *Acritoscincus trilineata* rather *than Tiliqua trilineata* or *Leiolopisma trilineatum*.
To avoid confusion I have changed the alternative names from previous studies shown in Table 3. Common names tend to follow the same source although I use aboriginal names for many of the mammal species such as Quenda for the Southern Brown Bandicoot and Mardo for the Yellow-footed Antechinus.

Photograph P. Gillespie.

Photograph 27. Unusual tracks in coastal dunes.

6.0 Results

6.1 Reserves

Records from this survey are presented in Table 3. Most of the species thought to be present within the study area were found during this study and the majority of these are also represented in the Photographic Record. Some species such as Kangaroos, Tiger Snakes and Bandicoots were found throughout the study area in a wide variety of habitats. Others such as *Metacrinia nichollsi* were habitat specific. Most species were identified from a wide variety of signs, such as tracks, scats, diggings and direct observations. There were a few species which were only observed from remains such as the Antechinus and Brush-Tailed Phascogale. There were a few species which were not observed during this study which are almost certainly present. Dunnarts were not observed within the Mt Hallowell reserve although the habitat is suitable.

There are several possible explanations for this: Much of the habitat is dense and observations of small mammals within the understorey is difficult; The large study area, with several difficult to access areas, provides sufficiently large areas of habitat which could support dunnarts; and the trapping regime was not sufficient to reveal the presence of dunnarts. In looking at these more closely, certainly the dense understorey makes observation of small mammals problematic not only is it not possible to view much of the forest floor, runs and scats cannot generally be seen, and any animals present have taken evasive action due to the noise of moving through such vegetation long before the observer gets close. Areas which are difficult to access are unlikely to be responsible for the lack of positive observations as similar habitat was surveyed extensively and dunnarts, if present, would have also been in these areas. Trapping was carried out on Mt Hallowell in a variety of habitats. The most commonly trapped animals being Bush Rats. These are likely to be trapped first being relatively abundant and bold and may reduce the chances of trapping other small mammals (personal communication J. Fletcher 2010). Pitfall traps, which typically are the most successful method of trapping dunnarts, were set on Mt Hallowell but only at a couple of locations due to lack of suitable terrain for this type of trap. These areas may have contained dunnarts but were not the highest value Dunnart habitat. Also, in further examination of Dunnart trapping it has been found that traps of 400mm deep were much less successful than those of 600mm deep (Ward 2009). The trap used was 450mm deep and although loose plant material was placed in bottom of the trap to reduce the capacity of animals such as Dunnarts to escape, found to be successful with mice, it maybe that this was not a sufficiently deep trap to hold any individuals which fall into it. Chuditch have been listed as occurring on Mt Hallowell as well as an unconfirmed report from South Coast Hwy near the Denmark Golf Course. No confirmed sign of Chuditch was recorded although there was evidence of predation on swans along the inlet close to the golf course. Scats were collected but without further forensic examination it was not possible to differentiate these from that of a Fox. Fox tracks and calls were recorded from this reserve and so it was thought to be a much more likely candidate. Ringtail Possums have been listed in the "Mt Hallowell Reserve Management Plan 1995" but were not observed during this study. Neither were areas of suitable habitat of sufficient size to support populations of Ring-tailed Possums identified on Mt Hallowell. There is an area of suitable habitat to support a population of Ring-tailed Possums in and surrounding Reserve 20578. However, despite extensive ground surveys and the use of a trail camera, no direct observation or secondary sign was identified. Some species are relatively easily found due to being diurnal or having loud distinctive calls, while others are cryptic and rarely seen. Without intensive study into the likelyhood of detecting a particular species it is not possible to accurately determine the relative abundance of species. The results, therefore, only indicate the presence of species rather than relative abundance.

6.2 Additional results from surrounding areas

Several species were observed in areas adjacent to the study area and almost certainly occur within it. These are presented at the end of the species list and have been included on the maps where possible. All of these records are included in the shape files. Such species include Bardick (*Eclipses curta*) found at Lights Beach by Shire Ranger, and the Chain-striped South-west Ctenotus (*Cteontus catenifer*). Although bats were not included in the survey they were seen in all of the reserves. However, identification was not possible except in one case where an individual was recorded in *Eucalyptus* diversicolor forest near Mt Hallowell. It is likely that this species, believed to be Beccari's Free-tail bat (*Mormopterus beccarii*), occurs within the reserve.

Photograph P. Gillespie.

Photograph 28. Beccari's Free-tail bat (*Mormopterus beccarii*).

6.3 Species Identified

Reptiles

Class: Reptilia (Reptiles)
Order: Squamata (Lizards & Snakes)

Family: Gekkonidae (Geckos)
Species: ***Christinus marmoratus*** (Marbled Gecko)

Family: Scincidae (Skinks)
Species: ***Acritoscincus trilineatus*** (Western Three-lined Skink)
Ctenotus labillardieri (Common South-west Ctenotus)
Egernia kingii (King Skink)
Egernia napoleonis (South-western Crevice-skink)
Hemiergis peronii subsp. peronii (Lowlands Earless Skink)
Lissolepis luctuosa (Western Mourning Skink)
Menetia greyii (Common Dwarf Skink)
Tiliqua rugosa (Bobtail)

Family: Elapidae
Species: ***Drysdalia coronatus*** (Crowned Snake)
Notechis ater occidentalis (Tiger Snake)
Pseudonaja affinis subsp. affinis (Dugite)
Echiopsis curta (Bardick)

Amphibians

Class: Amphibia (Amphibians)
Order: Anura (Frogs)

Family: Hylidae (Tree frogs)
Species: ***Litoria adelaidensis*** (Slender Tree Frog)
Litoria moorei (Motorbike Frog)

Family: Myobattrachidae (Southern Frogs)
Species: ***Crinia georgiana*** (Quacking Frog)
Crinia glauerti (Rattling Froglet)
Crinia pseudoinsignifera (Bleating Froglet)
Crinia subinsignifera (South Coast Froglet)
Geocrinia leai (Ticking Frog)
Metacrinia nichollsi (Forest Toadlet)

Family: Limnodynastidae
Species: ***Heleioporus eyrei*** (Moaning Frog)
Limnodynastes dorsalis (Western Banjo Frog)

Mammals

Class: Mammalia
- Family: Burramyidae
  - Species: ***Cercartetus concinnus*** (Western Pygmy-possum, Mundarda)
- Family: Canidae
  - Species: ***Vulpes vulpes*** (Red Fox)
- Family: Dasyuridae
  - Species: ***Antechinus flavipes*** (Yellow-footed Antechinus, Mardo)
  - ***Phascogale tapoatafa subsp. tapoatafa*** (Southern Brush-tailed Phascogale, Wambenger)
- Family: Felidae
  - Species: ***Felis catus*** (Cat)
- Family: Leporidae
  - Species: ***Oryctolagus cuniculus*** (Rabbit)
- Family: Macropodidae
  - Species: ***Macropus fuliginosus*** (Western Grey Kangaroo)
- Family: Muridae
  - Species: ***Hydromys chrysogaster*** (Water Rat)
  - ***Mus musculus*** (House Mouse)
  - ***Rattus fuscipes*** (Bush rat)
  - ***Rattus rattus*** (Black rat)
- Family: Peramelidae
  - Species: ***Isoodon obesulus subsp. fusciventer*** (Southern Brown Bandicoot, Quenda)
- Family: Phalangeridae
  - Species: ***Trichosurus vulpecula subsp. vulpecula*** (Common Brushtail Possum)
- Family: Tarsipedidae
  - Species: ***Tarsipes rostratus*** (Honey Possum, Noolbenger)

Species from adjacent Areas

Reptiles

Class: Reptilia (Reptiles)
- Order: Squamata (Lizards & Snakes)
  - Family: Scincidae (Skinks)
    - Species: ***Ctenotus catenifer*** (Chain-striped South-west Ctenotus)
  - Family: Elapidae
    - Species: ***Echiopsis curta*** (Bardick)

Mammals

Class: Mammalia
- Family: Molossidae
  - Species: ***Mormopterus beccarii*** (Beccari's Free tail-bat)

Species by Reserve

Table 4. Species by Reserve

Scientific Name	Common Name	Reserve ID														
		43923	41815	24452	14376	36714	29426	22248	12344	28993	34742	26480	25347	24596	20578	MtH
Frogs																
Crinia georgiana	Quacking Frog	X		X	X			X		X		X	X			X
Crinia glauerti	Clicking Frog	X		X				X		X	X	X	X		X	
Crinia pseudoinsignifera		X		X								X	X			X
Crinia subinsignifera		X						X		X	X		X			X
Geocrinia leai	Ticking Frog	X		X	X			X		X	X	X			X	X
Heleioporus eyrei	Moaning Frog			X								X				
Heleioporus inornatus	Whooping Frog															
Limnodynastes dorsalis	Western Banjo Frog			X	X							X			X	
Litoria adelaidensis	Slender Tree Frog			X								X				
Litoria moorei	Motorbike Frog	X										X				
Metacrinia nichollsi	Forest Toadlet															X
Pseudophryne guentheri	Crawling Toadlet															X
Mammals																
Antechinus flavipes	Yellow-footed Antechinus, Mardo											X				X
Cercartetus concinnus	Western Pygmy-possum, Mundarda											X				
Felis catus	Cat			X												
Hydromys chrysogaster	Water-rat				X											
Isoodon obesulus	Southern Brown Bandicoot, Quenda	X		X	X			X	X	X	X	X				X
Macropus fuliginosus	Western Grey Kangaroo	X		X	X			X		X					X	X
Mormopterus beccarii	Beccari's Freetail Bat															
Mus musculus	House Mouse											X				
Phascogale tapoatafa	Brush-tailed Phascogale, Wambenger											X				X
Pseudocheirus occidentalis	Western Ringtail Possum															
Oryctolagus cuniculus	Rabbit	X		X				X				X				
Rattus fuscipes	Western Bush Rat			X					X		X				X	X
Rattus rattus	Black Rat											X				
Tarsipes rostratus	Honey Possum, Noolbenger			X												
Trichosurus vulpecula	Common Brushtail Possum							X		X	X					X
Vulpes vulpes	Red Fox			X								X			X	X
Reptiles																
Acritoscincus trilineatus	Western Three-lined Skink	X		X												X
Christinus marmoratus	Marbled Gecko							X				X				X
Ctenotus catenifer	Chain-striped South-west Ctenotus														X	
Ctenotus labillardieri	Common South-west Ctenotus	X		X				X		X		X				X
Drysdalia coronatus	Crowned Snake											X				X
Echiopsis curta	Bardick															
Egernia kingii	King's Skink															X
Egernia napoleonis	South-western Crevice-skink															X
Lissolepis luctuosa	Western Swamp Skink			X												
Elapognathus minor	Short-nosed Snake															
Hemiergis peronii subsp. peronii	Lowlands Earless Skink	X		X				X		X		X				X
Lerista microtis subsp. microtis	South-western Slider															
Menetia greyii	Common Dwarf Skink														X	
Notechis ater occidentalis	Tiger Snake	X		X	X							X			X	X
Pseudonaja affinis subsp. affinis	Dugite											X				X
Tiliqua rugosa	Bobtail Skink											X			X	

7.0 Threats & Future Management

There are a number of threats to the fauna of the foreshore reserves and Mt Hallowell it is however, beyond the scope of this study to do more than identify observed threats and provide cautionary information regarding future management. Habitat loss is one of the major threatening processes affecting native animals in the Southwest of Western Australia. Kitchener (1982, cited in Bradshaw 2006) noted that of all animals groups studied, mammals have shown the greatest departure from their original richness since the fragmentation of landscape of South-Western Australia. Fragmentation of landscape and loss of habitat are listed as threatening processes for Quenda by the Department of Environment and Conservation. While Fougere (2000) states "habitat destruction is the clear determinant of wildlife survival". Many of the reserves surveyed are small (less than 20 ha), and for many species such as Quenda and Western Grey kangaroos their observed abundance appears to be due to offsite food sources such as golf courses, adjacent agricultural land or suburban gardens. For other species fragmentation of ecological communities may lead to species loss where individuals are unable to move between key food supplies. The loss of key species within ecosystems results in a decline of the whole system. Habitat loss is not confined to the loss of flora species, frequent burning or removal of old logs may result in a lack of den sites for species such as Chuditch, while loss of dead trees with hollows may impact on species such as the Brush-tailed Phascogale and Brush-tailed Possum. Fire regimes, inappropriate clearing and disease such as dieback all lead to habitat loss. For some species and reserves such as the Honey Possum population within reserves R 24452 and R 41815 inappropriate prescription burning regimes in adjacent reserves with similar habitat (R 12232), which result in either both reserves being burnt at the same time or an insufficient time gap, may result in the loss of this species from that area. A burning regime thus needs to ensure that regeneration of the neighbouring habitat is given sufficient time to provide both food and suitable nesting sites. Where suitable habitat is restricted to a small area and isolated from similar habitat fire regimes may need to be sufficiently long to ensure that populations have re-established . Similarly if dieback, a disease caused by the soil-bourne microscopic water mould *Phytophthora cinnamomi*, should spread to the small *Banksia spp* populations on Mt Hallowell it may not be possible for animals to find another suitable habitat without having to cross large areas of open country if at all. Habitat loss also leads to an increase in the risk of predation by introduced species such as foxes and cats. Several feral animals were observed during the survey including cats, foxes, black rats, house mice and rabbits. Generally, although seen as major threats to native animals these species do not appear to be having a major impact where the native habitat is intact. An example of this is the reserves R 24452 and R 41815 which contain populations of Honey Possums, Quenda, Bush Rats and Brush-tailed Possums even though foxes and feral cats were observed and have, presumably, been present within these areas for decades. The habitat provides sufficient shelter from predators for native animals to survive. This is in keeping with the lack of documented evidence of cats leading to local extinction of any native species on the mainland (Walton & Richardson (eds) 1989) where the habitat is intact. However, post burn conditions with a lack of suitable shelter, exacerbated by the lack of unburnt adjacent habitat, may result in high levels of predation from introduced species and potentially local extinction.

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Appendix A

Table 4. Results from previous surveys

Scientific Name	Common Name	1	2	3	4	5
Crinia georgiana	Quacking Frog	X	X	X		
Crinia glauerti	Clicking Frog	X				
Geocrinia leai	Ticking Frog	X	X	X		
Heleioporus eyrei	Moaning Frog	X	X	X	X	
Heleioporus inornatus	Whooping Frog		X	X		
Limnodynastes dorsalis	Western Banjo Frog	X	X	X	X	
Litoria adelaidensis	Slender Tree Frog	X	X	X	X	
Litoria moorei	Motorbike Frog	X	X	X	X	
Pseudophryne guentheri	Crawling Toadlet		X	X		
Bettongia penicillata	Woylie					X
Antechinus flavipes	Yellow-footed Antechinus					X
Cercartetus concinnus	Western Pygmy-possum, Mundarda	X	X			X
Dasyurus geoffroii	Western Quoll, Chuditch	X		X		X
Felis catus	Cat					X
Hydromys chrysogaster	Water-rat	X	X	X		X
Isoodon obesulus	Southern Brown Bandicoot, Quenda	X		X	X	X
Macropus fuliginosus	Western Grey Kangaroo	X		X		X
Macropus irma	Western Brush Wallaby	X		X	X	X
Mus musculus	House Mouse	X		X	X	X
Nyctophilus geoffroyi	Lesser Long-eared Bat	X				
Nyctophilus gouldi	Gould's Long-eared Bat	X				
Phascogale tapoatafa	Southern Brush-tailed Phascogale	X	X			X
Pseudocheirus occidentalis	Western Ringtail Possum					X
Oryctolagus cuniculus	Rabbit					X
Rattus fuscipes	Western Bush Rat	X		X	X	X
Rattus rattus	Black Rat	X		X	X	X
Setonix brachyurus	Quokka	X				X
Sminthopsis gilberti	Gilbert's Dunnart	X				
Sminthopsis griseoventer	Grey-bellied Dunnart	X	X	X	X	
Tachyglossus aculeatus	Echidna					X
Tarsipes rostratus	Honey Possum, Noolbenger	X	X	X		X
Trichosurus vulpecula	Common Brushtail Possum	X				X
Vespadelus regulus	Southern Forest Bat	X				
Vulpes vulpes	Red Fox			X		X
Acritoscincus trilineatus	Western Three-lined Skink					X
Christinus marmoratus	Marbled Gecko	X				X
Ctenotus catenifer	Chain-striped South-west Ctenotus	X	X	X	X	
Ctenotus labillardieri	Common South-west Ctenotus	X	X	X	X	
Drysdalia coronatus	Crowned Snake	X	X	X		X
Echiopsis curta	Bardick					
Egernia kingii	King's Skink	X	X	X	X	X
Egernia napoleonis		X	X	X		X
Egernia pulchra		X	X	X		
Elapognathus minor	Short-nosed Snake	X	X	X		
Hemiergis gracilipes		X				
Hemiergis peronii subsp. peronii		X	X	X	X	X
Lerista microtis subsp. microtis		X	X	X	X	
Lissolepis luctuosa	Western Swamp Skink	X	X	X		
Menetia greyii			X	X		
Notechis ater occidentalis	Tiger Snake	X				X
Pseudonaja affinis subsp. affinis	Dugite	X				X
Rhinoplocephalus bicolor	Square-nosed Snake					X
Sphenomorphus australis			X	X		
Tiliqua occipitalis	Western Bluetongue		X	X		
Tiliqua rugosa					X	X
Varanus rosenbergi	Heath Monitor	X	X	X	X	X

1. Nature Map 10 km radius of denmark
2. W.A. Museum surveys prior to 1950
3. W.A. Museum surveys 1950-1975
4. W.A. Museum surveys 1986
5. Shire of Denmark Mt Hallowell Management Plan

Photograph P. Gillespie.

Photograph 29. Western Three-lined Skink (*Acritoscincus trilineatus*)

Photograph P. Gillespie.

Photograph 30. Young Bobtail Skink (*Tiliqua rugosa*).

Photograph P. Gillespie.

Photograph 31. Quenda (*Isoodon obesulus*) at Poison Pt Reserve.

Photograph P. Gillespie.

Photograph 32. Bardick (*Echiopsis curta*) in coastal heath.

Photograph P. Gillespie.

Photograph 33. Brush-tailed Possum (*Trichosurus vulpecula*) on Mt Hallowell.

Photograph P. Gillespie.

Photograph 34. Bush Rat (*Rattus fuscipes*) scats on log in R26480

Photograph P. Gillespie.

Photograph 35. Bush Rat (Rattus fuscipes) tracks in R 20578.

Photograph P. Gillespie.

Photograph 36. Young Marbled Geckos (Christinus marmoratus) on granite.

Photograph P. Gillespie.

Photograph 37. *Crinia georgiana*.

Photograph P. Gillespie.

Photograph 38. *Crinia glauerti*.

Photograph P. Gillespie.

Photograph 39. *Crinia pseudoinsignifera* on paperbark in R 24452.

Photograph P. Gillespie.

Photograph 40. *Crinia pseudoinsignifera* in R 36714.

Photograph P. Gillespie.

Photograph 41. Chain-striped South-west Ctenotus (*Ctenotus catenifer*).

Photograph P. Gillespie.

Photograph 42. Common South-west Ctenotus (*Ctenotus labillardieri*).

Photograph P. Gillespie.

Photograph 43. Fox (*Vulpes vulpes*) scats Hallowell.

Photograph P. Gillespie.

Photograph 44. Fox (*Vulpes vulpes*) tracks on coastal dunes.

Photograph P. Gillespie.

Photograph 45. Frog eggs believed to be *Metacrinia nichollsi*.

Photograph P. Gillespie.

Photograph 46. *Heleioporus eyrei*.

Photograph P. Gillespie.

Photograph 47. *Geocrinia leai* in R 22248.

Photograph P. Gillespie.

Photograph 48. *Geocrinia leai* on Mt Hallowell.

Photograph P. Gillespie.

Photograph 49. *Heleioporus eyrei*.

Photograph P. Gillespie.

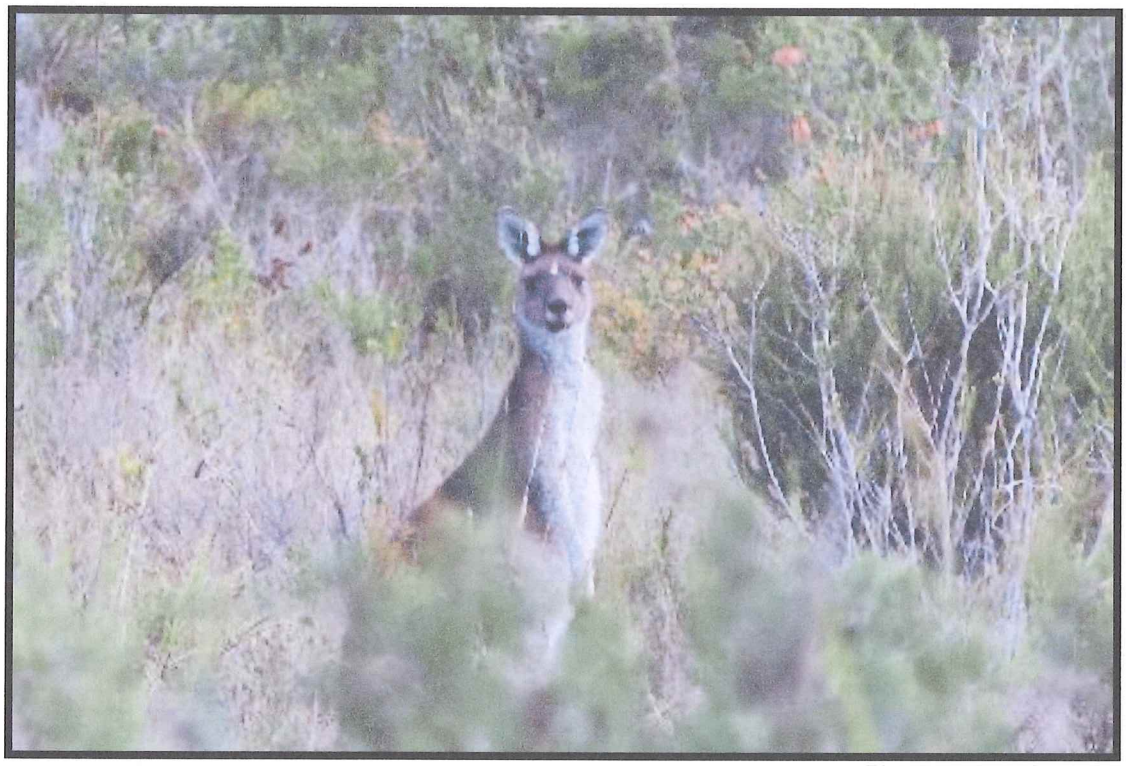
Photograph 50. Lowlands Earless Skink (*Hemiergis peronii*) on Mt Hallowell.

Photograph P. Gillespie.

Photograph 51. Kangaroo (*Macropus fuliginosus*) scats in R 24452

Photograph P. Gillespie.

Photograph 52. Kangaroo (*Macropus fuliginosus*) tracks on Mt Hallowell.



Photograph P. Gillespie.

Photograph 53. Kangaroo (Macropus fulignosus).

Photograph P. Gillespie.

Photograph 54. Western Swamp Skink (*Lissolepis luctuosa*) in R 24452

Photograph P. Gillespie.

Photograph 55. Slender Tree Frog (*Litoria adelaidensis*).

Photograph P. Gillespie.

Photograph 56. Motorbike Frog (Litoria moorei).

Photograph P. Gillespie.

Photograph 57. Motorbike Frog (Litoria moorei) colour variation.

Photograph P. Gillespie.

Photograph 58. Dead Yellow-footed Antechinus or Mardo (*Antechinus flavipes*).

Photograph P. Gillespie.

Photograph 59. Common Dwarf Skink (*Menetia greyii*).

Photograph P. Gillespie.

Photograph 60. *Metacrinia nichollsi* on Mt Hallowell.

Photograph P. Gillespie.

Photograph 61. *Metacrinia nichollsi* showing typical belly spots.

Photograph P. Gillespie.

Photograph 62. Quenda (*Isoodon obesulus*) caught on trail camera.

Photograph P. Gillespie.

Photograph 63. Brushtail Possum (*Trichosurus vulpecula*) scat on fallen tree.

Photograph P. Gillespie.

Photograph 64. Typical Rabbit (*Oryctolagus cuniculus*)digging in R 43923

Photograph P. Gillespie.

Photograph 65. Rabbit (*Oryctolagus cuniculus*) jaw bone.

Photograph P. Gillespie.

Photograph 66. Rabbit (*Oryctolagus cuniculus)* in R 29426.

Photograph P. Gillespie.

Photograph 67. Rabbit (*Oryctolagus cuniculus)* scats.

Photograph P. Gillespie.

Photograph 68. Tiger snake (*Notechis ater occidentalis*) in cave on Mt Hallowell

Photograph P. Gillespie.

Photograph 69. Tiger snake (*Notechis ater occidentalis*) in R 24452

Photograph P. Gillespie.

Photograph 70. Unknown scats possibly those of a Dunnart (*Sminthopsis spp*).

Photograph P. Gillespie.

Photograph 71. Tiger snake (*Notechis ater occidentalis*) on Mt Hallowell

Photograph P. Gillespie.

Photograph 72. Quenda (*Isoodon obesulus*) scats.

Photograph P. Gillespie.

Photograph 73. Tiger Snake (*Notechis ater occidentalis*) in R 24452

Photograph P. Gillespie.

Photograph 74. Bush Rat (Rattus fuscipes) being examined after Elliot trapping.

Photograph P. Gillespie.

Photograph 75. Examining *Hemiergis peronii* with characteristic yellow belly.

Photograph P. Gillespie.

Photograph 76. Marbled Gecko (*Christinus marmoratus*) at Poison Pt.

Photograph P. Gillespie.

Photograph 77. *Crinia georgiana* on Mt Hallowell.

Photograph P. Gillespie.

Photograph 78. *Crinia georgiana* on granite at Poison Pt.

Photograph P. Gillespie.

Photograph 79. *Crinia glauerti*.

Photograph P. Gillespie.

Photograph 80. *Hemiergis peronii* in R 29426

Photograph P. Gillespie.

Photograph 81. King Skink (Egernia kingii) on granite outcrop.

Photograph P. Gillespie.

Photograph 82. Western Crevice Skink (Egernia napoleonis).

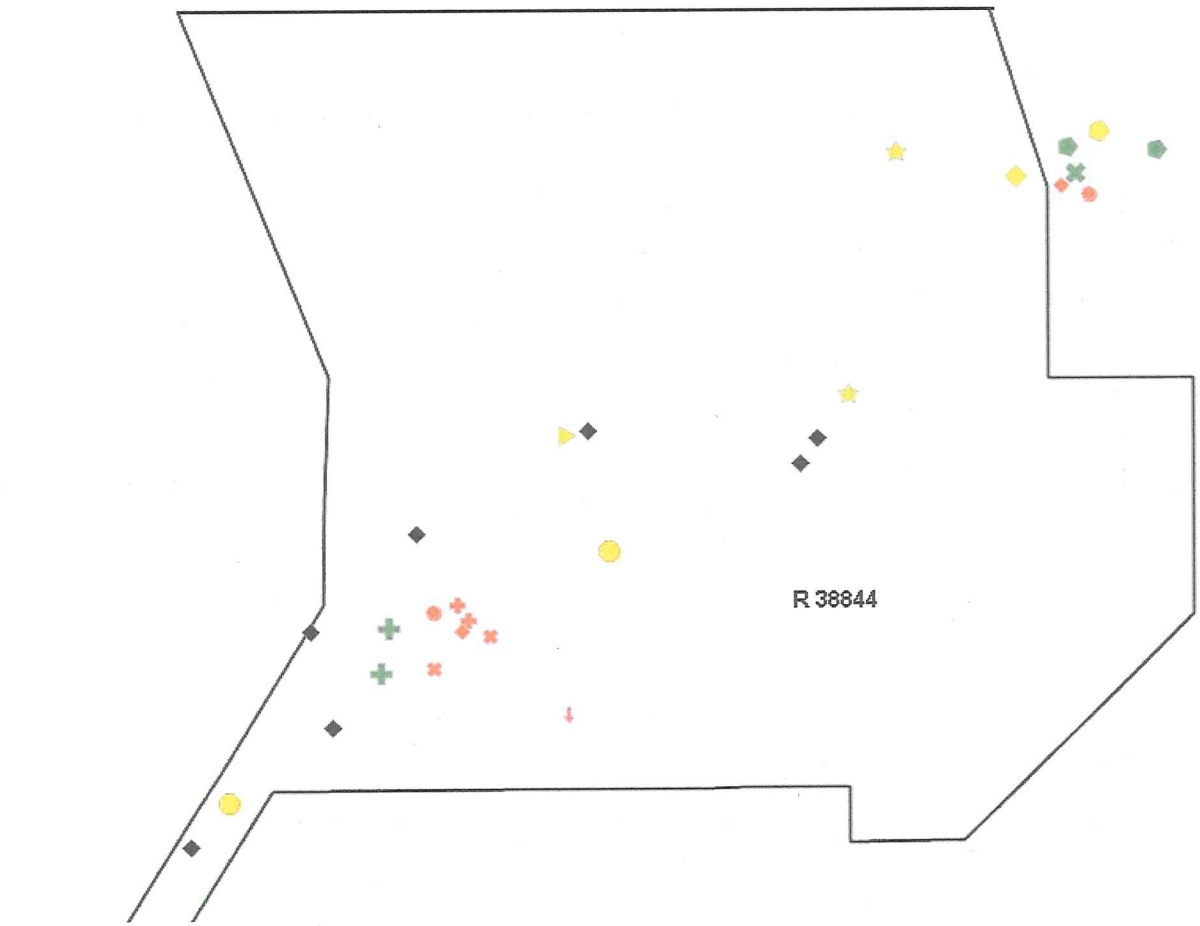
Photograph P. Gillespie.

Photograph 83. Quenda (*Isoodon obesulus*)were common throughout the study area.

Photograph P. Gillespie.

Photograph 84. Bardick (*Echiopsis curta*) found by Shire Ranger.

Map 1. Sth Mt Hallowell R 38844



Reptiles

Categories: Species

- Acritoscincus trilineatus
- Christinus marmoratus
- Ctenotus catenifer
- Ctenotus labillardieri
- Drysdalia coronatus
- Echiopsis curta
- Egernia kingii
- Egernia napoleonis
- Hemiergis peronii subsp. peronii
- Lissolepis luctuosa
- Menetia greyii
- Notechis scutatus occidentalis
- Pseudonaja affinis subsp. affinis
- Tiliqua rugosa

Mammals

Categories

- Antechinus flavipes
- Cercartetus concinnus
- Felis catus
- Hydromys chrysogaster
- Isoodon obesulus
- Macropus fuliginosus
- Mus musculus
- Oryctolagus cuniculus
- Phascogale tapoatafa
- Rattus fuscipes
- Rattus rattus
- Tarsipes rostratus
- Trichosurus vulpecula
- Vulpes vulpes

Frogs

Categories

- Crinia georgiana
- Crinia glauerti
- Crinia pseudoinsignifera
- Crinia subinsignifera
- Geocrinia leai
- Litoria adelaidensis
- Litoria moorei
- Lymnodynastes dorsalis
- Metacrinia nichollsi
- Pseudophryne guentheri

Trapping

Reserves

N

W E

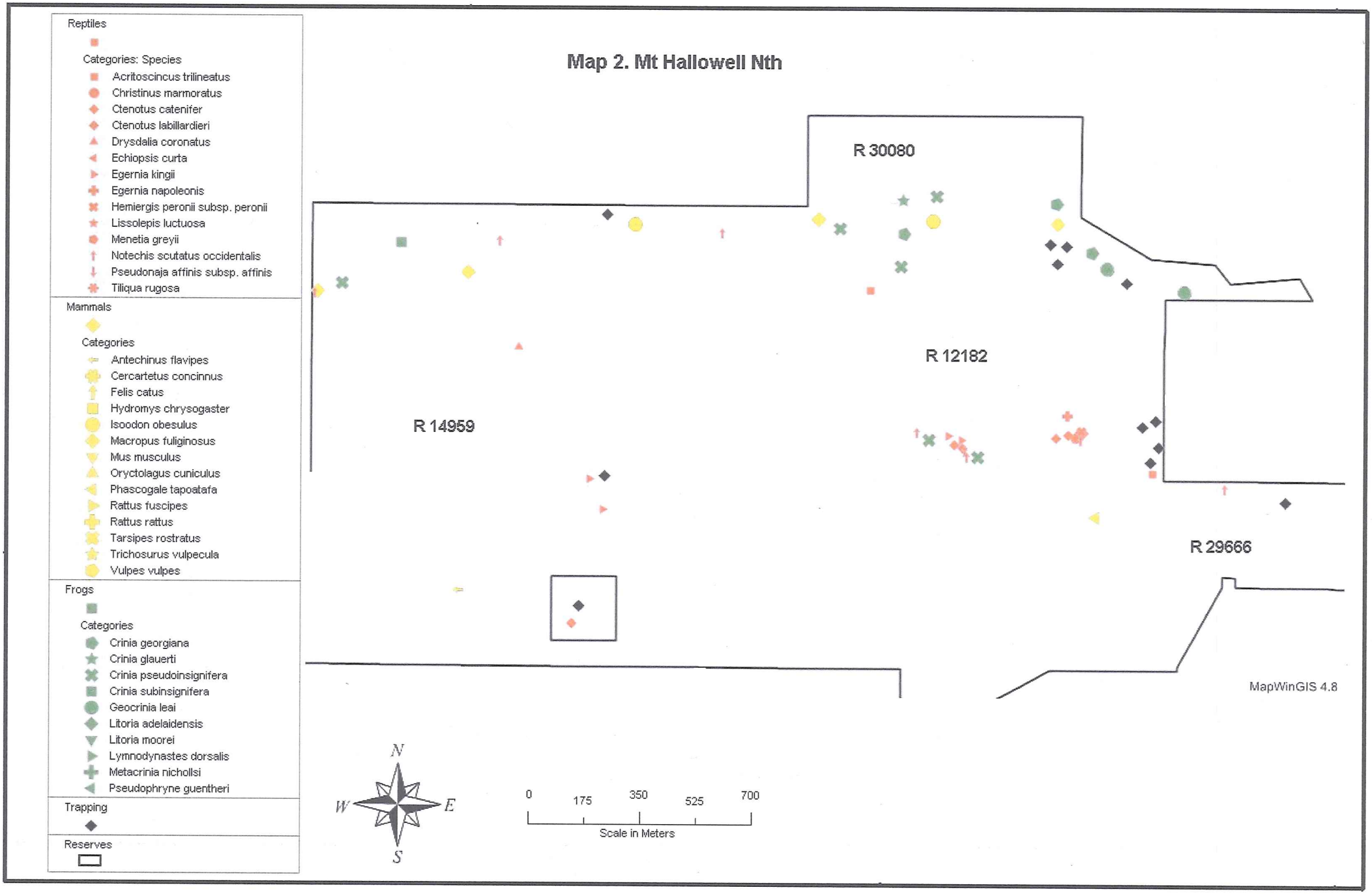
S

0 75 150 225 300

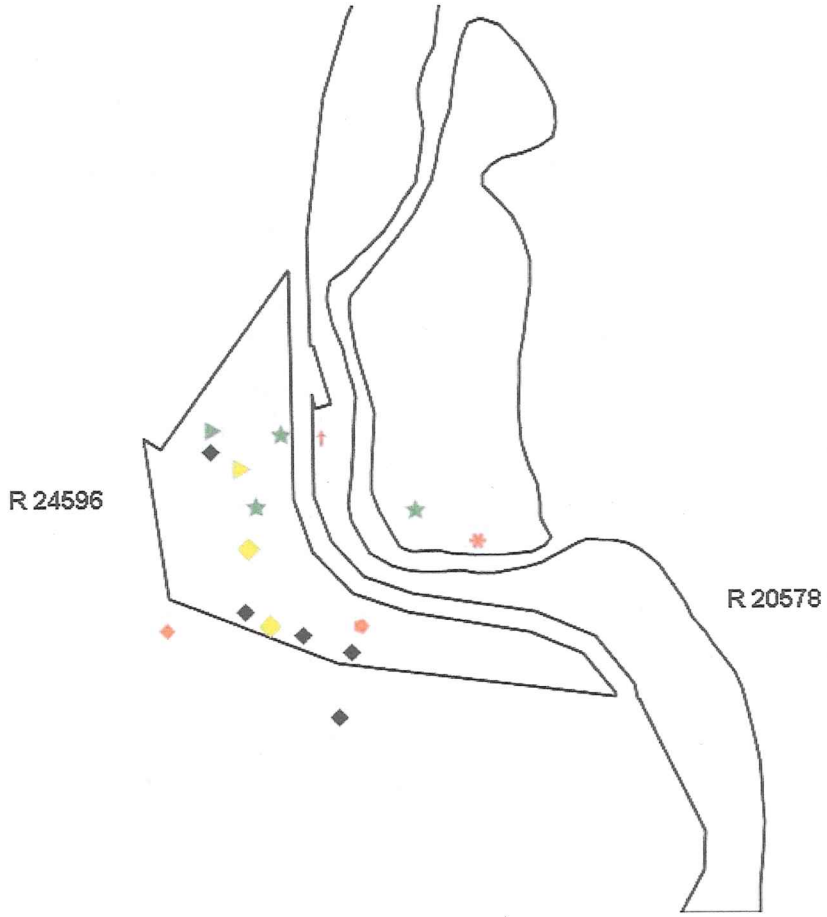
Scale in Meters

MapWinGIS 4.8

Map 2. Mt Hallowell Nth



Map 3. R 24596 & R 20578



Reptiles

Categories: Species

- Acritoscincus trilineatus
- Christinus marmoratus
- Ctenotus catenifer
- Ctenotus labillardieri
- Drysdalia coronatus
- Echiopsis curta
- Egernia kingii
- Egernia napoleonis
- Hemiergis peronii subsp. peronii
- Lissolepis luctuosa
- Menetia greyii
- Notechis scutatus occidentalis
- Pseudonaja affinis subsp. affinis
- Tiliqua rugosa

Mammals

Categories

- Antechinus flavipes
- Cercartetus concinnus
- Felis catus
- Hydromys chrysogaster
- Isoodon obesulus
- Macropus fuliginosus
- Mus musculus
- Oryctolagus cuniculus
- Phascogale tapoatafa
- Rattus fuscipes
- Rattus rattus
- Tarsipes rostratus
- Trichosurus vulpecula
- Vulpes vulpes

Frogs

Categories

- Crinia georgiana
- Crinia glauerti
- Crinia pseudoinsignifera
- Crinia subinsignifera
- Geocrinia leai
- Litoria adelaidensis
- Litoria moorei
- Lymnodynastes dorsalis
- Metacrinia nichollsi
- Pseudophryne guentheri

Trapping

Reserves

N
W E
S

0 100 200 300 400

Scale in Meters

MapWinGIS 4.8

Map 4. R36714

Reptiles

Categories: Species

- Acritoscincus trilineatus
- Christinus marmoratus
- Ctenotus catenifer
- Ctenotus labillardieri
- Drysdalia coronatus
- Echiopsis curta
- Egernia kingii
- Egernia napoleonis
- Hemiergis peronii subsp. peronii
- Lissolepis luctuosa
- Menetia greyii
- Notechis scutatus occidentalis
- Pseudonaja affinis subsp. affinis
- Tiliqua rugosa

Mammals

Categories

- Antechinus flavipes
- Cercartetus concinnus
- Felis catus
- Hydromys chrysogaster
- Isoodon obesulus
- Macropus fuliginosus
- Mus musculus
- Oryctolagus cuniculus
- Phascogale tapoatafa
- Rattus fuscipes
- Rattus rattus
- Tarsipes rostratus
- Trichosurus vulpecula
- Vulpes vulpes

Frogs

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- Crinia subinsignifera
- Geocrinia leai
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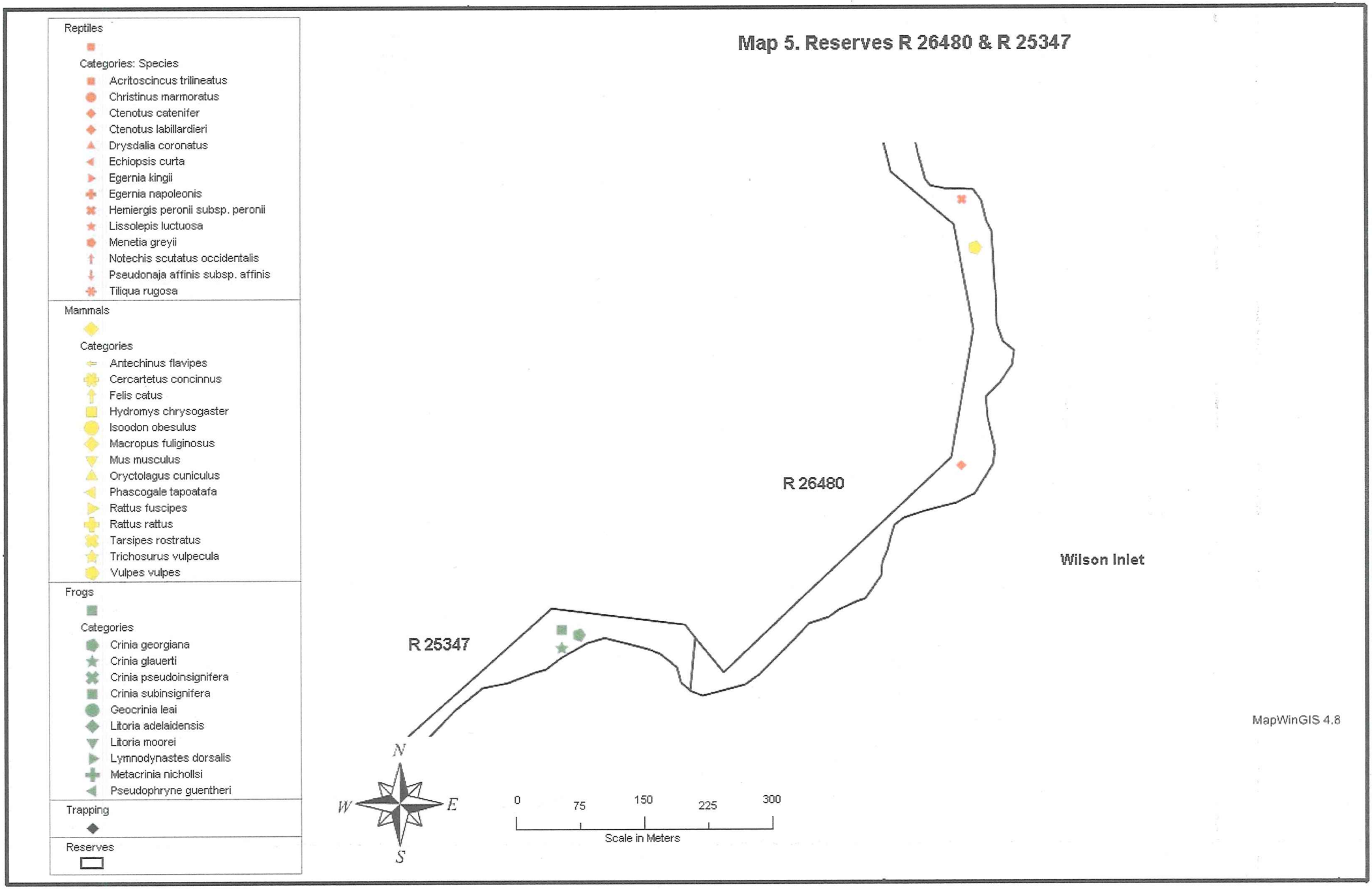
- Litoria moorei
- Lymnodynastes dorsalis
- Metacrinia nichollsi
- Pseudophryne guentheri

Trapping

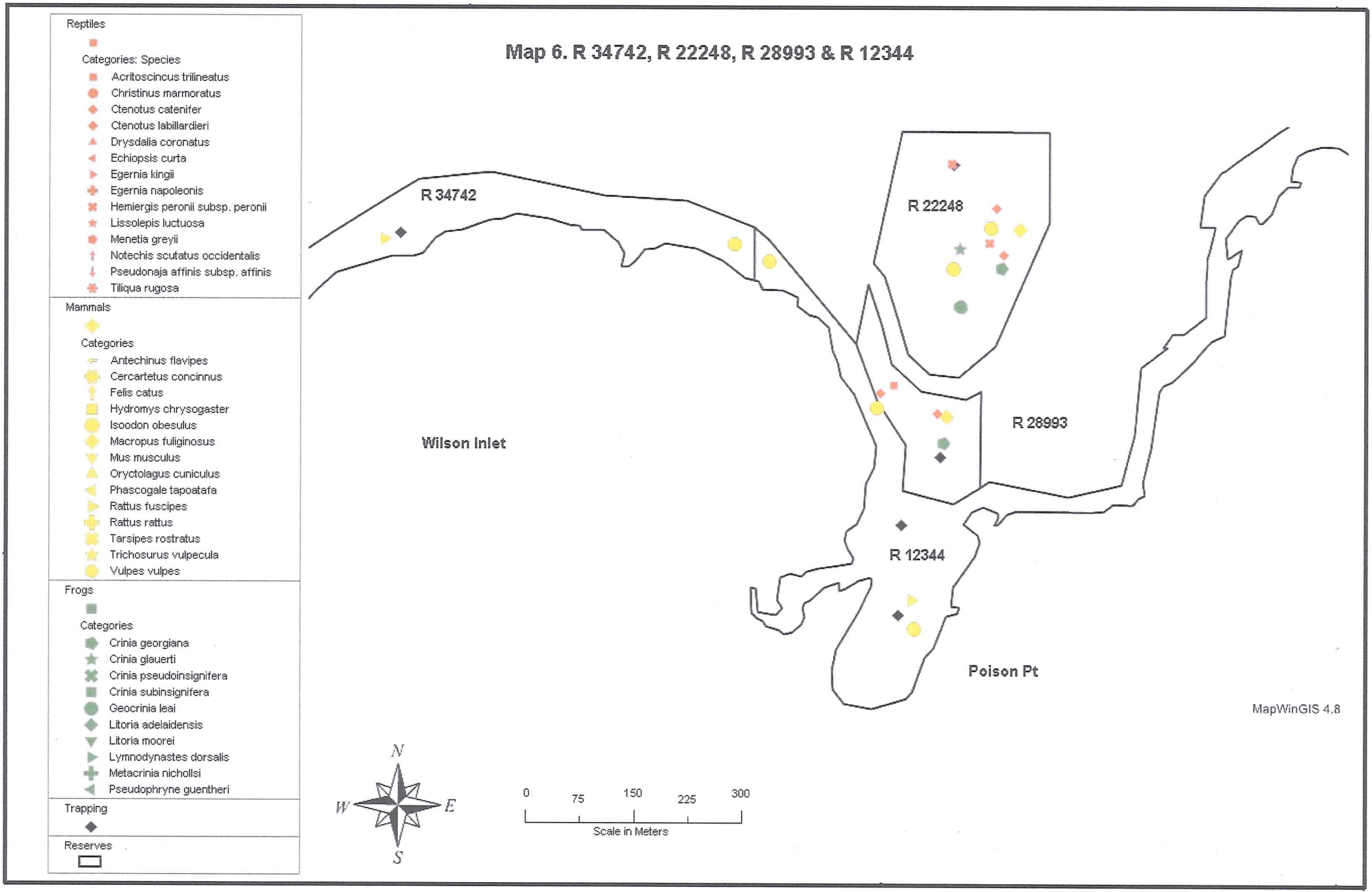
Reserves

MapWinGIS 4.8

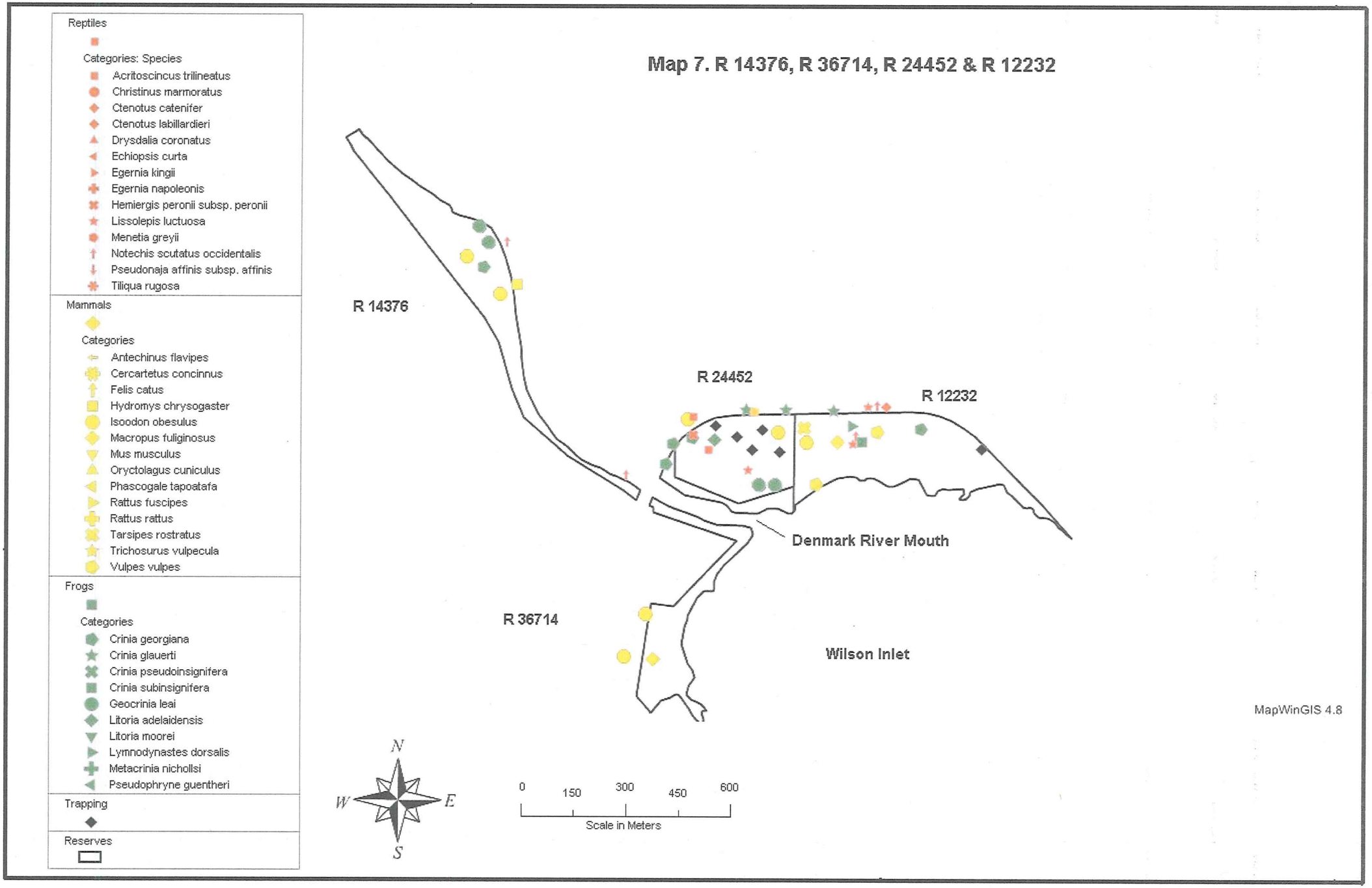
Map 5. Reserves R 26480 & R 25347



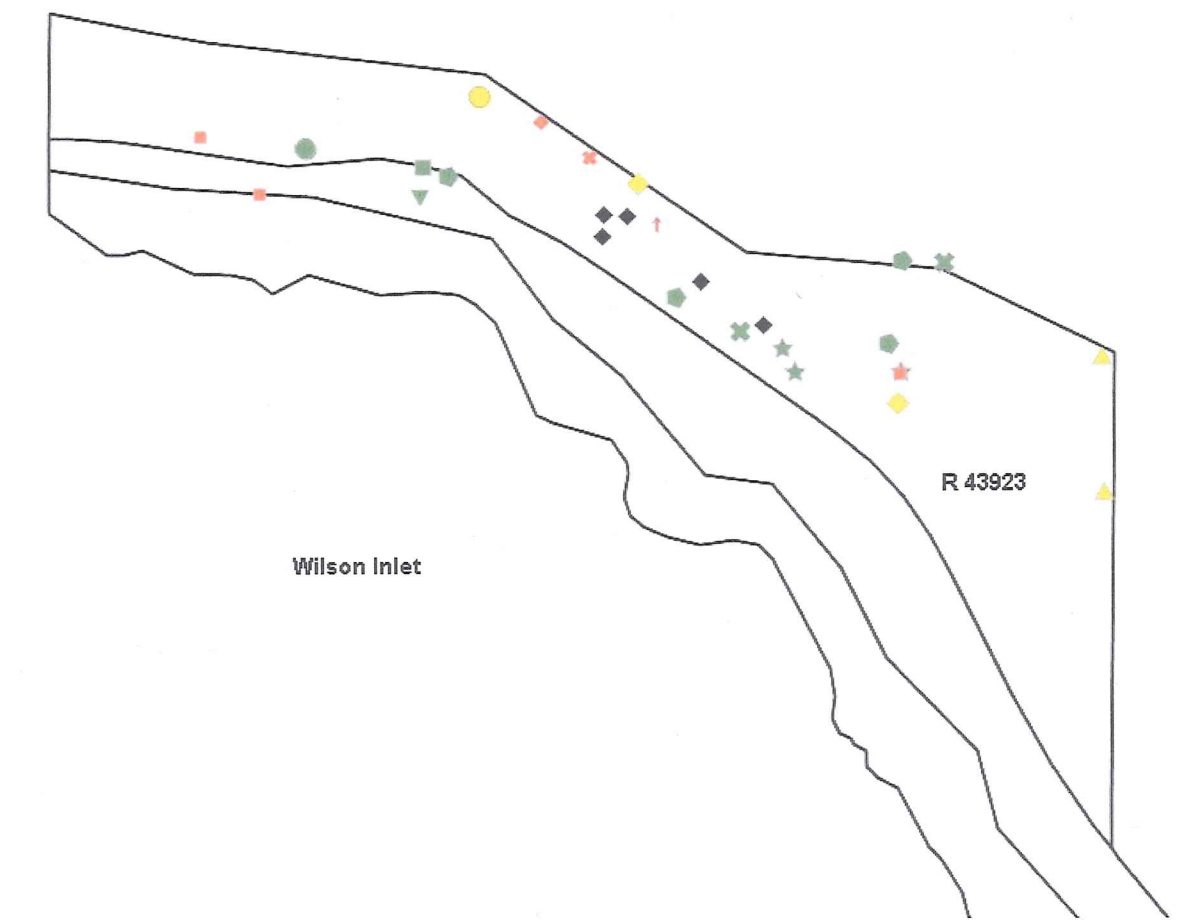
Map 6. R 34742, R 22248, R 28993 & R 12344



Map 7. R 14376, R 36714, R 24452 & R 12232



Map 8. R 43923



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- Egernia kingii
- Egernia napoleonis
- Hemiergis peronii subsp. peronii
- Lissolepis luctuosa
- Menetia greyii
- Notechis scutatus occidentalis
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- Tiliqua rugosa

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Categories

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- Hydromys chrysogaster
- Isoodon obesulus
- Macropus fuliginosus
- Mus musculus
- Oryctolagus cuniculus
- Phascogale tapoatafa
- Rattus fuscipes
- Rattus rattus
- Tarsipes rostratus
- Trichosurus vulpecula
- Vulpes vulpes

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Categories

- Crinia georgiana
- Crinia glauerti
- Crinia pseudoinsignifera
- Crinia subinsignifera
- Geocrinia leai
- Litoria adelaidensis
- Litoria moorei
- Lymnodynastes dorsalis
- Metacrinia nichollsi
- Pseudophryne guentheri

Trapping

Reserves

N
W
E
S

0 75 150 225 300

Scale in Meters

MapWinGIS 4.8