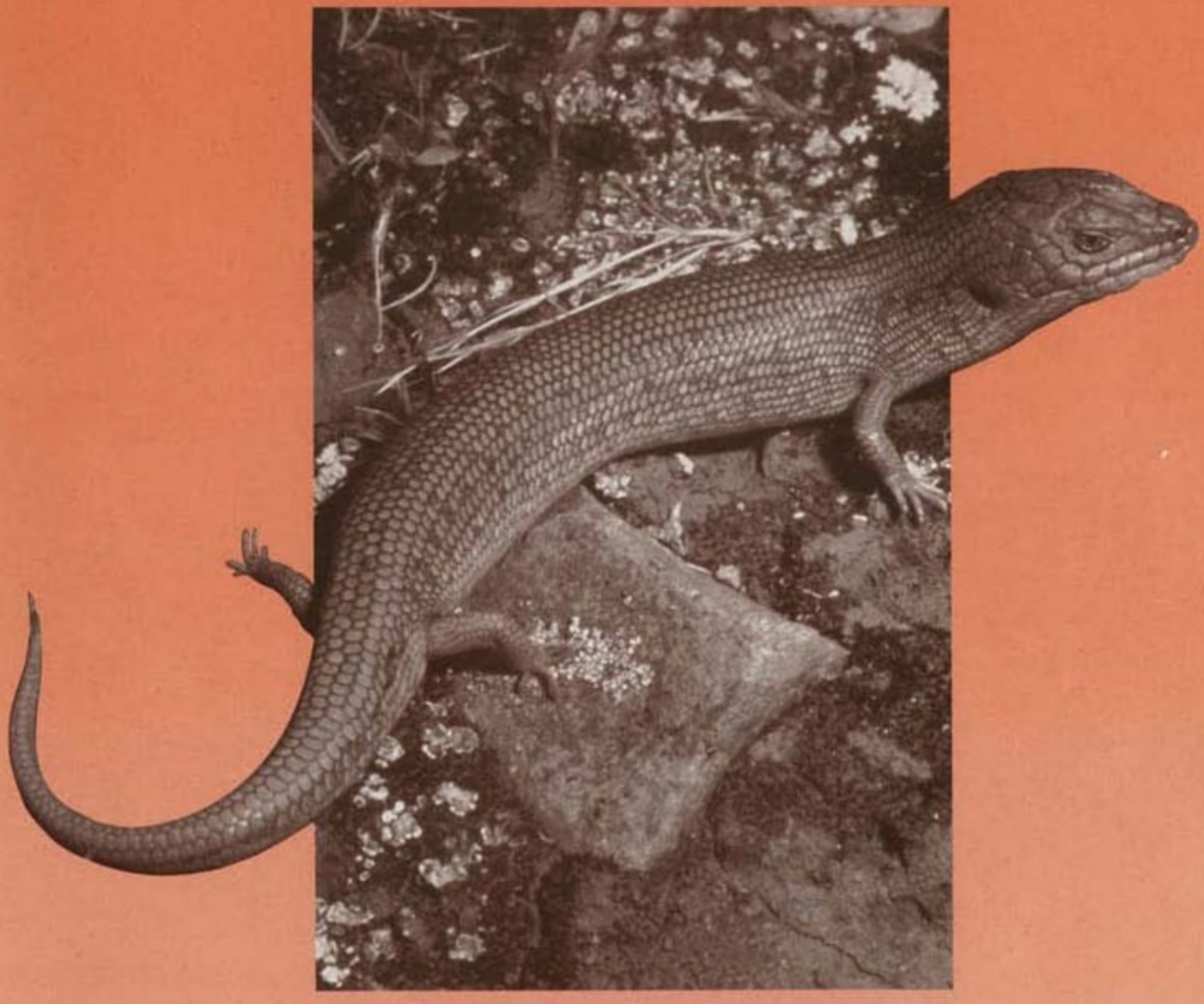
THE ACTION PLAN FOR



AUSTRALIAN REPTILES

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Australian Nature Conservation Agency
Endangered Species Program
Project Number 124

Australian Nature Conservation Agency

THE ACTION PLAN FOR AUSTRALIAN REPTILES

by

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The Action Plan for Australian Reptiles
by Hal Cogger, Elizabeth Cameron, Ross Sadlier and Peter Eggler

The views and opinions expressed in this report are those of the authors and do not necessarily reflect those of the Commonwealth Government, the Minister for the Environment, Sport and Territories, or the Director of National Parks and Wildlife.

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FOREWORD

Australia is noted for the enormous diversity and abundance of its reptile fauna, from the most arid deserts to the tropical waters of the northern coasts. An increasing fascination with these animals is reflected in the recent proliferation of texts, both professional and amateur, on reptile identification, distribution, biology, evolution and conservation. *The Action Plan for Australian Reptiles* is a landmark document for those interested in the conservation of our reptiles as it summarises for the first time the conservation status and requirements of those species at risk.

As a group, the reptiles seem to have survived the perturbations of the last 200 years rather better than the mammals and birds. As this action plan reveals however, there is no room for complacency. Some species such as the Western Swamp Tortoise would probably be extinct by now without the action being taken to conserve the last remaining wild population and to establish another free-living population. Even with all the effort being undertaken, its continued existence is not guaranteed.

One species has recently re-emerged from presumed extinction. Not sighted since 1959, the Pygmy Bluetongue was rediscovered in October 1992 to the excitement of more than a few herpetologists. As with many species the major threat has been the loss of habitat. Found only in small patches of remnant native grassland in a sea of introduced pastures, the Pygmy Bluetongue highlights the urgent need for habitat as well as species conservation.

Many of the arid and semi-arid zone species seem to be relatively secure, but in many cases little is known about their former distributions and abundances. Without further investigation and long-term monitoring there is no way of knowing if species are declining. For many species the collection of further scientific information is essential before an accurate assessment can be made of their conservation status and needs.

The marine reptiles, particularly the migratory turtles, have conservation requirements beyond Australia's control and legislative powers. Our assent to the international Convention on the Conservation of Migratory Animals (Bonn Convention) does, however, give us some capability in helping to secure these species. Meanwhile we should be leading the world in ensuring the security of their feeding and breeding grounds here and reducing the incidental take by fisheries.

Island species have suffered more than species in any other habitat. Having evolved in isolation, often in response to specialised conditions, and lacking reservoirs for recolonisation, these species display the characteristics of small populations including their sensitivity to changes in their environment. This vulnerability of island species to extinction should alert us to the effects of habitat fragmentation on mainland species.

One factor that emerges from this document is the paucity of information on many reptile species. Reptiles have been often neglected by scientists (apart from an eager cohort), planners and decision-makers, and their public profile has been poor. As a fascinating and integral part of Australia's environment, it is time that their status and requirements were taken seriously.

The Action Plan for Australian Reptiles is the third in the series of Action Plans commissioned by the Australian Nature Conservation Agency. Preceding this were the action plans for birds and freshwater fishes, as well as that for marsupials and monotremes produced by WWF/IUCN. Currently in preparation are action plans for amphibians, rodents, bats, cetaceans, and seals and dugongs, as well as conservation overviews for non-vascular plants and non-marine invertebrates.

The Action Plan for Australian Reptiles will play a key role in determining priorities for both research and conservation management needed to prevent extinctions of Australia's unique reptilian fauna.

Peter Bridgewater
Chief Executive Officer
Australian Nature Conservation Agency
December 1993

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EXECUTIVE SUMMARY

Of Australia's diverse reptile fauna comprising some 765 species, 204 species or subspecies or geographically-discrete populations (henceforth collectively called "species") have been nominated by conservation agencies and individuals as warranting threatened status and requiring management actions to slow or halt the processes which are threatening their survival. This represents about 25% of Australia's reptile fauna.

The authors have reviewed the knowledge available on these species in consultation with a panel of representative herpetologists, and recommend 11 species for Endangered status and 41 species for Vulnerable status. A further 152 species are recommended for Rare or Insufficiently Known status.

Ranking of threatened taxa was achieved by use of a modified version of a system developed by Millsap *et al.* (1990) for the vertebrate fauna of Florida. Initially trialed in a national workshop of representative herpetologists, this system was adopted when found to reliably rank threatened species on the limited data available for Australian reptiles.

It is recommended that all the species assigned Endangered or Vulnerable status in this Action Plan be included on the ANZECC List of Endangered Vertebrate Fauna and on the gazetted schedules of relevant Federal, State and Territory conservation agencies.

Recovery outlines have been prepared for all Endangered and Vulnerable species except marine turtles. The outlines summarise current knowledge of the conservation status, distribution, habitats and threats to each species. They also review current research and management actions and identify gaps in the knowledge needed to effectively manage and conserve these species, and list the actions (together with their costs) needed to reduce or eliminate the current threats and ensure secure status for the species on and off reserves.

Families with the highest proportion of Endangered and Vulnerable species are the marine turtles (Cheloniidae and Dermochelyidae), the freshwater tortoises or turtles (Chelidae) and the legless lizards (Pygopodidae).

Western Australia, followed by Queensland and New South Wales, has the highest number of species in the Endangered and Vulnerable categories.

The WORLDMAP software package, using a variety of biodiversity measures to analyse the distribution of Endangered and Vulnerable terrestrial reptiles, identifies 13 areas (at a resolution of 2° of latitude and longitude) that collectively contain the highest biodiversity of this subset of species. It is recommended that priority be given to these areas in the allocation of national conservation resources and in the establishment and management of reserves by State and Territory conservation agencies.

The class of habitat with the greatest number of reptiles at risk is "isolated rocky outcrops" which includes small offshore islands. Other habitats with high numbers of Endangered or Vulnerable species are open woodland, woodland, tussock grassland and heathland.

The threatening processes identified in this review as affecting the greatest number of species, are habitat clearance or modification, overgrazing by stock, cropping, urban development, and predation by introduced mammals (principally foxes, cats and rats).

This review has highlighted the dearth of knowledge on the distribution, biology and ecology of Australia's reptiles, with the result that 85% of the $4,848,900 required to implement the recommended actions is assigned to these basic areas of research.

INTRODUCTION

This Action Plan was commissioned by the Australian Nature Conservation Agency (formerly the Australian National Parks and Wildlife Service), through the Endangered Species Program. The assigned task was to "...prepare an overview of the conservation status of Australian reptiles, develop a list of endangered and vulnerable reptile taxa, and develop conservation profiles for these taxa."

This task faced some difficulties which were probably not encountered in the Action Plans for birds and mammals. Australian reptiles are exceptionally diverse (765 species in 136 genera spanning 17 families). Within this fauna, some 270 species (36% of the total reptilian fauna) have been described only during the past two decades - a figure indicative of the continuing need for herpetofaunal surveys and taxonomic research.

Unlike birds, few reptiles can be confidently identified by observation from a distance; in most cases, a reptile must be taken in hand and a suite of morphological and meristic characters examined before an accurate identification is possible. Recognition of sibling (cryptic) species is becoming increasingly common as the application of molecular and biochemical techniques permits them to be identified; once such species are characterised, it is often possible to find correlated morphological features, but even so, identification of wild specimens almost invariably requires capture of the individual. Capturing most live reptiles for examination and identification requires knowledge, skill and, in most States and Territories, a permit from the appropriate conservation and wildlife agency.

Unlike the Australian birds and mammals, few reptiles have been subjected to intensive bio-ecological study. The life histories of fewer than 10 species have been studied with any degree of completeness and the distributions of individual species are typically extrapolated from a handful of specimen-based museum records.

For all of the foregoing reasons, the knowledge base available to identify and assess the status of threatened species of reptiles in Australia is inadequate, uneven and usually fragmentary. (In this document, the term 'threatened' is used in a broad sense to describe all or any species whose conservation status is considered insecure; it includes reptiles in Endangered, Vulnerable, and Rare or Insufficiently Known categories).

In an effort to overcome these shortcomings, the preparation of this Action Plan involved extensive consultation with individual Australian herpetologists and with Commonwealth, State and Territory agencies responsible for aspects of reptile conservation in Australia and its Territories.

No Australian reptile is known to have become extinct since 1788. However, the importance of a quantified, objective ranking system was emphasised during the course of the Plan's preparation when the only Australian reptile believed to be "probably extinct" - the Pygmy Bluetongue, *Tiliqua adelaidensis* - was rediscovered in extraordinary circumstances near Burra, South Australia (Armstrong and Reid, 1993). More than 50 of these lizards have since been discovered, albeit in a very small area, and population studies are currently under way. Successful reproduction was recorded during the 1992-93 summer.

Recognition of taxa and use of common names

We have recognised some undescribed species, subspecies and geographically-discrete populations in the Reptile Action Plan. The taxonomic integrity of most of the undescribed chelids is supported by an allozyme electrophoresis study (Georges and Adams, 1992) but some of the other taxa widely recognised as distinct, lack published data to define them. We strongly urge herpetologists concerned about the conservation status of undescribed reptiles, to formally describe such taxa.

With the intention of making this Plan more readable for non-specialists, we have given common names to all the reptiles listed as Endangered or Vulnerable. Some names are already in common usage and others have been applied in the recent literature on threatened species; for the remainder we depended on recommendations from the people most familiar with the species, or coined names ourselves. All members of the family Chelidae have been

called "Tortoise" to conform with the preferred common name of "Western Swamp Tortoise" for *Pseudemydura umbrina*.

Definitions of threatened categories

All nominated taxa were classified into one of three categories: 'Endangered', 'Vulnerable', and 'Rare or Insufficiently Known'. The definitions of 'Endangered', 'Vulnerable' and 'Insufficiently Known' used in this publication are those used officially by the World Conservation Union (IUCN), with minor additions to the endangered and vulnerable categories. These modifications are used by the Endangered Species Program (ESP) and the Australian and New Zealand Environment and Conservation Council (ANZECC). The categories 'Extinct' and 'Rare' are also used in this publication and are defined below:

'Extinct': Taxa not definitely located in the wild during the past 50 years, or species that have not been found in recent years despite thorough searching.

'Endangered': Taxa in danger of extinction and whose survival is unlikely if the causal factors continue to operate.

Included are taxa whose numbers have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to be in immediate danger of extinction. Also included are taxa that may now be extinct but have definitely been seen in the wild during the past 50 years and have not been subject to thorough searching.

'Vulnerable': Taxa believed likely to move into the 'Endangered' category in the near future if the causal factors continue to operate.

Included are species of which most or all of the populations are decreasing because of over-exploitation, extensive destruction of habitat or other environmental disturbance; species with populations that have been seriously depleted and whose ultimate security has not yet been assured; and taxa with populations that are still abundant but are under threat from severe adverse factors throughout their range. Also included are taxa with low or localised populations or dependent on limited habitat that would be vulnerable to new threatening processes. In practice, both 'Endangered' and 'Vulnerable' categories may include, temporarily, species whose populations are beginning to recover as a result of remedial action, but whose recovery is at present insufficient to justify their transfer to another category.

'Rare': Taxa with small populations that are not at present 'Endangered' or 'Vulnerable', but are threatened. These taxa are usually localised within restricted geographical areas or habitats or are thinly scattered over a more extensive range.

'Insufficiently Known': Species that are *suspected* of being 'Endangered', 'Vulnerable' or 'Rare' but whose true status cannot be determined without more information.

While these categories may appear relatively unambiguous to the layman, they are highly subjective, with the boundaries between one category and another being difficult to define in any objective way: boundaries between the categories vary widely in different countries and regions, and in different taxonomic groups.

More recently the shortcomings of these categories have been recognised and a new classification (Mace and Lande, 1991) using more objective criteria, has been proposed to replace them. The proposed classification is:

'Critical': 50% probability of extinction within 5 years or 2 generations, whichever is the longer.

'Endangered': 20% probability of extinction within 20 years or 10 generations, whichever is the longer.

'Vulnerable': 10% probability of extinction within 100 years.

The criteria used to assign species to the above categories are summarised in Appendix 10, Table 4, where full details of the approach and methods adopted in preparing this Action Plan appear.

Summary of methods and results

Initially a list was compiled of Australian reptiles which had been included by conservation and wildlife agencies on schedules of threatened species. Further nominations of threatened species were sought from the

community through a questionnaire mailed to herpetological, natural history and conservation societies. The collection databases of all major natural history museums in Australia were then consulted to obtain information on distribution and the history and chronology of geographic records held on these species.

Government conservation and wildlife agencies in all States and Territories were approached for assistance. They were asked to supply non-specimen-based distribution data and information on reserves and research and management programs relevant to reptiles on the ANZECC List of Endangered Vertebrate Fauna (April, 1991) or on their own schedules of threatened fauna. (The reptiles listed on the ANZECC List are the same as those on Schedule 1 of the Commonwealth's *Endangered Species Protection Act 1992*).

A working list of 204 taxa (about 25% of all species known from Australia and its Territories) was prepared from the above sources. The conservation status of each of these species was discussed and ranked by specialist herpetologists at a workshop held in December 1991.

As indicated above, knowledge of Australian reptiles is generally poor, so even small amounts of new information can require dramatic revision of prior perceptions of distribution, habitat preferences and conservation status. For these reasons the authors considered that a system of objective ranking of threatened taxa was essential if new information about individual taxa was to be rapidly processed and incorporated into relevant legislation and regulations. Several such systems are in use (eg Ahern *et al.*, 1985; Molloy and Davis, 1992), but after preliminary trials, the wildlife ranking system developed by Millsap *et al.* (1990) for the Florida Game and Freshwater Fish Commission was modified, trialed and adopted.

As a result of the workshop (and subsequent consideration of recent research which resulted in the re-scoring of biological variables for some species), 11 species, subspecies or geographically-discrete populations of Australian reptiles are considered to warrant Endangered status and a further 41 reptiles are considered to warrant Vulnerable status. The remaining 152 reptile taxa are classified as Rare or Insufficiently Known and warrant further study to assess whether they are likely to become Vulnerable or Endangered in the near future. The scores for all 204 taxa, based on Millsap *et al.*, appear in Appendix 11.

Some of the species which have been identified as Endangered or Vulnerable in this Plan are not currently gazetted in State, Commonwealth or ANZECC schedules of threatened reptiles. We strongly recommend that they be added to the relevant schedules as soon as possible.

Four species on the 1991 ANZECC List did not score enough points in our analysis to qualify for Endangered or Vulnerable status in this Action Plan (see Appendix 3 and Appendix 11). They are *Aprasia parapulchella*, *Delma mitella*, *Ctenotus angusticeps* and *Morelia carinata*; a review of recent information on the distribution of these species and the processes threatening them was the reason for their changed status.

An extensive survey of *A. parapulchella* by the ACTP&CS has located it at many sites within two conservation reserves in the ACT; recent records from Bathurst and Tarcutta in NSW suggest its total range may not have declined since it was described. The area occupied by *Delma mitella* is estimated to have declined by less than 25% and the trend in its population size is unknown. Although it is known from only a few specimens, it occurs in a region which has not been adequately surveyed and which is not subject to drastic habitat modification at this time. It was the opinion of the Workshop participants (including its describer) that *Delma mitella* was Rare or Insufficiently Known rather than Vulnerable.

The known range of *Ctenotus angusticeps* was recently extended by the discovery of five individuals on the mainland near Roebuck Bay, 700 km north-east of the type locality, Airlie Island (Sadlier, 1993). Although *Morelia carinata* is known from only a few individuals, it occurs in sandstone gorges in a remote region which has not been fully surveyed. No major threatening processes have been identified and both population size and area occupied are considered to be stable or increasing.

All six marine turtles were nominated for threatened status but none scored as high as the lowest ranked Vulnerable terrestrial reptile. This was in part due to the low endemism of the marine turtles compared with the high

endemism of terrestrial reptiles, in part to the large geographic distribution of most marine turtles compared with the usually limited range of threatened terrestrial species, and in part to the great pressures being placed on many terrestrial habitats.

Some species, such as the Luth (*Dermochelys coriacea*), have no significant nesting sites in Australia. However, given the intense hunting pressure put on this and other species in many neighbouring countries, it is critical that the species be afforded protection in Australian waters so as not to contribute to the depletion of regional breeding stocks. Conversely Limpus (pers. comm.) has indicated that Australian nesting populations of the Green Turtle (*Chelonia mydas*) are genetically distinguishable from those of adjacent areas such as Indonesia, maintaining discrete breeding sites while sharing feeding areas. Hence hunting activities in such regions can impact on Australian breeding stocks. Limpus and Reimer (in prep.) have also shown that eastern Australian stocks of the Loggerhead Turtle (*Caretta caretta*) have fallen sharply in the past two decades.

Consequently, with all species of sea turtles (except *Natator*) declining globally, and the Australian populations of several species in serious decline at least regionally, we believe that a special case can be made for all species except *Natator depressus* to be listed as Vulnerable. This view reflects the conservation status previously accorded marine turtles by ANZECC. It is also supported by most Australian marine turtle experts, who have prepared a series of draft recommendations for marine turtle conservation (Australian Nature Conservation Agency and Queensland Dept of Environment and Heritage, in press).

The Australian Nature Conservation Agency has retained the Queensland Department of Environment and Heritage (Dr Col Limpus) as a consultant to prepare a Strategy for Regional Cooperation on Marine Turtle Conservation in the Indo-Pacific Region. Because of that ongoing consultancy and the draft recommendations in press, and because they constitute a special case in the conservation of Australian reptiles, marine turtles have been treated differently from terrestrial reptiles in this Action Plan. Brief Species Profiles and distribution maps for the Vulnerable species appear in Appendix 6.1.

Only three species of sea snakes were nominated for threatened status and all were eventually classified as Rare or Insufficiently Known. The same classification could well be applied to many other species in this group.

Sea snakes are a significant by-catch of commercial prawn trawling in northern Australian waters - more than 200,000 were taken during 1989 and 1990 (Ward, 1993) - and many of their skins are processed in tanneries in Australia. The Australian Government has not yet issued commercial export permits for Australian sea snakes, but sea snakeskin goods are already sold widely in northern Australia. This trade requires careful monitoring to ensure that populations of individual species do not decline to a level which threatens their survival.

The taxonomic breakdown of Australia's threatened reptiles is summarised in Appendix 1, Table 1. Marine turtles (families Cheloniidae and Dermochelyidae) top the list with all species except *Natator depressus* proposed as Vulnerable; they are followed by the freshwater tortoises (Chelidae) and endemic legless lizards (Pygopodidae), each with approximately 25% of species classified as Endangered or Vulnerable.

Genetic research has been recommended in 10 Species Recovery Outlines. The following examples illustrate the importance of such studies in determining the biological uniqueness of threatened taxa currently regarded as ecologically and morphologically distinct.

Of the reptiles classified as Endangered in this Plan the island species, *Ctenotus lancelini*, is morphologically very similar to the mainland species, *Ctenotus labillardieri*. *Eulamprus leuraensis* was elevated from the species complex of *Sphenomorphus* (now *Eulamprus*) *kosciuskoi* on the basis of colour pattern and some scalation characters. The undescribed subspecies of *Eulamprus tympanum* in the Drecite area of Victoria may interbreed with the nominal subspecies on the edges of its range (John Coventry, pers. comm.).

Until recently *Lerista allanae* was recognised as fairly widespread species in central Queensland; in 1992 the taxon was split and a new species, *Lerista colliveri*, was described to which individuals throughout most of this range were assigned (Couper and Ingram, 1992). The range of *Lerista allanae* is now regarded as a very

small area around Clermont and its re-scoring has elevated it to Endangered status.

Generally, isolated populations could be considered less genetically distinct and thus of less conservation significance than subspecies, and the latter less distinct and significant than species. However the status of all conspecifics and congeners should be considered when assessing the extent to which a gene pool is threatened. For example, all three subspecies of *Egernia stokesii* are threatened so the species complex warrants priority in conservation actions over a threatened subspecies whose conspecifics are all considered secure.

The distribution of Endangered and Vulnerable terrestrial species by States and Territories is shown in Appendix 5.1 (summarised below). Western Australia and Queensland have the highest numbers of species in these categories.

The WORLDMAP analyses identified 13 areas of high biodiversity for Endangered and Vulnerable reptiles - four in Queensland, three each in Western Australia and South Australia, two in Victoria, one in New South Wales and one encompassing Christmas Island (Appendix 8.1, Table 3). It is recommended that priority be given to these areas in the allocation of national conservation resources and in the establishment and management of reserves by State and Territory conservation agencies.

Information compiled for Species Recovery Outlines indicated that only a few highly threatened terrestrial reptiles were adequately represented in conservation reserves: (12 out of 47 Vulnerable or Endangered species); 18 species in these categories were not recorded from any reserves. Moreover there is very little overlap of threatened species in the reserve system. Only four reserves were recorded as containing more than one threatened species and three of these were insular: Lord Howe Island Permanent Park Reserve and Phillip Island Forest Reserve (*Christinus guentheri* and *Pseudemoia lichenigera*) and Christmas Island NP (*Lepidodactylus listeri* and *Ramphotyphlops exocoeti*); *Notechis ater ater* and *Aprasia pseudopulchella* have both been recorded from Mount Remarkable NP in South Australia.

	STATE/TERRITORY										
	SA	WA	NT	QLD	NSW	ACT	VIC	TAS	Norfolk Island	Lord Howe Island	Christmas Island
Endangered	1	5		2	1		2				
Vulnerable	7	10	2	10	9	2	3	1	2	2	2
Total Endangered + Vulnerable	8	15	2	12	10	2	5	1	2	2	2
Rare or Insufficiently Known	12	54	24	74	24	4	7	1			
Total Threatened Taxa	20	69	26	86	34	6	12	2	2	2	2

The WORLDMAP software package (Appendix 8) has been used to identify **priority areas for the conservation of threatened (Endangered and Vulnerable) reptiles** based on biodiversity measures which analyse the distribution of these species in 2° grid squares. The biodiversity measures include "species richness" which prioritises areas in direct proportion to the number of species present, and "endemism" which gives priority to taxa with the smallest geographic ranges. "Taxonomic root weight" assigns priority to areas containing the greatest number of early-diverging or relict species - that is, species which are genetically distinctive or unique. "Higher taxon richness" gives priority to areas with the most species from early-diverging higher taxa (irrespective of the number of surviving species) while "spanning-tree length" gives greatest weight to areas with the greatest taxonomic spread of species.

Lack of knowledge contributes to the difficulty of identifying the **habitat preferences** of many threatened species. Appendix 4 (summary on following page) lists the habitats used by each of the Endangered or Vulnerable terrestrial reptiles, based on the literature and field observations. Habitats have been classified by vegetation structure after AUSLIG (1990) or by the aquatic or geological features.

Isolated rocky outcrops (including offshore

islands) have the greatest number of species at risk, followed by open woodland, woodland, tussock grassland and heathland. The small geographic area of many islands and their high susceptibility to threatening processes such as ecological changes wrought by introduced animals and plants, climate change and anthropogenic fires, automatically elevate many insular endemic taxa to threatened status.

declined, the reasons for the decline (see Section 9 in the Species Recovery Outlines) are speculative. Appendix 7 lists the major threatening processes which are believed to be operating on Australia's Endangered and Vulnerable terrestrial reptiles. Because the threatening processes leading to the decline of most taxa of threatened Australian reptiles remain subjective or speculative, no attempt has been made to rank the severity of individual threats other than in terms of the number of species on which they are believed to impact (see table below).

HABITAT																		
Closed forest	Low closed forest	Tall open forest	Open forest	Wood -land	Open wood-land	Low wood-land	Low open wood-land	Tall shrub-land	Tall open shrub-land	Heath-land	Low shrub-land	Hum-mock grass-land	Tussock grass-land	Littoral complex	Swamps	Rivers	Riparian habitats	Rocky isolates
5	1	3	6	9	10	2	2	6	3	8	2	2	9	1	3	4	3	12

While this Plan concentrates on identifying threatened taxa, the participants in the December 1991 workshop expressed the opinion that entire reptile communities in Australia and its Territories were also at risk. They identified communities in the following habitats and regions as being most under threat:

Fragments of original mallee (tall shrubland) and woodland habitats in the wheatbelt of south-western Western Australia and in western Victoria and western New South Wales.
Brigalow (open forest) in southern Queensland.
Vine thickets and seasonally-dry rainforests (closed forests) of Arnhem Land, the Kimberley and Queensland.
Riparian habitats sensitive to changes in drainage patterns.
Heathlands of Cape York Peninsula.
Lord Howe and Norfolk Islands and their satellite islets.
Closed forests of Christmas Island, Indian Ocean.

Knowledge of the **processes threatening reptile populations** in Australia is also fragmentary, and documented in only a few cases. In most species which are known or suspected to have

The threats affecting the greatest number of species are habitat clearance, overgrazing by domestic stock, cropping, urban development and predation by introduced mammals (foxes, cats and rats).

The **budgets** recommended in Section 19 of the Species Recovery Outlines are based on the following rates:

Mean full-time salary	\$40K *per annum*
Casual rate	approx. \$20 per hour
Expenses	\$20K *per annum*

The salary rate follows that adopted in the Bird Action Plan (Garnett, 1992). A 50% loading on salary has been allowed for expenses (ie all non-salary costs), with higher loadings for species on islands and in remote regions. Expenses for the preparation of management strategies have been set arbitrarily at 20% of salary. The total cost of one full-time research worker averages \$60K per annum. Where post-graduate students are employed to undertake the research, salary costs could be reduced by up to 50%.

THREATENING PROCESS																	
Habitat clear-ance	Over-grazing by stock	Cropping	Pre-dation	Urban develop-ment	Pasture improve-ment	Fire regime	Soil degrad -ation	Visitor disturb-ance	Soil &/or water pollution	Mining	Native forest logging	Climatic vari-ation	Rabbit grazing	Habitat fragment -ation	Weed invasion	Habitat drainage	Rock removal
30	21	21	14	14	12	10	9	8	7	6	6	5	6	5	5	4	4

Distribution surveys can probably be accomplished most effectively within broader surveys of regional faunas utilising GIS. However we believe the detailed biological data which need to be collected for little-known species such as the Mary River chelid (*gen. nov. sp. nov.*) or *Underwoodisaurus sphyrurus*, may sometimes best be accomplished by funding post-graduate projects which can focus full-time for several years on the target species.

Implementation

The approach adopted in this Plan is intended to reflect the dynamic nature of the problem. A recurring theme is the need for further survey and research. The knowledge base necessary to identify and effectively conserve Australia's threatened reptiles is hopelessly inadequate. This became clear when attempting to provide objective answers to the biological questions posed by the Millsap *et al.* methodology. It is also reflected in the budgets - 85% of the total of $4,848,900 being recommended for expenditure on surveys and research into basic biology and ecology.

It is our hope that by adopting a quantitative methodology, new information can be integrated rapidly into our existing database (Appendix 11). This should alert conservation managers to the changing priorities for the conservation of Australia's threatened reptiles, and to the underlying environmental causes of the changed and changing status of individual taxa.

The nomination of a few dozen taxa for Endangered or Vulnerable status and the allocation of extensive resources to their conservation will be futile if we fail to address the major cause of the decline of so many species - massive habitat modification and destruction.

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Michael Kennedy (WWF) briefed us on the processes and problems involved in developing the Marsupial and Monotreme Action Plan.

We are especially grateful to those who participated in the workshop held at Pearl Beach in November 1991: Mr John Coventry (Museum of Victoria), Mr Harald Ehmann (Sydney Technical College), Mr Paul Horner (NT Museum of Arts and Sciences), Dr Mark Hutchinson (South Australian Museum), Dr Glen Ingram (Queensland Museum), Mr Hank Jenkins (ANCA), Dr Max King (NT Museum of Arts and Sciences), Professor Arnold Kluge (University of Michigan), Mr Keith McDonald (QDEH), Dr Steve Morton (CSIRO Division Wildlife and Ecology), Mr Magnus Peterson, Dr Glenn Shea (University of Sydney), Mr Laurie Smith (Western Australian Museum), Ms Sally Stephens (ANCA), Mr Steve Wilson (Queensland Museum), Mr John Wombey (CSIRO Division of Wildlife & Ecology). Mrs Heather Cogger and Ms Amanda Egan contributed greatly to the success of the workshop through their organisational and logistical skills.

Museum records of Endangered and Vulnerable species were generously provided by the CSIRO Division of Wildlife & Ecology (Mr John Wombey), Museum of Victoria (Mr John Coventry), NT Museum of Arts and Sciences (Mr Paul Horner, Dr Max King), Queensland Museum (Mr Patrick Cooper, Dr Glen Ingram), South Australian Museum (Ms Adrienne Edwards, Dr Mark Hutchinson), Tasmanian Museum and Art Gallery (Dr Phil Andrews) and Western Australian Museum (Mr Laurie Smith).

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Mrs Lee Fennell prepared the final layout and index of the manuscript and Mrs Sascha Lynch assisted with the onerous task of copying documents and maps.

ABBREVIATIONS

The following abbreviations have been used in this document:

ACT	Australian Capital Territory
ACTP&CS	ACT Parks and Conservation Service
ANCA	Australian Nature Conservation Agency (formerly ANPWS)
ANPWS	Australian National Parks and Wildlife Service (now ANCA)
ANZECC	Australian and New Zealand Environment and Conservation Council
ANZECC List	ANZECC List of Endangered Vertebrate Fauna (April, 1991). ANPWS.
asl	above sea level
BP	before present
c.	circa (about)
CALM	Department of Conservation and Land Management
CCNT	Conservation Commission of the Northern Territory
cm	centimetres
CP	Conservation Park
CR	Conservation Reserve
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DCNR	Department of Conservation and Natural Resources
DELM	Department of Environment and Land Management
EP	Environmental Park
ERIN	Environmental Resources Information Network of ANCA
ESAC	Endangered Species Advisory Committee
et al.	and others
FFR	Fauna and Flora Reserve
FINP	Aboriginal freehold/National Park
FLR	Flora Reserve
FP	Forest Park
FR	Forest Reserve
gen. nov.	new genus
GR	Game Reserve
ha	hectares
in litt.	in a letter
in prep.	manuscript in preparation
IUCN	World Conservation Union
km	kilometres
km^2	square kilometres
op. cit.	in the work cited
m	metres
MCZ	Museum of Comparative Zoology, Harvard
mm	millimetres
ms	manuscript
MSc	Master of Science
NP	National Park
NPWS	National Parks and Wildlife Service
NR	Nature Reserve
NSW	New South Wales
NT	Northern Territory
P	Park
p.a.	*per annum*
pers. comm.	personal communication
PhD	Doctor of Philosophy
pp.	pages
QDEH	QLD Department of Environment and Heritage
QLD	Queensland

RAOU	Royal Australasian Ornithologists' Union
RP	Recreation Park
SA	South Australia
SA	Scientific Area
SF	State Forest
SP	State Park
sp.	species (singular)
sp. aff.	species related to
sp. nov.	new species
spp.	species (plural)
SRA	State Recreation Area
SWR	State Wildlife Reserve
TAS	Tasmania
VIC	Victoria
W	Wilderness
WA	Western Australia
WHA	World Heritage Area
WR	Wildlife Reserve
WWF	Worldwide Fund for Nature

KEY TO THE DISTRIBUTION MAPS FOR SPECIES RECOVERY OUTLINES

Species occurring on Australian mainland and offshore islands:

Upper map: Black squares represent the 2° grids in which the species is found.

Lower map: Circles represent the collection localities of specimens held in Australian museums.

Irregular rectangular black blocks represent the larger (generally in excess of 1,000 km^2) conservation reserves within the species' range. These should not be confused with the outline of the coast in maps of coastal species.

[Maps of the reserve system are derived from software provided by the Environmental Resources Information Network Unit, 1992.]

Species on oceanic islands (Norfolk, Lord Howe and Christmas Islands):

Circles represent museum specimens plus sight records.

1. Family:	Chelidae
2. Scientific Name:	*Elseya sp. nov.* (Namoi and Gwydir Rivers, NSW) [also appears in the literature as *Elseya sp.* (Gwydir, *aff. latisternum*)]
3. English Name:	Namoi River Elseya

4. Infraspecific taxa: None. The species awaits formal description.

5. Species survival status: Vulnerable.

6. Former distribution: Not known to have differed from current distribution.

7. Current distribution: Headwaters of the Namoi and Gwydir Rivers, west of Armidale, northern New South Wales. Known localities for the species on the two watersheds are separated narrowly by the Nandewar Range and are between 700 and 800 m asl. The distribution of this species is poorly known and there have been two independent reports of specimens from the Macquarie Marshes (Arthur Georges, *in litt.*).

8. Habitat: Rivers. Found in shallow to deep pools flowing through granitic bedrock.

9. Reasons for decline: Not known to have declined (there have been no surveys of the populations) but probably vulnerable to a combination of factors including soil degradation, habitat clearance, and water pollution.

The land adjacent to the streams has been modified by activities associated with pastoralism, resulting in disturbance to the stream banks and associated vegetation. As a consequence the aquatic habitat of the tortoises is vulnerable to the effects of increased runoff, siltation and pollution. The changes in water quality are believed to be implicated in the high incidence of eye disease in the tortoise populations (John Cann, pers. comm.).

Should the occurrence of the species in the Macquarie Marshes be confirmed, additional threats would include altered water flow regimes in the Marshes and demand on surface waters for agriculture (Arthur Georges, *in litt.*).

10. Conservation reserves on which species occurs: None known.

10A. Other conservation reserves where species might be expected to occur: Warrabah NP, Watson's Creek NR.

11. Other public land on which species occurs: None known.

12. Other land on which species occurs: Retreat Station about 25 km west of Uralla, and private properties through which the following streams flow: Macdonald River (known also as Muluerindie Creek, a tributary of the Namoi River west of Uralla) and Roumalla Creek (a tributary of the Gwydir River in the vicinity of Kingstown about 40 km west of Armidale); potentially present on private properties on other upper tributaries of the Namoi and Gwydir Rivers.

13. Is knowledge about species adequate for objectives and actions to be defined accurately?: No.

13.1: Research is needed into the cause and extent of blindness and eye loss affecting populations of this species.

13.2: Ground surveys need to be conducted to determine the full geographic range of the species, its habitat preferences, and the extent of its occurrence in existing reserves.

13.3: Research is needed into the basic biology and ecology of the species in the field including long term monitoring of changes in population size, habitat use and geographic range of the species.

13.4: Research is needed to determine if the species is declining and if so, to determine whether eye disease is contributing to that decline and to identify any other major factors causing decline.

14. Recovery Plan objectives:

14.1: To reduce the level of eye disease in the populations.

14.2: To obtain sufficient information on the

species' biology, ecology and distribution to determine its current conservation status and formulate appropriate management strategies.

14.3: To ensure that secure, viable populations of the species are maintained within a reserve system.

14.4: To implement land management practices which promote the maintenance of secure, viable populations of the species outside reserves.

15. Management actions already initiated: None known.

16. Management actions required:

16.1: Identify and treat eye disease affecting populations and attempt to determine cause.

16.2: Survey known and potential habitat in reserves within the species' known range.

16.3: Survey known habitat outside reserves within the species' known range.

16.4: Establish aquatic reserves (including adjacent terrestrial habitats) in those reaches of the Namoi and Gwydir River drainages identified as prime habitat for the species.

16.5: Develop and promote guidelines and provide incentives for landowners and users to reduce the impact of current land use practices on the species outside reserves.

16.6: Develop community awareness within the species' known range.

16.7: Monitor and regulate water quality within the upper reaches of the Namoi and Gwydir River drainages.

17. Organisations responsible for conservation of species and individuals involved: New South Wales National Parks and Wildlife Service.

18. Other organisations and individuals involved: Paul Canfield (Dept of Veterinary Pathology, Sydney University), John Cann (Sydney), Arthur Georges (University of Canberra), Ross Sadlier (Australian Museum).

19. Can recovery plan be carried out with existing resources?: No. It has been suggested (Arthur Georges, *in litt.*) that the data collection recommended in 13.2 and Recovery Plan Objective 14.2, could together form the subject of an MSc project, in which case the salary component in the following budget could be reduced by up to 50%:

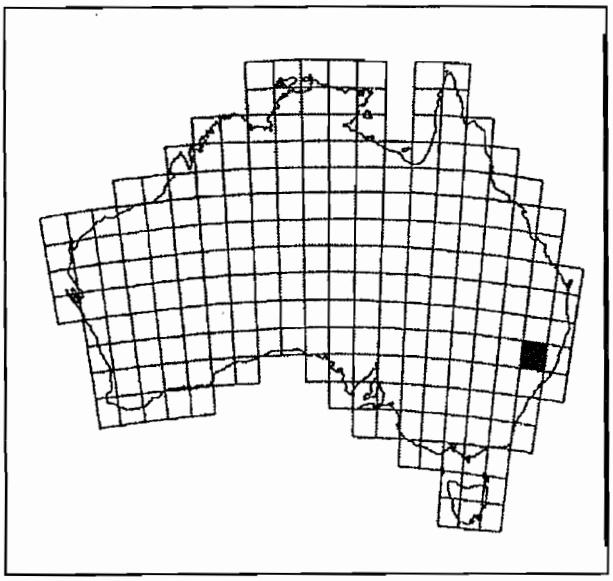
1.	Survey of geographic range, habitat preferences and occurrence in reserves: 1 half-time worker for 2 years - $40,000 salary; $20,000 expenses.	**$60K**
2.	Research into basic biology and ecology, including assessment of threatening processes: 1 worker half-time for 2 years - $40,000; $20,000 expenses.	**$60K**
3.	Preparation of management strategies: 1 worker for 3 months - $10,000 salary; $2,000 expenses.	**$12K**
4.	Purchase of land for the reserve system: uncosted.	
		Total $132K

20. Remarks: Thirteen specimens documented in Australian museum collections.
A preliminary investigation into the cause of the eye disease in these tortoises has been initiated by Dr Paul Canfield, Dept of Veterinary Pathology, Sydney University.

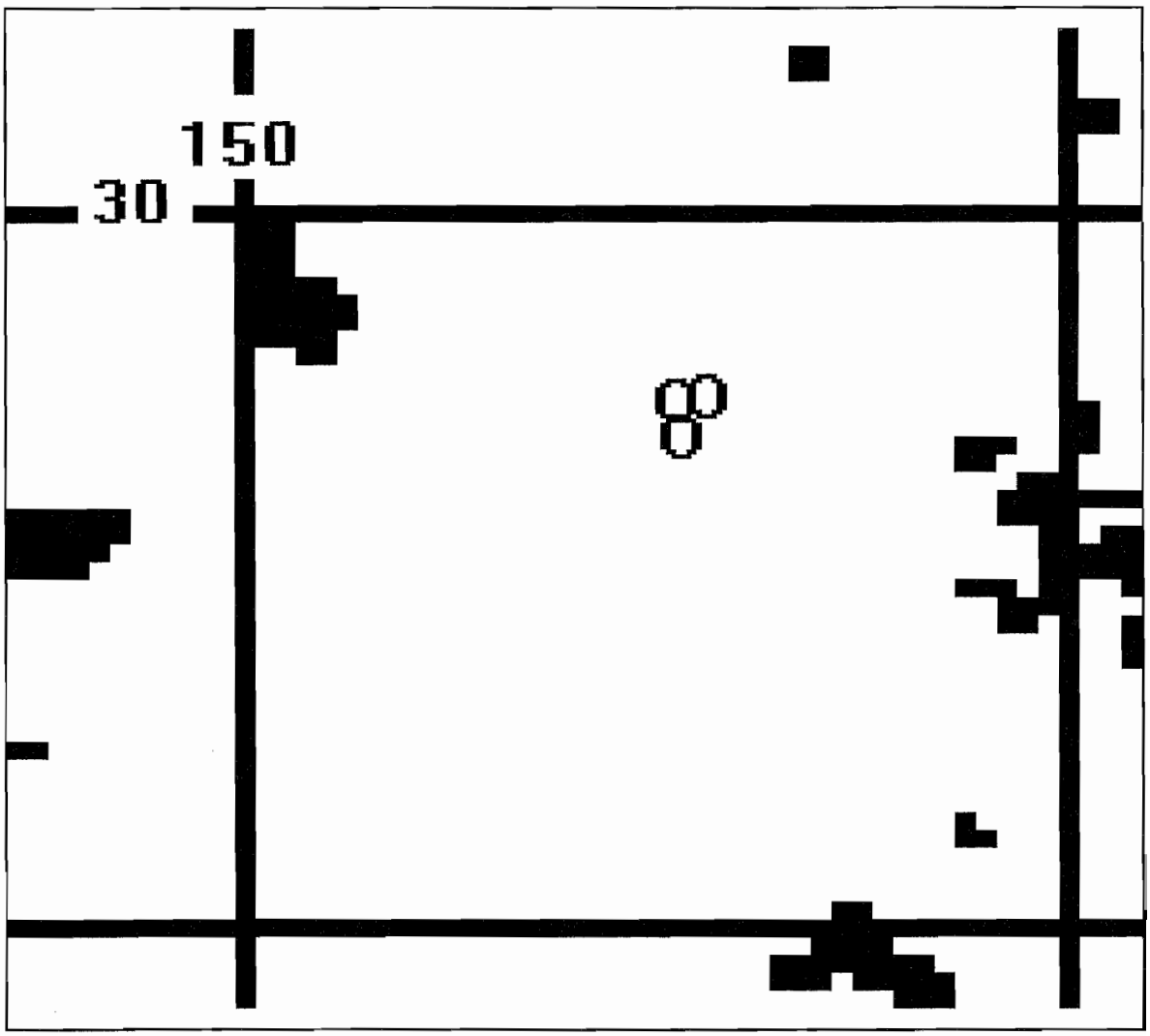
References:

Cann, J. 1978. Tortoises of Australia. Angus & Robertson, Australia. 79 pp.

Georges, A. and Adams, M., 1992. A phylogeny for Australian chelid turtles based on allozyme electrophoresis. Australian Journal of Zoology 40: 453-76.



Distribution of *Elseya sp. nov.*



1. **Family:**	Chelidae
2. **Scientific Name:**	*Emydura signata* (population in Bellinger River, NSW)
3. **English Name:**	Bellinger River Emydura

4. **Infraspecific taxa**: Polytypic populations of *Emydura signata* as it is currently recognised, range from the Brisbane River in the north to the Nepean River in the south. Studies by Arthur Georges and colleagues have failed to find consistent variation among populations of *E. macquarii, E. krefftii* and *E. signata* and it may transpire that they are all subspecies of a single widespread polytypic species (Arthur Georges, *in litt.*).

5. **Taxon survival status**: Vulnerable.

6. **Former distribution**: Not known to have differed from current distribution. Opportunistic but widespread searching for this taxon has been conducted over the past 15-20 years along the length of the Bellinger River (John Cann, pers. comm.) but it has only ever been found at the one locality.

7. **Current distribution**: Known only from a single locality near Thora on the Bellinger River, north-eastern New South Wales.

8. **Habitat**: Rivers. Several long deep pools in the moderately broad mid-reaches of the river.

9. **Reasons for decline**: Not known to have declined (there have been no surveys of the populations) but its apparently restricted distribution and small population size make this taxon vulnerable to a combination of factors including logging of native forests leading to water pollution and soil degradation. Line fishing may be a minor threat.

Native forests are still being logged in the upper reaches of the river near Woods Creek and extensive runoff and soil erosion occur during periods of heavy rainfall (Ross Sadlier, pers. comm.). Tortoise populations downstream would be vulnerable to the resultant increased sediment loads. A proposal is under consideration to pipe water from the Bellinger River to augment the present water supply for the city of Coffs Harbour; this could deleteriously affect the tortoise by changing the river's ecology.
Line fishing for bass is another potential threat because chelid tortoises are known to take baits from fishing lines although the long-term consequences are not documented.

The reasons for the apparent scarcity of this taxon are unknown and perplexing, particularly when the Bellinger River Elseya (*Elseya sp. nov.*) (Rare or Insufficiently Known), despite its apparent sensitivity to poor water quality, has been recorded from a number of localities in the mid to upper reaches of the Bellinger River and its tributary the Kalang River (John Cann pers. comm.).

10. **Conservation reserves on which taxon occurs**: None known.

10A. **Other conservation reserves where taxon might be expected to occur**: New England NP; it may occur in the upper reaches of the Bellinger River within the Park.

11. **Other public land on which taxon occurs**: None known.

12. **Other land on which taxon occurs**: The only known locality is "Ralph's Crossing", approximately 11 km upstream from Thora; the taxon is potentially present on private properties through which the mid-reaches of the Bellinger River flow.

13. **Is knowledge about taxon adequate for objectives and actions to be defined accurately?**: No.

13.1: Ground surveys need to be conducted to determine the full geographic range of the taxon, its habitat preferences, and the extent of its occurrence in existing reserves.

13.2: Research is needed into the basic biology and ecology of the taxon in the field including long term monitoring of changes in population size, habitat use and geographic range of the taxon.

13.3: Research is needed to document the extent of the taxon's apparent decline and to identify the major factors contributing to that decline.

14. Recovery Plan objectives:

14.1: To obtain sufficient information on the taxon's biology, ecology and distribution to determine its current conservation status and formulate appropriate management strategies.

14.2: To ensure that secure, viable populations of the taxon are maintained within a reserve system.

14.3: To implement land management practices which promote the maintenance of secure, viable populations of the taxon outside reserves.

15. Management actions already initiated: None known.

16. Management actions required:

16.1: Survey known and potential habitat in reserves within the taxon's known range.

16.2: Survey known habitat outside reserves within the taxon's known range.

16.3: Establish aquatic reserves (including adjacent terrestrial habitats) in those reaches of the Bellinger River drainage identified as prime habitat for the taxon.

16.4: Develop and promote guidelines and provide incentives for landowners and users to reduce the impact of current land use practices on the taxon outside reserves.

16.5: Develop community awareness within the taxon's known range.

16.6: Monitor and regulate water quality within the Bellinger River drainage.

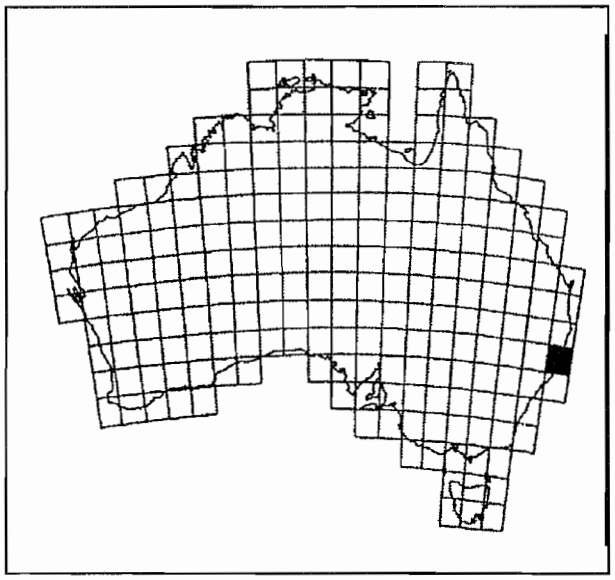
17. Organisations responsible for conservation of taxon and individuals involved: New South Wales National Parks and Wildlife Service.

18. Other organisations and individuals involved: John Cann (Sydney), Arthur Georges (University of Canberra), Ross Sadlier (Australian Museum).

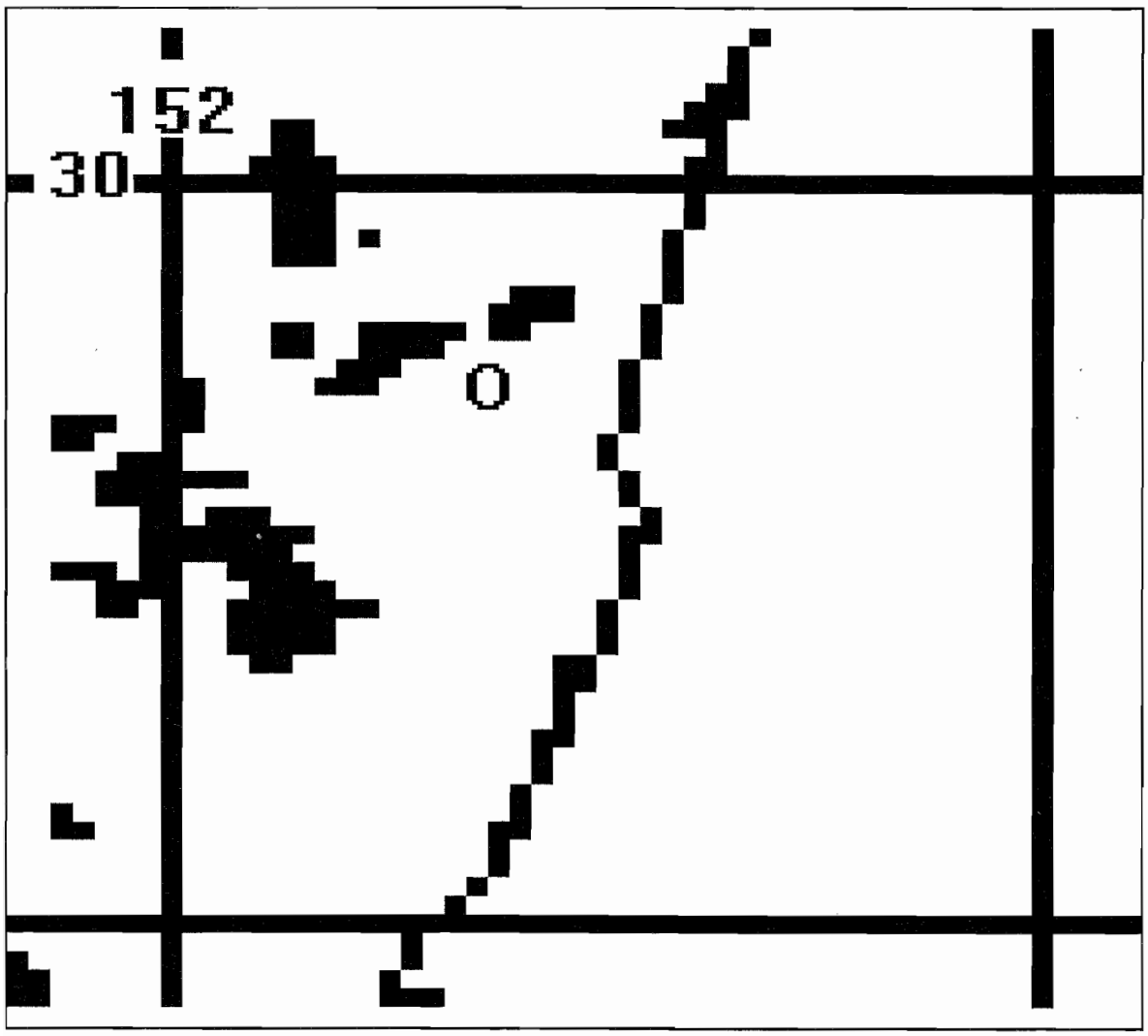
19. Can recovery plan be carried out with existing resources?: No.

1.	Survey of geographic range, habitat preferences and occurrence in reserves: 2 workers half-time for 2 years - $80,000 salary; $40,000 expenses.	**$120K**
2.	Research into basic biology and ecology, including assessment of threatening processes: 1 worker quarter-time for 2 years - $20,000 salary; $10,000 expenses.	**$30K**
3.	Preparation of management strategies: 1 worker for 3 months - $10,000 salary; $2,000 expenses.	**$12K**
4.	Purchase of land for the reserve system: uncosted.	
		Total $162K

20. Remarks: Two specimens documented in Australian museum collections. A total of six individuals has been recorded (John Cann, pers. comm.).



Distribution of *Emydura signata*



1. Family:	Chelidae
2. Scientific Name:	*Pseudemydura umbrina* Siebenrock, 1901
3. English Name:	Western Swamp Tortoise

4. Infraspecific taxa: None

5. Species survival status: Endangered (Critical).

6. Former distribution: No localised records prior to 1953, since when it has been recorded from scattered localities in a narrow strip of the Swan Coastal Plain north of Perth city, extending from Guildford to Bullsbrook (Burbidge and Kuchling, in press). Anecdotal information collected by Burbidge (1981) suggests its former distribution was restricted to the clay soils of the Swan River Valley - an area encompassing no more than 100-150 km^2.

7. Current distribution: Ellen Brook Nature Reserve north-east of Perth city, Western Australia.

8. Habitat: Swamps. "Shallow, ephemeral, winter-wet swamps on clay or sand over clay soils with nearby suitable aestivation refuges." (Burbidge and Kuchling, in press).

9. Reasons for decline: Clearance of habitat for agriculture, urban and industrial development (including clay mining), increasing aridity, predation by foxes, inappropriate fire regimes (Twin Swamps NR), drainage.

All these threats are compounded by the specialised biology of the species (which has low fecundity and slow maturation) and by the paucity of protected habitat within what is the most intensively developed region of WA.

10. Conservation reserves on which species occurs: Ellen Brook NR; until 1985 also occurred in the nearby Twin Swamps NR.

10A. Other conservation reserves where species might be expected to occur: None.

11. Other public land on which species occurs: None.

12. Other land on which species occurs: Small numbers captured in recent years on two lots of private property adjacent to Ellen Brook NR (Andrew Burbidge, *in litt.*, 1993). Captive breeding population at the Perth Zoo.

13. Is knowledge about species adequate for objectives and actions to be defined accurately?: Yes.

14. Recovery Plan objectives: "To ensure the survival of the Western Swamp Tortoise by creating at least two viable wild populations" (Burbidge and Kuchling, in press: 5).

15. Management actions already initiated:

15.1: Listed on Schedule 1 of the Commonwealth's *Endangered Species Protection Act 1992* and listed as "threatened" on the 1990 Schedule of the *WA Wildlife Conservation Act 1950*.

15.2: Two Class A Nature Reserves managed by the WA Department of Conservation and Land Management. More land has been purchased and added to the Reserves and negotiations are continuing to purchase two more lots adjacent to Ellen Brook NR.

15.3: Preparation and implementation of a Management Plan for Ellen Brook NR including actions listed in 15.4-15.6 below.

15.4: Experimental rehabilitation of habitat including pond construction, monitoring of aquatic invertebrates, revegetation, provision and monitoring of aestivation tunnels.

15.5: Ongoing fire management, construction of a "fox-proof" fence and regular poison baiting inside the fence, and works to mitigate the deleterious effects of land usage adjacent to the reserves.

15.6: Monitoring of population including radio-tracking, recording nests and breeding success and hatchling growth and survival.

15.7: Captive breeding program under way to

raise tortoises to 2+ years for re-introduction to Twin Swamps NR.

15.8 Construction of fox-proof fence around Twin Swamps NR prior to proposed re-introduction of captive-bred animals.

16. Management actions required (based on actions recommended in the Draft Recovery Plan prepared by Burbidge and Kuchling, in press: 22-33):

16.1: Preparation and implementation of a Management Plan for Twin Swamps NR, including replenishment of swamps.

16.2: Completion of negotiations and purchase of additional private property adjacent to Ellen Brook NR.

16.3: Continuation of education and publicity programs on Western Swamp Tortoise.

16.4: Continuation of campaign to raise funds for the tortoise's conservation.

17. Organisations responsible for conservation of species and individuals involved: Western Australian Department of Conservation and Land Management (CALM). CALM members of the Recovery Team are Andrew Burbidge (chair), Phil Fuller, Lyndon Mutter and Gordon Wyre.

18. Other organisations and individuals involved: Non-CALM members of Recovery Team include Dr Gerald Kuchling and Professor Don Bradshaw (University of Western Australia), David Groth (Curtin University of Technology), and representatives of Australian Nature Conservation Agency, Perth Zoo and World Wide Fund for Nature.

19. Can recovery plan be carried out with existing resources?: Recovery Plan for the Western Swamp Tortoise is fully funded for 1993 and funding has been allocated for the next four years. Funding comes from CALM, Endangered Species Program and Feral Pests Program, ANCA, Perth Zoo, Western Australian Water Authority, the World Wide Fund for Nature Australia, and several other smaller donors and sponsors (Andrew Burbidge, *in litt.*).

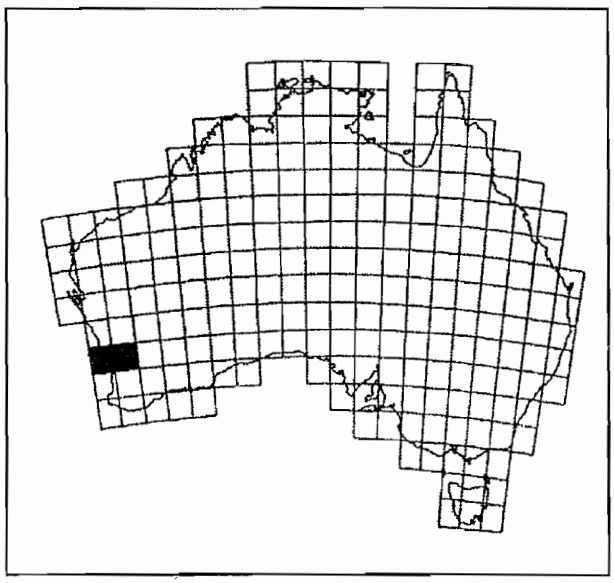
20. Remarks: 40 specimens documented in Australian museum collections; wild population estimated at 30 and may be slightly above this figure. Total holdings in Perth Zoo at December 1992: 14 males, 12 females and 47 unsexed juveniles.

References:

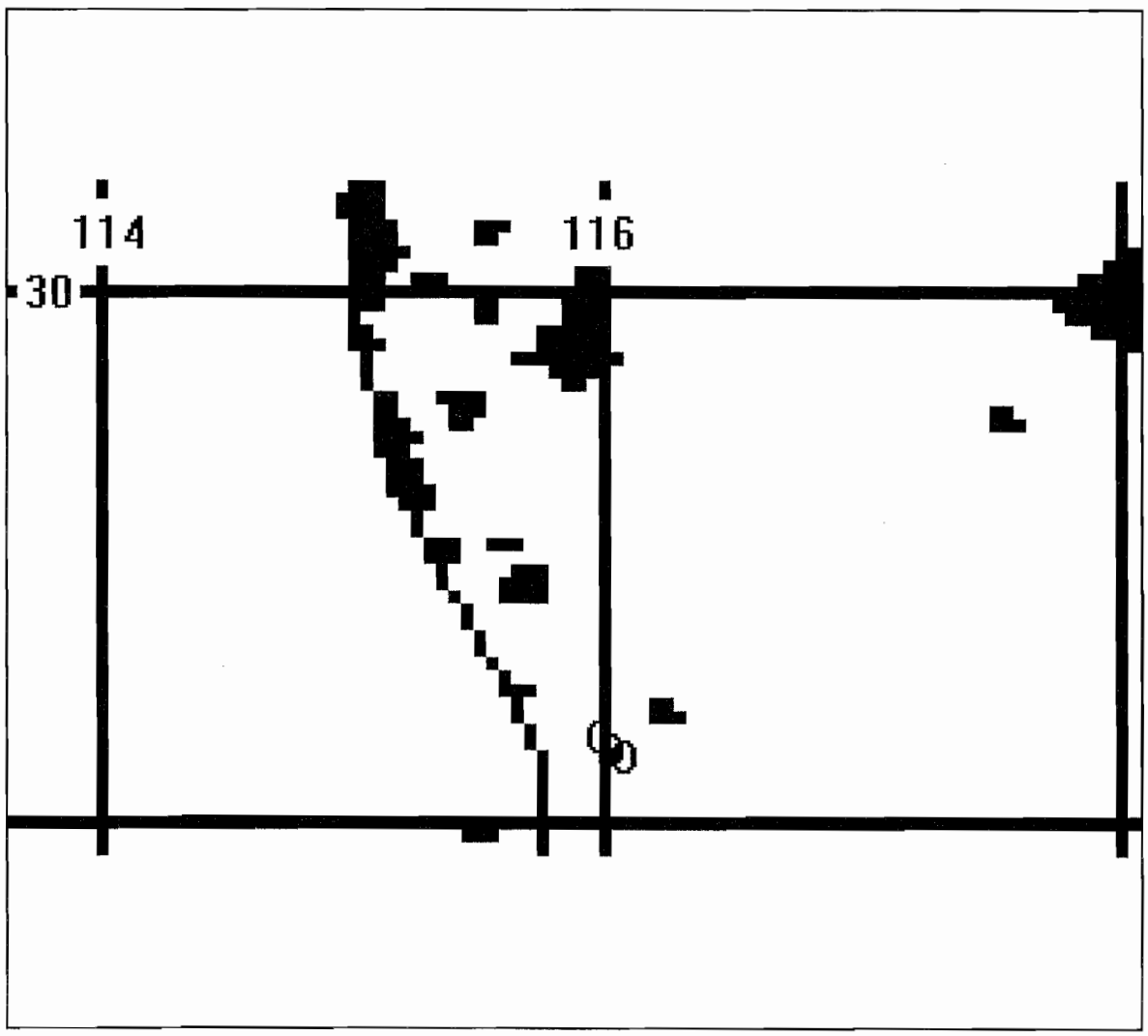
Burbidge, A.A. 1981. The ecology of the Western Swamp Tortoise, *Pseudemydura umbrina* (Testudines, Chelidae). Australian Wildlife Research 8: 203-222.

Burbidge, A.A. and Kuchling, G. (in press). Recovery plan for the Western Swamp Tortoise (*Pseudemydura umbrina*). Western Australian Department of Conservation and Land Management.

Kuchling, G. and DeJose, J.P. 1989. A captive breeding operation to rescue the critically endangered Western Swamp Turtle *Pseudemydura umbrina*. International Zoo Yearbook 28: 103-109.



Distribution of *Pseudemydura umbrina*



1. Family:	Chelidae
2. Scientific Name:	*Rheodytes leukops* Legler and Cann, 1980
3. English Name:	Fitzroy Tortoise

4. Infraspecific taxa: None.

5. Species survival status: Vulnerable.

6. Former distribution: Not known to have differed from current distribution.

7. Current distribution: Known only from the Fitzroy River and its tributaries, Queensland, with a maximum geographic range of less than 10,000 km^2 (McDonald *et al.*, 1991).

8. Habitat: Rivers.

The rivers in which it has been found are characterised by large deep pools with rocky, gravelly or sandy substrates, connected by shallow riffles (Legler and Cann, 1980); high water clarity appears to be preferred by the tortoises. Extensive beds of Ribbon Weed (*Vallisneria* sp.) are associated with several of the sites where *R. leukops* is still seen regularly, and the weed is known to be eaten by the tortoises. Nests are excavated in river sand banks.

9. Reasons for decline: Probably a combination of factors including soil and water pollution resulting from mining and agricultural activities, and clearance of adjacent habitat for crop production.

In several rivers which were previously clear, turbidity and deep sedimentation have been observed in recent years; causes appear to be soil erosion in paddocks heavily grazed by cattle, and spillage of tailings from greenstone mines (John Cann, *in litt.*).

10. Conservation reserves on which species occurs: None known.

10A. Other conservation reserves where species might be expected to occur: None known.

11. Other public land on which species occurs: Roadside reserves beside river crossings listed in **12.** below, within the species' range.

12. Other land on which species occurs: Private properties through which the following rivers and tributaries flow: Fitzroy River in vicinity of Glenroy Crossing; Connors River near the crossing of the old inland Sarina road; Dawson River close to Gainesford; vicinity of crossing of the Dawson River south-east of Duaringa; Develin or Marlborough Creek; Fitzroy Pocket Road crossing near Gogango; Isaac River; Mackenzie River between Bedford and Bingegang Weirs; Windah Creek (all in the Fitzroy River drainage) (John Cann, *in litt.*).

13. Is knowledge about species adequate for objectives and actions to be defined accurately?: No.

13.1: Ground surveys need to be conducted to determine the full geographic range of the species, its habitat preferences, and the extent of its occurrence in existing reserves.

13.2: Research is needed into the basic biology and ecology of the species in the field; it should include long term monitoring of changes in population size, habitat use and geographic range.

13.3: Research needed to document the extent of the species' decline and to identify the major factors contributing to that decline.

14. Recovery Plan objectives:

14.1: To obtain sufficient information on the species' biology, ecology and distribution to determine its current conservation status and formulate appropriate management strategies.

14.2: To ensure that secure, viable populations of the species are maintained within a reserve system.

14.3: To implement land management practices which promote the maintenance of secure, viable populations of the species outside reserves.

15. Management actions already initiated:

15.1: Listed on Schedule 1 of the Commonwealth's *Endangered Species*

Protection Act 1992.

16. Management actions required:

16.1: Survey known and potential habitat in reserves within the species' known range.

16.2: Survey known habitat outside reserves within the species' known range.

16.3: Establish aquatic reserves (including adjacent terrestrial habitats) in those reaches of the Fitzroy drainage identified as prime habitat for the species.

16.4: Develop and promote guidelines for landowners and users to reduce the impact of current land use practices on the species outside reserves.

16.5: Develop community awareness within the species' known range.

16.6: Monitor and regulate water quality within the Fitzroy River drainage.

17. Organisations responsible for conservation of species and individuals involved: Queensland Department of Environment and Heritage; Queensland Department of Minerals and Energy.

18. Other organisations and individuals involved: John Legler (University of Utah); John Cann (Sydney); Arthur Georges (University of Canberra).

19. Can recovery plan be carried out with existing resources?: No.

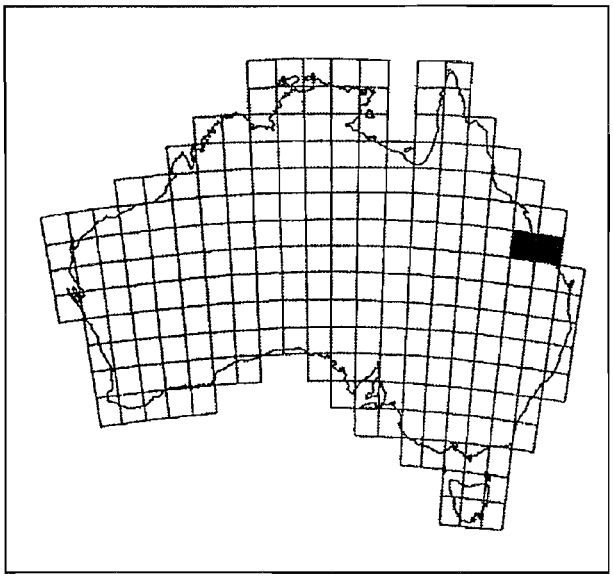
1.	Survey of geographic range, habitat preferences and occurrence in reserves: 2 workers quarter-time for 2 years - $40,000 salary; $20,000 expenses.	**$60K**
2:	Research into basic biology and ecology, including assessment of threatening processes: 1 worker half-time for 2 years - $40,000 salary; $20,000 expenses.	**$60K**
3:	Preparation of management strategies: 1 worker for 3 months - $10,000 salary; $2,000 expenses.	**$12K**
4:	Purchase of land for the reserve system: uncosted.	
		Total $132K

20. Remarks: Approximately 200 specimens (including hatchlings) documented in museum collections.

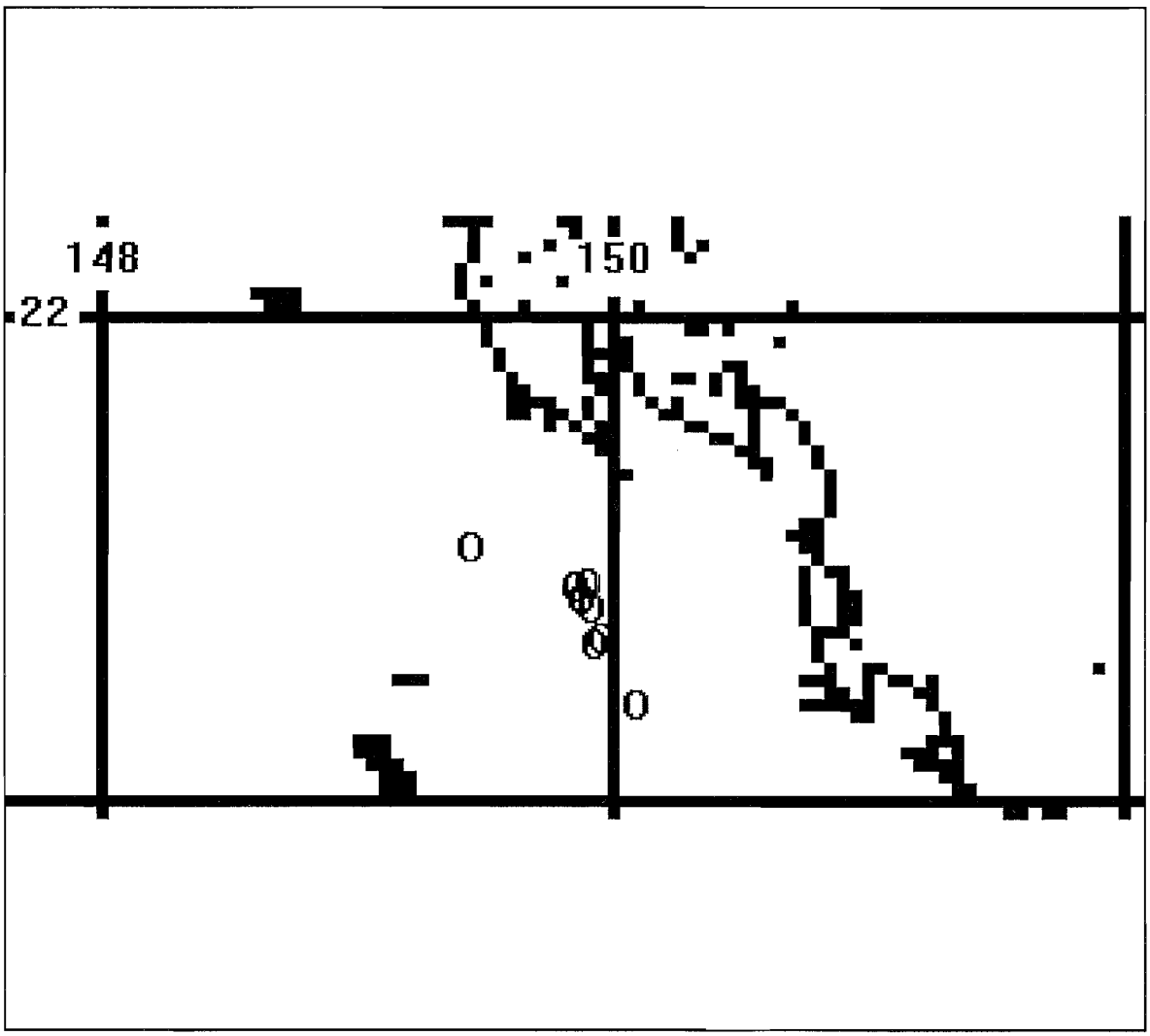
References:

Legler, J.M. and Cann, J. 1980. A new genus and species of chelid turtle from Queensland, Australia. Contributions in Science, Natural History Museum of Los Angeles County 324: 1-18.

McDonald, K.R., Covacevich, J.A., Ingram, G.J. and Couper, P.J. 1991. The status of frogs and reptiles. pp. 338-345 in G.J. Ingram and R.J. Raven (eds) An Atlas of Queensland's Frogs, Reptiles, Birds and Mammals. Queensland Museum, Brisbane.



Distribution of *Rheodytes leukops*



1. Family:	Chelidae
2. Scientific Name:	*Gen. nov. sp. nov.* (Mary River, QLD) [also appears in the literature as Short-necked Alpha]
3. English Name:	Mary River Tortoise

4. Infraspecific taxa: None

5. Species survival status: Endangered.

6. Former distribution: Not known to have differed from current distribution.

7. Current distribution: Known only from the Mary River, south of Maryborough in south-eastern Queensland. The two localities from which it has been recorded are Tiaro and Miva, on the mid-reaches of the river. Suitable habitat appears to be present along a 100 km stretch of the river, extending upstream from the seawater barrage north of Tiaro. A description of the Mary River appears in Hauser *et al.* (1992) and section maps 12-17 in that report refer to the stretch of river where the tortoise has been recorded.

8. Habitat: Rivers.

Deep pools in the moderately broad mid-reaches of the river; it has not been observed in the shallower sections of the river.

9. Reasons for decline: Not known to have declined (there have been no surveys of the populations) but its apparent restricted distribution and small population size probably make this species highly vulnerable to a number of factors including clearance of riverside habitat, crop production, overgrazing by cattle, and soil and water pollution resulting from agricultural and mining activities; visitor disturbance and nest predation are also threats.

At the downstream locality of Tiaro the sandy banks in which the tortoises nest are vulnerable to disturbance by frequent visitation by people for recreation (John Cann, pers. comm.). Upstream at Miva, nests are subject to trampling by cattle and entire sandbanks and sandbars are eroded by long-term trampling. Heavy nest predation by foxes has been observed by Arthur Georges (*in litt.*).

The upstream locality is surrounded by cleared country which is heavily grazed by cattle (Cann & Legler, in prep.); tortoises here are vulnerable to the effects of increased runoff, siltation, and pollution resulting from the clearance and grazing.

The water in the mid-reaches of the Mary River is nearly always brown and turbid, but according to local residents has only become so in the past 20 years (John Cann, pers. comm.); the change is attributed to increased commercial sand-mining upstream (Cann & Legler, in prep.). The increased siltation has resulted in the deeper holes (the preferred habitat of the species) becoming filled in, effectively reducing the area of available habitat and probably, the size of the populations. A description of some of the soil and water degradation appears in Hauser *et al.* (1992).

Downstream of the known range of the species the river is subject to extensive pumping for irrigation of sugarcane and citrus crops (John Cann, pers. comm.); should populations occur in this section of the river, they would be vulnerable to changes in water levels and the effects of pollution associated with runoff from these activities.

A past threat was the poaching of eggs and sale of the hatchlings for the pet shop trade; this trade has apparently ceased. Females congregate over short periods of time to lay eggs in a few concentrated nesting sites which makes them very vulnerable to nest predation and also to mass loss of reproductive effort through single flood events.

10. Conservation reserves on which species occurs: None known.

10A. Other conservation reserves where species might be expected to occur: None known.

11. Other public land on which species occurs: None known.

12. Other land on which species occurs: Private properties through which the Mary River flows between Miva and Tiaro, south of Maryborough.

13. Is knowledge about species adequate for objectives and actions to be defined accurately?: No.

13.1: Ground surveys need to be conducted to determine the full geographic range of the species, its habitat preferences, and its possible occurrence in nearby reserves.

13.2: Research is needed into the basic biology and ecology of the species in the field including long term monitoring of changes in population size, habitat use and geographic range of the species.

13.3: Research is needed to determine if the species is declining, and if so, to identify the major factors contributing to that decline.

14. Recovery Plan objectives:

14.1: To obtain sufficient information on the species' biology, ecology and distribution to determine its current conservation status and formulate appropriate management strategies.

14.2: To ensure that secure, viable populations of the species are maintained within a reserve system.

14.3: To implement land management practices which promote the maintenance of secure, viable populations of the species outside reserves.

15. Management actions already initiated: None known.

16. Management actions required:

16.1: Survey known and potential habitat in reserves within the species' known range.

16.2: Survey known habitat outside reserves within the species' known range. Tinana Creek flowing parallel and east of the Mary River, should be surveyed for this species (John Cann, pers. comm.).

16.3: Establish aquatic reserves (including adjacent terrestrial habitats) in those reaches of the Mary River drainage identified as prime habitat for the species.

16.4: Develop and promote guidelines and provide incentives for landowners and users to reduce the impact of current land use practices on the species outside reserves.

16.5: Develop community awareness within the species' known range.

16.6: Monitor and regulate water quality within the Mary River drainage.

17. Organisations responsible for conservation of species and individuals involved: Queensland Department of Environment and Heritage.

18. Other organisations and individuals involved: John Cann (Sydney), Arthur Georges (University of Canberra), John Legler (University of Utah), Ross Sadlier (Australian Museum).

19. Can recovery plan be carried out with existing resources?: No. It has been suggested (Arthur Georges and Col Limpus, *in litt.*) that many of the objectives outlined above could be addressed by a PhD project in which case the salary component in the following budget could be reduced by up to 50%:

1.	Survey of geographic range, habitat preferences and occurrence in reserves: 2 workers quarter-time for 2 years - $40,000 salary; $20,000 expenses.	**$60K**
2:	Research into basic biology and ecology, including assessment of threatening processes: 1 worker half-time for 2 years - $40,000 salary; $20,000 expenses.	**$60K**
3:	Preparation of management strategies: 1 worker for 3 months - $10,000 salary; $2,000 expenses.	**$12K**
4:	Purchase of land for the reserve system: uncosted.	
		Total $132K

20. Remarks: 14 specimens documented in museum collections with locality data; an additional 26 specimens of unknown origin (originating from the pet-shop trade).

This species has been known colloquially as the 'pet-shop tortoise' because until recently it was known only from specimens obtained through the pet trade.

John Cann (pers. comm.) has observed extreme aggression in this species (compared with other chelids)

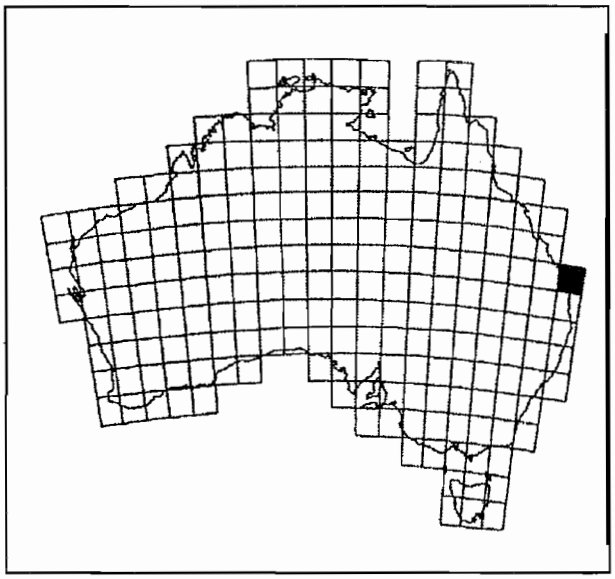
between captive adult males placed in the same pool. Such behaviour suggests that in natural populations adult males may defend well defined and possibly extensive territories to the exclusion of other adult males. If such a social structure is confirmed, it must be taken into account when planning the size and configuration of conservation reserves.

References:

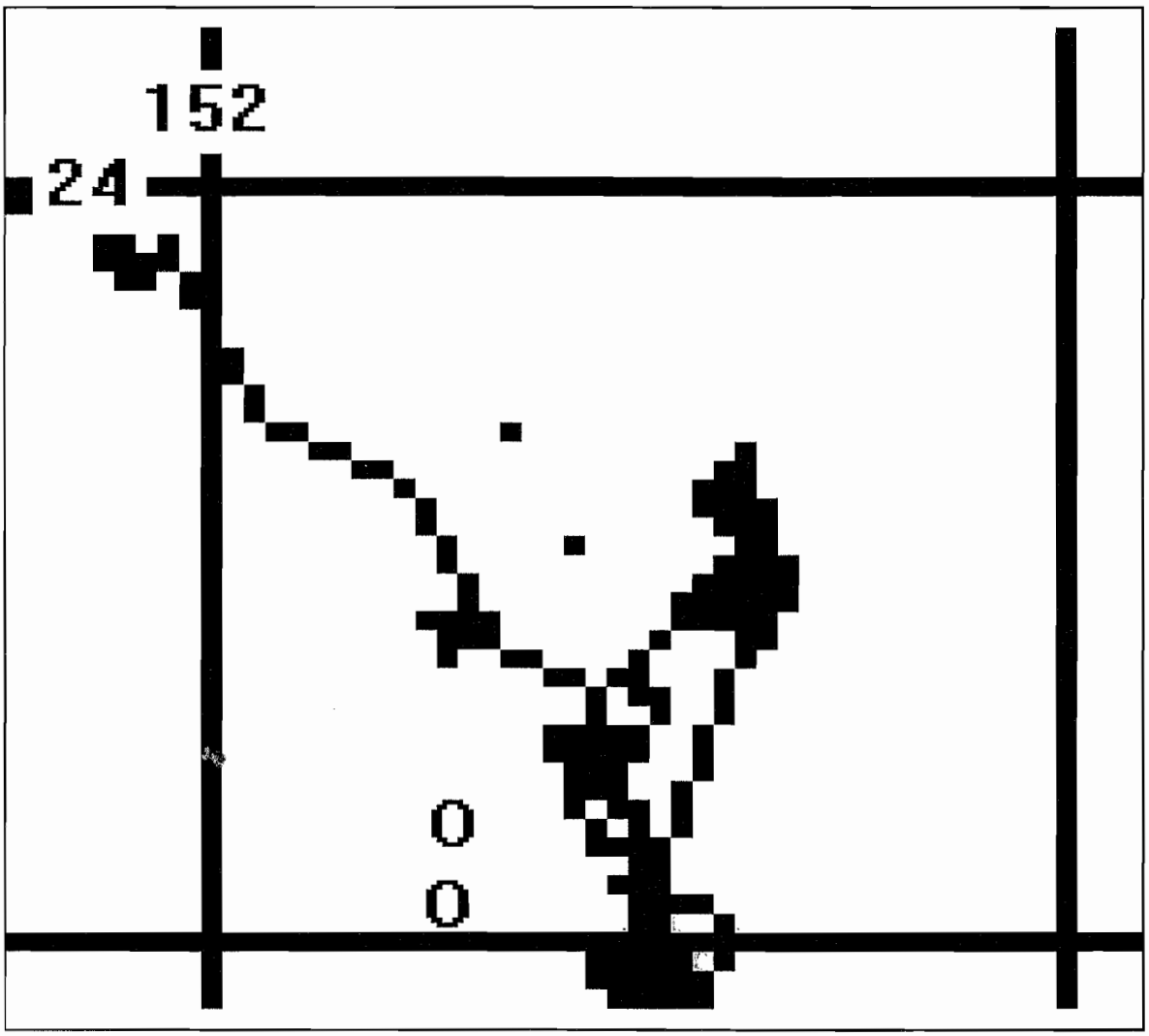
Cann, J. and Legler J., in prep. The Mary River tortoise: a new genus and species of short-necked chelid from Queensland, Australia (Testudines: Pleurodira).

Georges, A. and Adams, M., 1992. A phylogeny for Australian chelid turtles based on allozyme electrophoresis. Australian Journal of Zoology 40: 453-476.

Hauser, D. and Members of the Task Force. 1992. Our Mary River: a current assessment. Mary River Regional Recreational Study Task Force, Maryborough. Unpublished report including maps.



Distribution of *Gen. nov. sp. nov.*
(Chelidae)



1. Family:	Gekkonidae
2. Scientific Name:	*Christinus guentheri* (Boulenger, 1885) [also appears in the literature as *Phyllodactylus guentheri*].
3. English Name:	Lord Howe Island Gecko

4. Infraspecific taxa: None at present but morphological differences between the Lord Howe and Norfolk populations are indicative of some degree of taxonomic distinctiveness.

5. Species survival status: Vulnerable.

6. Former distribution: Lord Howe Island and Norfolk Island and their small off-shore islands, Pacific Ocean. Former presence on Norfolk Island mainland confirmed by fossil remains dated at about 750 years BP (ANCA - Phillip Island Draft Plan of Management).

7. Current distribution: On Lord Howe Island apparently now restricted to a small area in the vicinity of the main settlement; also on Blackburn (Rabbit) Island in the lagoon, probably all of the Admiralty Islets (specific records are only from Roach Island), and on Ball's Pyramid. Appears to be extinct on Norfolk Island, but still occurs on the two large off-shore islands - Phillip and Nepean - and on at least two small rocky islets adjacent to Norfolk - Moo-oo Rock (Moo-oo Stone) and Bird Rock (Red Stone).

8. Habitat: Closed forest, low open woodland, tussock grassland, rocky isolates.

Lord Howe Island: on the island in the lagoon found under and among loose basalt boulders. On the main island almost restricted to honeycombed beachrock boulders in dense *Howea* palm forest.

Norfolk Island: on Phillip Island found in most habitats but highest densities on grassy and rocky coastal cliffs and among the low wooded boulder slopes of the central valley. Two important seasonal sources of food appear to be nectar, including that of the Norfolk Island Hibiscus (*Lagunaria patersonia*) (Cogger *et al.*, 1983) and the fruit of the succulent herb, Pigface, on Phillip Island (Paul Stevenson, *in litt.*).

9. Reasons for decline: Probably a combination of factors, including grazing by rabbits, soil compaction and erosion, predation by rats, cats and pigs.

The virtual disappearance from the main island of Lord Howe has been due almost certainly to the introduction of the Black Rat, *Rattus rattus*, through a shipwreck in 1918 (Cogger, 1971). Predation by cats and pigs on Lord Howe Island has also been documented.

It is generally assumed the disappearance of *C. guentheri* from the mainland of Norfolk Island was due to the introduction of the Pacific Rat, *Rattus exulans* by Polynesians visiting the island about 900 years BP (ANCA - Phillip Island Draft Plan of Management). The Black Rat, *Rattus rattus*, now occurs on Norfolk Island and is considered a greater threat to endemic birds. The population on Phillip Island is assumed to have declined dramatically with the massive habitat destruction caused by the introduction of rabbits, pigs and goats in the late 1700s; the pigs and goats died out quickly but rabbits were only eliminated in 1986.

10. Conservation reserves on which species occurs (including a list of other Action Plan species in each conservation reserve):
Lord Howe Island: Lord Howe Island Permanent Park Reserve, which includes the Malabar region of Lord Howe Island, Blackburn (Rabbit) Island, the Admiralty Islands and Balls Pyramid;
Norfolk Island: Phillip Island Forest Reserve and Nepean Island Reserve for the purpose of conservation of flora and fauna.

Pseudemoia lichenigera (Vulnerable) also occurs in the reserves in the Lord Howe Island complex and on Phillip Island Forest Reserve.

10A. Other conservation reserves where species might be expected to occur: None.

11. Other public land on which species occurs: Norfolk Island: rocky islets around the

coast of Norfolk Island (vacant crown land).

12. Other land on which species occurs: Lord Howe Island: Signal Point, Old Settlement, Ocean View Guest Lodge, the Palm Nursery, Golf Course; Cameron Leary (*in litt.*) observed that the "range and extent of occurrence on Lord Howe Island if surveyed would be far greater than our current information indicates".

13. Is knowledge about species adequate for objectives and actions to be defined accurately?: No.

13.1: Conduct surveys of current distribution on the main island of Lord Howe and on Phillip Island, with ongoing periodic surveys to determine the response of the gecko populations to the ameliorative measures cited in section 15 below.

13.2: Conduct surveys on those offshore islets in the Norfolk and Lord Howe Island complexes which have not yet been surveyed for the occurrence of this species.

13.3: Research is needed into the basic biology and ecology of the species in the field; it should include long term monitoring of changes in population size, habitat use and geographic range.

13.4: Genetic study needed to determine the extent of differentiation between the populations on the two island groups.

14. Recovery Plan objectives:

14.1: To obtain sufficient information on the species' biology, ecology and distribution to determine its current conservation status and formulate appropriate management strategies.

14.2: To ensure that secure, viable populations of the species are maintained within a reserve system.

14.3: To implement land management practices which promote the maintenance of secure, viable populations of the species outside reserves.

15. Management actions already initiated:

Lord Howe Island

15.1: Listed as "vulnerable and rare" on the 1992 Revised (Interim) Schedule 12 of the *NSW Endangered Fauna (Interim Protection) Act 1991.*

15.2: The entire area has World Heritage listing.

15.3: An intensive rat and mouse control program is in progress.

15.4: Prohibition placed on the importation of cats (only 12 domestic cats remaining in April 1993).

15.5: Pigs have been removed from the island.

Norfolk Island

15.6: Phillip Island is listed on the Register of the National Estate for its conservation values.

15.5: Survey of terrestrial reptiles of the Norfolk Island complex conducted for ANPWS in 1978 (Cogger *et al.*, 1979).

15.6: Rabbits eliminated from Phillip Island and revegetation program undertaken.

15.7: Current program to exclude rats from a large section of Norfolk Island National Park with associated possibility of re-introducing lizards.

15.8: Draft Management Plan for Phillip Island prepared by ANCA.

16. Management actions required:

16.1: Survey known and potential habitat in reserves.

16.2: Periodically monitor the many small satellite rocks on which this species occurs in both the Norfolk Island and Lord Howe Island complexes; the small size, inhospitable environment and inaccessibility of these will mitigate against the need for direct management actions.

16.3: Maintain existing management strategies on Nepean and Blackburn (Rabbit) Islands.

16.4: Continue present program to rehabilitate vegetation on Phillip Island.

16.5: Implement or continue rat, cat and pig eradication programs on the main islands of Norfolk and Lord Howe.

16.6: Concentrate conservation management actions on those islands (Blackburn = Rabbit, Roach, Phillip) on which both this species and *Pseudemoia lichenigera* are known to occur.

16.7: Develop and promote guidelines for landowners and users to reduce the impact of current land use practices on the species outside reserves.

16.8: Develop community awareness.

17. Organisations responsible for conservation of species and individuals involved: Lord Howe Island: New South Wales National Parks and Wildlife Service (Cameron Leary, Senior Ranger); Lord Howe Island Board.

Norfolk Island: Australian National Parks and Wildlife Service (Paul Stevenson, Conservator); Norfolk Island Administration.

18. Other organisations and individuals involved: Hal Cogger (Australian Museum).

19. Can recovery plan be carried out with existing resources?: No, although responsible agencies are currently directing some of their existing resources into recovery activities. For cost effectiveness, any study of *Christinus guentheri* should be run jointly with a study of *Pseudemoia lichenigera*, which would result in a combined budget of perhaps $180K.

1:	Survey of habitat preferences and occurrence in reserves: 2 workers for 2 months each year for 3 years - $40,000 salary; $40,000 expenses (twice standard expenses for overseas destination).	**$80K**
2:	Research into basic biology, taxonomy and ecology, including assessment of threatening processes: 1 worker half-time for 2 years - $40,000 salary; $40,000 expenses (twice standard expenses for overseas destination).	**$80K**
3:	Preparation of management strategies: 1 worker for 3 months - $10,000 salary; $2,000 expenses.	**$12K**
		Total $172K

20. Remarks: 186 specimens documented in Australian museum collections; experienced observers record an increase in the numbers of geckoes seen on Phillip Island in the years since rabbits were exterminated.

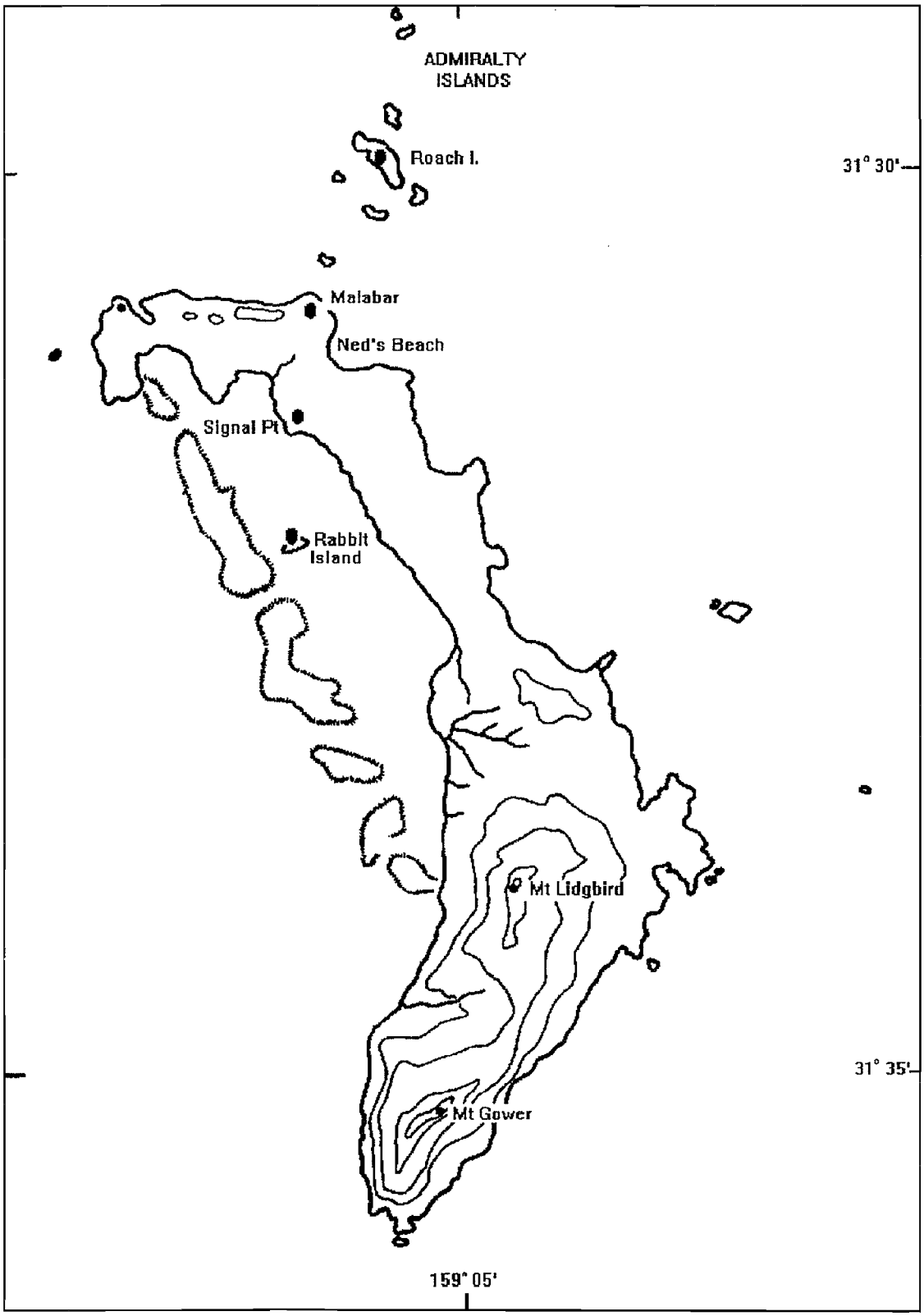
References:

Cogger, H. (1971). The reptiles of Lord Howe Island. Proceedings of the Linnean Society of New South Wales 96(1): 23-38.

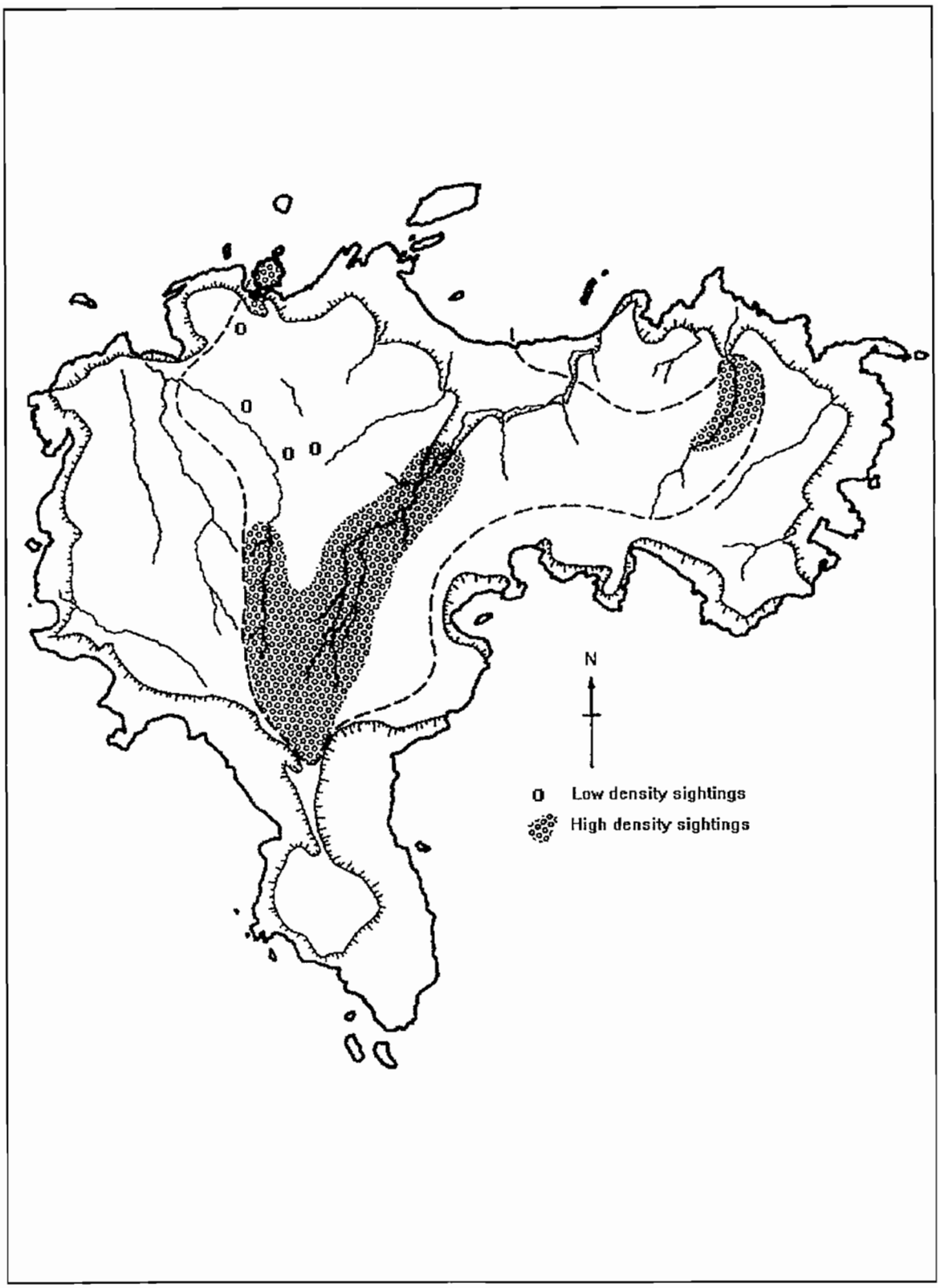
Cogger, H.G., Cameron, E.E. and Sadlier, R.A. 1979. The terrestrial reptiles of islands in the Norfolk Island complex. Australian Museum, Sydney. 122 pp. Limited circulation report for Australian National Parks & Wildlife Service.

Cogger, H.G., Sadlier, R.A. and Cameron, E.E. 1983. The terrestrial reptiles of Australia's island territories. Australian National Parks and Wildlife Service Special Publication 11: 1-80.

Specht, J. 1978. The early mystery of Norfolk Island. Australian Natural History 19(7): 218-223.



Distribution of *Christinus guentheri* on Lord Howe Island



Distribution of *Christinus guentheri* on Phillip Island.

1. **Family:**	Gekkonidae
2. **Scientific Name:**	*Lepidodactylus listeri* (Boulenger, 1889)
3. **English Name:**	Christmas Island Gecko

4. **Infraspecific taxa**: None. Brown and Parker (1977) compared the meristics of two males of this species with two males of *Lepidodactylus manni* from the Fiji Islands, and found them almost identical; they could distinguish them only by locality. They believed the two populations might be conspecific, the explanation being that recent human introduction accounted for one or other of the populations. Given the long isolation of Christmas Island prior to the first discovery of *L. listeri* in 1887 (Boulenger, 1889) there seems little doubt that *L. listeri* is a Christmas Island endemic.

5. **Species survival status**: Vulnerable.

6. **Former distribution**: Not known to have differed from current distribution.

7. **Current distribution**: Christmas Island, Indian Ocean (total area 13,470 ha).

8. **Habitat**: Closed forest.

Most abundant on the plateau area in primary rainforest, but has colonised disturbed habitats in this area including secondary growth forest. It appears to be least abundant on the terraces and is absent from all mined areas, including those covered by dense shrubby regeneration.

9. **Reasons for decline**: Probably a combination of factors, including habitat clearance, disturbance by mining and invasion of habitat by exotic weeds; potential threats include displacement and/or predation by introduced reptiles.

Original vegetation in some areas has been grossly modified as a result of clearing (for open cut phosphate mining) and the introduction of exotic plant species.

Two ubiquitous gecko species (*Gehyra mutilata* and *Hemidactylus frenatus*) and a skink (*Lygosoma bowringii*) apparently have been introduced to Christmas Island in recent times (between 10 and 50 years ago) and are well established in disturbed, anthropogenic habitats (Cogger *et al.*, 1983). They have the potential to displace *Lepidodactylus listeri* should they disperse into primary forest.

The Wolf Snake *Lycodon capucinus* was introduced quite recently - in 1987 *vide* Smith (1988) or about 1982 *vide* Rumpff (1992); a population of probably thousands of individuals is now established in urban and industrial zones in the north-eastern corner of the island (Rumpff, *op. cit.*). Geckos form a large part of the Wolf Snake's diet elsewhere in South-East Asia (Smith, 1943) and both of the introduced gecko species have been confirmed as its main prey on Christmas Island.

Rumpff (1992) did not detect any Wolf Snakes in primary forest on the island and hypothesised that it was sub-optimal habitat for the species. However, increasing population size and a decrease in abundance of geckos around the settlement could lead to an invasion of primary forest by Wolf Snakes, thus posing a serious threat to the endemic lizards and the shrew recorded only from that habitat. Another species of colubrid snake introduced to Guam, the Brown Tree Snake *Boiga irregularis*, has almost eliminated that island's endemic forest avifauna (Fritts, 1988).

10. **Conservation reserves on which species occurs** (including a list of other Action Plan species in each conservation reserve): Christmas Island NP; *Ramphotyphlops exocoeti* (Endangered) also occurs here.

10A. **Other conservation reserves where species might be expected to occur**: None.

11. **Other public land on which species occurs**: Regeneration nursery at Drumsite.

12. **Other land on which species occurs**: None known.

13. **Is knowledge about species adequate for**

objectives and actions to be defined accurately?: No.

13.1: Further ground survey needs to be conducted to determine its habitat preferences and the extent of its occurrence in the existing reserve.

13.2: Research is needed into the basic biology and ecology of the species in the field; it should include long term monitoring of changes in population size and habitat use.

13.3: Research is needed to document the extent of the species' decline and to identify the major factors contributing to that decline.

14. Recovery Plan objectives:

14.1: To obtain sufficient information on the species' biology, ecology and distribution to determine its current conservation status and formulate appropriate management strategies.

14.2: To ensure that secure, viable populations of the species are maintained within the reserve.

15. Management actions already initiated:

15.1: Survey of all terrestrial reptiles funded by ANPWS and conducted in 1979 (Cogger and Sadlier, 1981).

15.2: Study of the introduced Wolf Snake funded by ANPWS and conducted in 1991/92 (Rumpff, 1992).

15.3: Christmas Island National Park Plan of Management in preparation.

15.4: Establishment of a nursery to provide plants for the rehabilitation of the mine fields.

16. Management actions required:

16.1: Survey known and potential habitat in Christmas Island NP for *Lepidodactylus listeri*.

16.2: Monitor the populations of all species of geckos and skinks in urban areas; maintain surveillance of dispersal routes to primary forest, for possible invasion of the latter by introduced geckos.

16.3: Continue monitoring the population and distribution of Wolf Snakes, as recommended by Rumpff (1992).

16.4: Implement control program for the Wolf Snake; application of organochloride pesticides is not recommended. The establishment of a bounty system and use of sticky traps (Knight, 1986) may have some effect in reducing the population.

16.5: Introduce appropriate quarantine regulations and enforce thorough inspection of imported goods to detect introduced flora and fauna.

16.6: Continue rehabilitation of mined areas by wide-scale planting of forest species on the plateau.

16.7: Develop community awareness of the species and of the Wolf Snake as a potential predator.

17. Organisations responsible for conservation of species and individuals involved: Australian Nature Conservation Agency.

18. Other organisations and individuals involved: Hal Cogger and Ross Sadlier (Australian Museum), Holger Rumpff, Christmas Island National Park Advisory Committee.

19. Can recovery plan be carried out with existing resources?: No, although mining royalties have contributed considerably towards the costs of maintaining the regeneration nursery.

1: Survey of habitat preferences and distribution in reserve: 2 workers for 2 months each year for 2 years - $26,667 salary; $26,667 expenses (twice standard expenses for overseas destination). **$53.3K**

2: Research into basic biology and ecology, including assessment of threatening processes: 1 worker half-time for 2 years - $40,000 salary; $40,000 expenses (twice standard expenses for overseas destination). **$80K**

3: Monitor population of Wolf Snake and lizards in urban areas: 15 hours per month for 2 years @ $20 per hour - $7,200 salary. **$7.2K**

4: Preparation of management strategies: 1 worker for 3 months - $10,000 salary; $2,000 expenses. **$12K**

Total $152.5K

20. Remarks: 91 specimens documented in Australian museum collections.

References:

Australian National Parks and Wildlife Service. 1990. Annual Report 1989-90. Australian Government Publishing Service, Canberra. 114 pp.

Brown, W.C. and Parker, F. 1977. Lizards of the genus *Lepidodactylus* (Gekkonidae) from the Indo-Australian Archipelago and the islands of the Pacific, with descriptions of new species. Proceedings of the Californian Academy of Sciences (4)41(8): 253-265.

Boulenger, G.A. 1889. On the reptiles of Christmas Island. Proceedings of the Zoological Society of London 1888: 534-536.

Cogger, H.G. and Sadlier, R.A. 1981. The terrestrial reptiles of Christmas Island, Indian Ocean. Australian Museum, Sydney. 194 pp. Report to the Australian National Parks & Wildlife Service.

Cogger, H.G., Sadlier, R.A. and Cameron, E.E. 1983. The terrestrial reptiles of Australia's island territories. Australian National Parks and Wildlife Service Special Publication 11: 1-80.

Fritts, T.H. 1988. The brown tree snake, *Boiga irregularis*, a threat to Pacific Islands. US Dept of Interior Fish and Wildlife Service Biological Report 88(31): i-vi, 1-36.

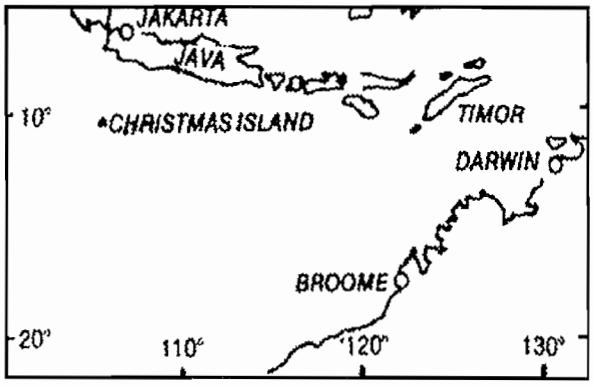
Fritts, T.H. 1993. The common wolf snake, *Lycodon aulicus capucinus*, a recent colonist of Christmas Island in the Indian Ocean. Wildlife Research 20: 261-266.

Knight, J.E. 1986. A humane method for removing snakes from dwellings. Wildlife Society Bulletin 14: 301-303.

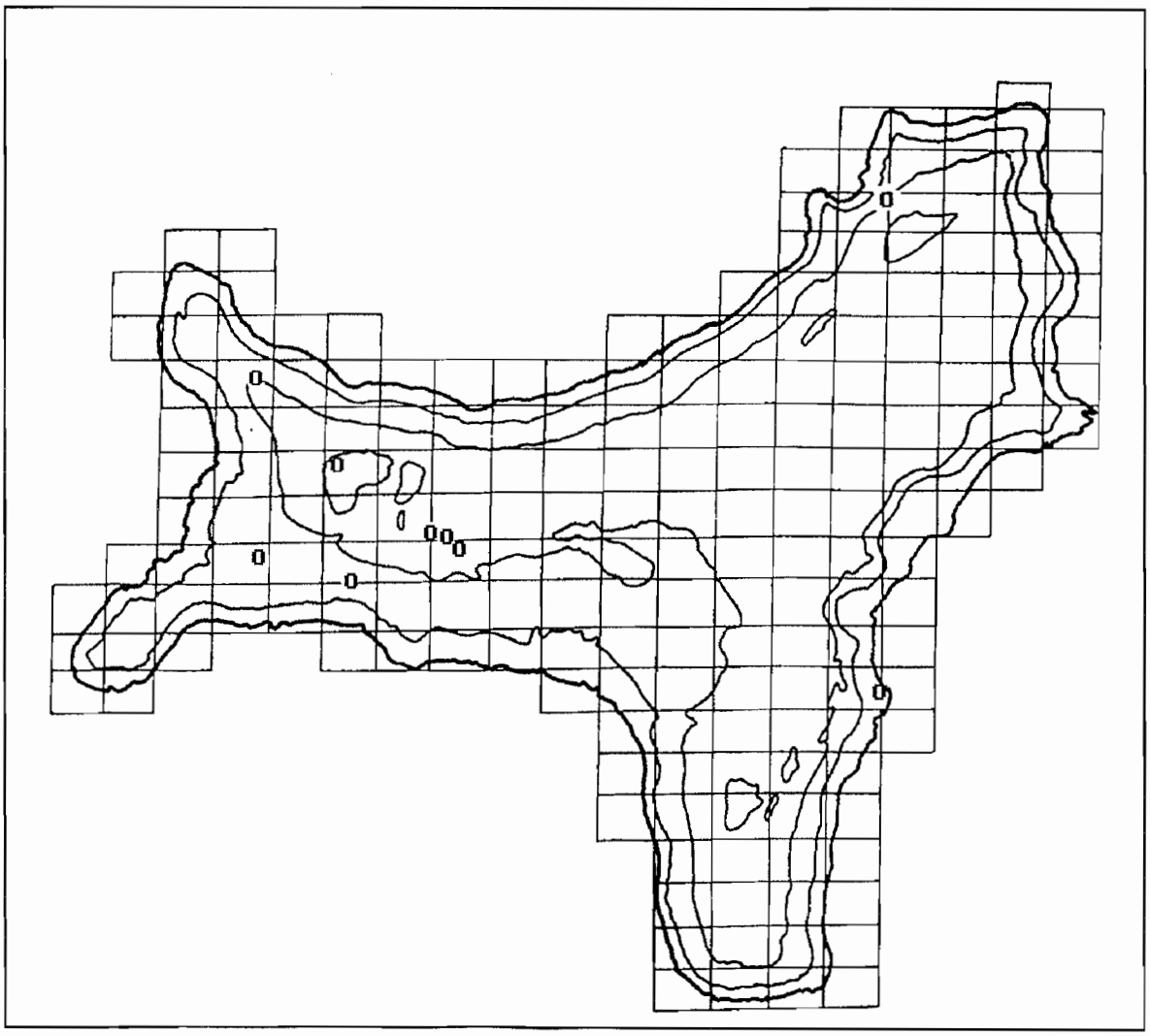
Rumpff, H. 1992. Distribution, population, structure and ecological behaviour of the introduced South-East Asian Wolf Snake *Lycodon aulicus capucinus* on Christmas Island, Indian Ocean. Report to the Australian National Parks and Wildlife Service, Canberra.

Smith, L.A. 1988. *Lycodon aulicus capucinus* a colubrid snake introduced to Christmas Island, Indian Ocean. Records of the Western Australian Museum 14(2): 251-252.

Smith, M.A. 1943. The Fauna of British India ... Reptilia and Amphibia. Vol. III. Serpentes. Taylor and Francis. London. xii + 583 pp.



Distribution of *Lepidodactylus listeri*



1. Family:	Gekkonidae
2. Scientific Name:	*Nephrurus deleani* Harvey, 1983
3. English Name:	Pernatty Knob-tail

4. Infraspecific taxa: None.

5. Species survival status: Vulnerable.

6. Former distribution: Not known to have differed from current distribution.

7. Current distribution: Restricted by apparently unsuitable surrounding habitat, to a very small area in the vicinity of Pernatty Lagoon, between Island Lagoon and Lake Torrens, South Australia.

8. Habitat: Tall shrubland.

Only recorded on the highest sand dunes supporting *Acacia ligulata* shrubland with an understorey of other shrubs including *Acacia burkitti*, *Alectryon elifolium*, pituri (*Duboisia hopwoodi*) and hopbush (*Dodonea sp.*) and canegrass (*Zygochloa sp.*) (John Read, *in litt.*).

9. Reasons for decline: Not known to have declined, but its small range makes it vulnerable to a number of threats including grazing by rabbits, overgrazing by sheep and cattle, soil compaction and erosion.

"The restricted range of *N. deleani* is subject to marked disturbance by sheep and cattle, resulting in destruction of vegetation and trampling of burrows" (Wilson and Knowles, 1988).

10. Conservation reserves on which species occurs: None known.

10A. Other conservation reserves where species might be expected to occur: None known.

11. Other public land on which species occurs: None known.

12. Other land on which species occurs: Apparently occurs only on private properties.

13. Is knowledge about species adequate for objectives and actions to be defined accurately?: No.

13.1: Ground surveys need to be conducted to determine the full geographic range of the species.

13.2: Research is needed into the basic biology and ecology of the species in the field; it should include long term monitoring of changes in population size, habitat use and geographic range.

13.3: Research is needed to determine if the species is declining and if so, to identify the major factors contributing to that decline.

14. Recovery Plan objectives:

14.1: To obtain sufficient information on the species' biology, ecology and distribution to determine its current conservation status and formulate appropriate management strategies.

14.2: To ensure that secure, viable populations of the species are maintained within a reserve system.

14.3: To implement land management practices which promote the maintenance of secure, viable populations of the species outside reserves.

15. Management actions already initiated: None known.

16. Management actions required:

16.1: Survey known and potential habitat in reserves within the species' known range.

16.2: Survey known habitat outside reserves within the species' known range.

16.3: Establish appropriate reserves.

16.4: Develop and promote guidelines for landowners and users to reduce the impact of current land use practices on the species outside reserves.

16.5: Develop community awareness within the species' known range.

17. Organisations responsible for conservation of species and individuals involved: South Australian Department of Environment and

Land Management.

18. Other organisations and individuals involved: John Read (Western Mining Corporation, Olympic Dam); Mark Hutchinson (South Australian Museum).

19. Can recovery plan be carried out with existing resources?: No.

1: Survey of geographic range, habitat preferences and occurrence in reserves: 2 workers for 2 months each year for 3 years - $40,000 salary; $30,000 expenses (1.5 x standard expenses for remote area). **$70K**

2: Research into basic biology and ecology, including assessment of threatening processes: 1 worker for 4 months each year for 2 years - $26,667 salary; $20,000 expenses (1.5 x standard expenses for remote area). **$46.7K**

3: Preparation of management strategies: 1 worker for 3 months - 10,000 salary; $2,000 expenses. **$12K**

4: Purchase of land for the reserve system: uncosted.

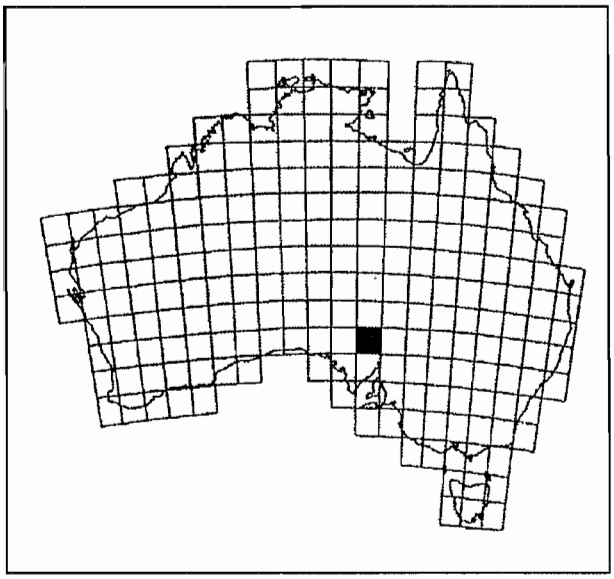
Total $128.7K

20. Remarks: Nine specimens documented in Australian museum collections. John Read (*in litt.*) has recorded live animals in nine localities in the past two years and it still appears to be relatively common on the few dunes of suitable habitat.

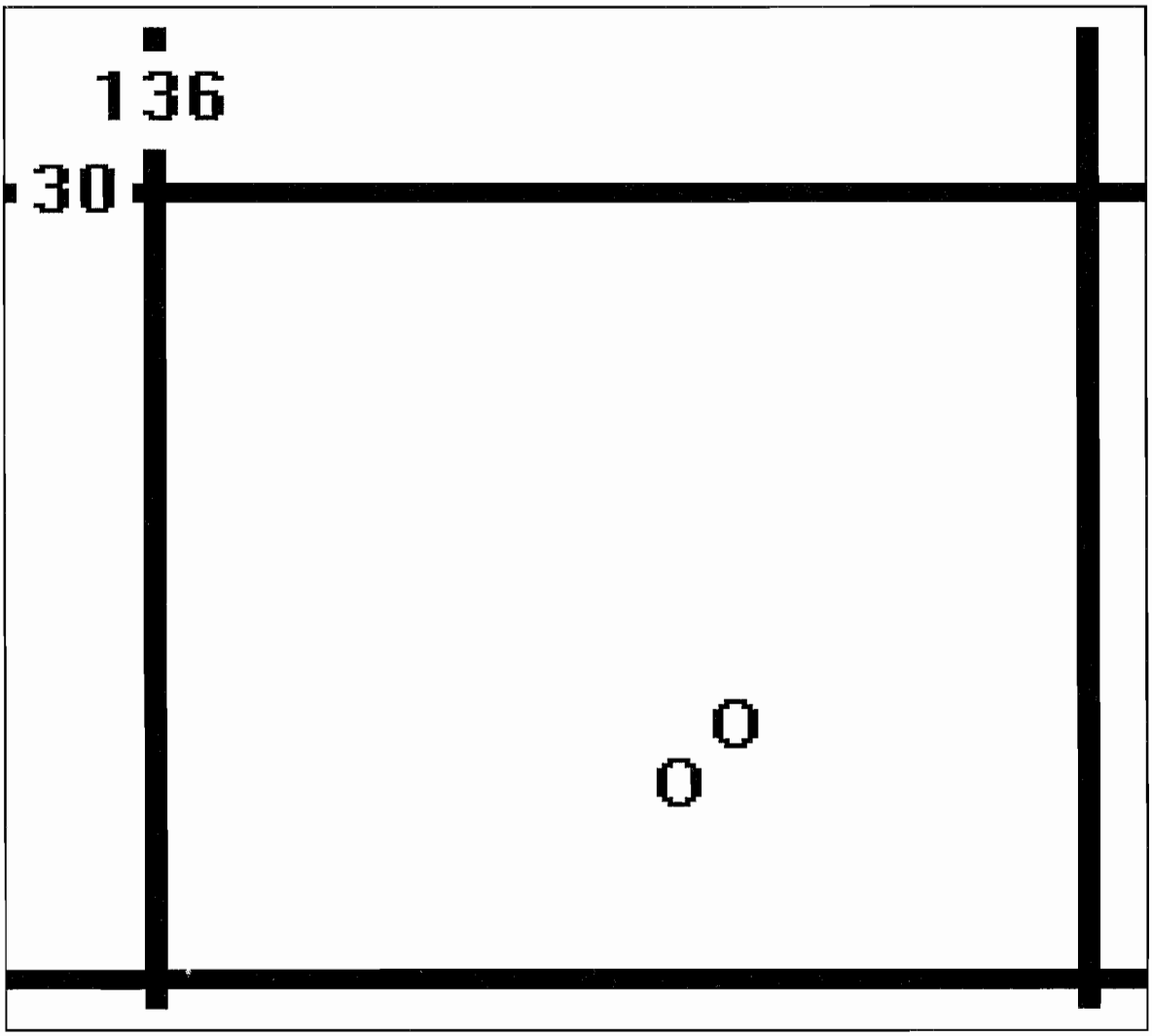
References:

Harvey, C. 1983. A new species of *Nephrurus* (Reptilia: Gekkonidae) from South Australia. Transactions of the Royal Society of South Australia 107(4): 231-235.

Wilson, S.K. and Knowles, D.G. 1988. Australia's Reptiles; a photographic reference to the terrestrial reptiles of Australia. Collins Publishers, Australia. 447 pp.



Distribution of *Nephrurus deleani*



1. **Family**: Gekkonidae

2. **Scientific Name**: *Underwoodisaurus sphyrurus* (Ogilby, 1892)

3. **English Name**: Border Thick-tailed Gecko

4. **Infraspecific taxa**: None.

5. **Species survival status**: Vulnerable.

6. **Former distribution**: Not known to have differed from current distribution.

7. **Current distribution**: North-western slopes and northern tablelands of New South Wales and the adjacent Stanthorpe region of southern Queensland, between about 500 and 1500 m asl.

8. **Habitat**: Rocky isolates, open woodland.

In the hills of the Granite Belt its preferred habitat appears to be deep leaf litter and exfoliating rocky outcrops in *Eucalyptus* and *Callitris* woodland (Cogger, 1992, Gerry Swan, *in litt.*). In the Tamworth region it has been found close to outcrops of metamorphic and sedimentary as well as granite rocks (Harry Hines, Gerry Swan, *in litt.*).

9. **Reasons for decline**: Not known to have declined but probably vulnerable to a combination of factors, including overgrazing by stock, clearance of habitat for agriculture and grazing, native forest logging and inundation of habitat by dam construction.

At least one individual is known to have been displaced by the rising waters of the Copeton Dam (Gerry Swan, *in litt.*). The species has a patchy distribution in a region of high human impact and its habitat requirements are not well known.

10. **Conservation reserves on which species occurs**: Queensland: Girraween NP;
New South Wales: Mount Kaputar NP.

10A. **Other conservation reserves where species might be expected to occur**: Queensland: Sundown NP;
New South Wales: Bald Rock NP, Boonoo Boonoo NP, Cameron's Gorge NR, Ironbark NR, Kings Plains NP, Mount Yarrowitch NR, Rowleys Creek Gulf NR, Severn River NR, Sherwood NR, The Basin NR, The Hole Creek NR, Wallabadah NR, Warrabah NP, Watsons Creek NR.

11. **Other public land on which species occurs**: New South Wales: Copeton Dam SRA; Moonbi Lookout north of Tamworth; Emmaville rubbish tip (Gerry Swan, *in litt.*).

12. **Other land on which species occurs**: Private land around Woolomin, south-east of Tamworth; potentially present in suitable habitat on private properties throughout its range.

13. **Is knowledge about species adequate for objectives and actions to be defined accurately?**: No.

13.1: Ground surveys need to be conducted to determine the full geographic range of the species, its habitat preferences, and the extent of its occurrence in existing reserves.

13.2: Research is needed into the basic biology and ecology of the species in the field; it should include long term monitoring of changes in population size, habitat use and geographic range.

13.3: Research is needed to determine if the species is declining and if so, to identify the major factors contributing to that decline.

14. **Recovery Plan objectives**:

14.1: To obtain sufficient information on the species' biology, ecology and distribution to determine its current conservation status and formulate appropriate management strategies.

14.2: To ensure that secure, viable populations of the species are maintained within a reserve system.

14.3: To implement land management practices which promote the maintenance of secure, viable populations of the species outside reserves.

15. Management actions already initiated: Listed as "vulnerable and rare" on the 1992 Revised (Interim) Schedule 12 of the *NSW Endangered Fauna (Interim Protection) Act 1991.*

16. Management actions required:

16.1: Survey known and potential habitat in reserves within the species' known range.

16.2: Survey known habitat outside reserves within the species' known range.

16.3: Establish appropriate reserves if the existing reserve system is found to be inadequate to secure the survival of the species.

16.4: Develop and promote guidelines for landowners and users to reduce the impact of current land use practices on the species outside reserves.

16.5: Develop community awareness within the species' known range.

17. Organisations responsible for conservation of species and individuals involved: Queensland Department of Environment and Heritage, New South Wales National Parks and Wildlife Service (Harry Hines).

18. Other organisations and individuals involved: Harald Ehmann (Sydney Institute of Technology); Gerry Swan (Australian Herpetological Society).

19. Can recovery plan be carried out with existing resources?: No.

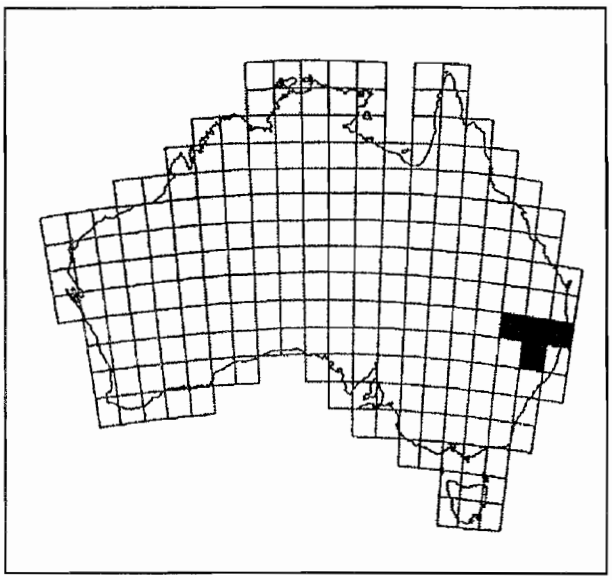
1:	Survey of geographic range, habitat preferences and occurrence in reserves: 2 workers quarter-time for 2 years - $40,000 salary; $20,000 expenses.	**$60K**
2:	Research into basic biology and ecology, including assessment of threatening processes: 1 worker for 4 months each year for 2 years - $26,667 salary; $13,333 expenses.	**$40K**
3:	Preparation of management strategies: 1 worker for 3 months - $10,000 salary; $2,000 expenses.	**$12K**
		Total $112K

20. Remarks: 15 specimens documented in Australian museum collections. Recent records include several sightings in early 1993 around Woolomin (Harry Hines, *in litt.*).

References:

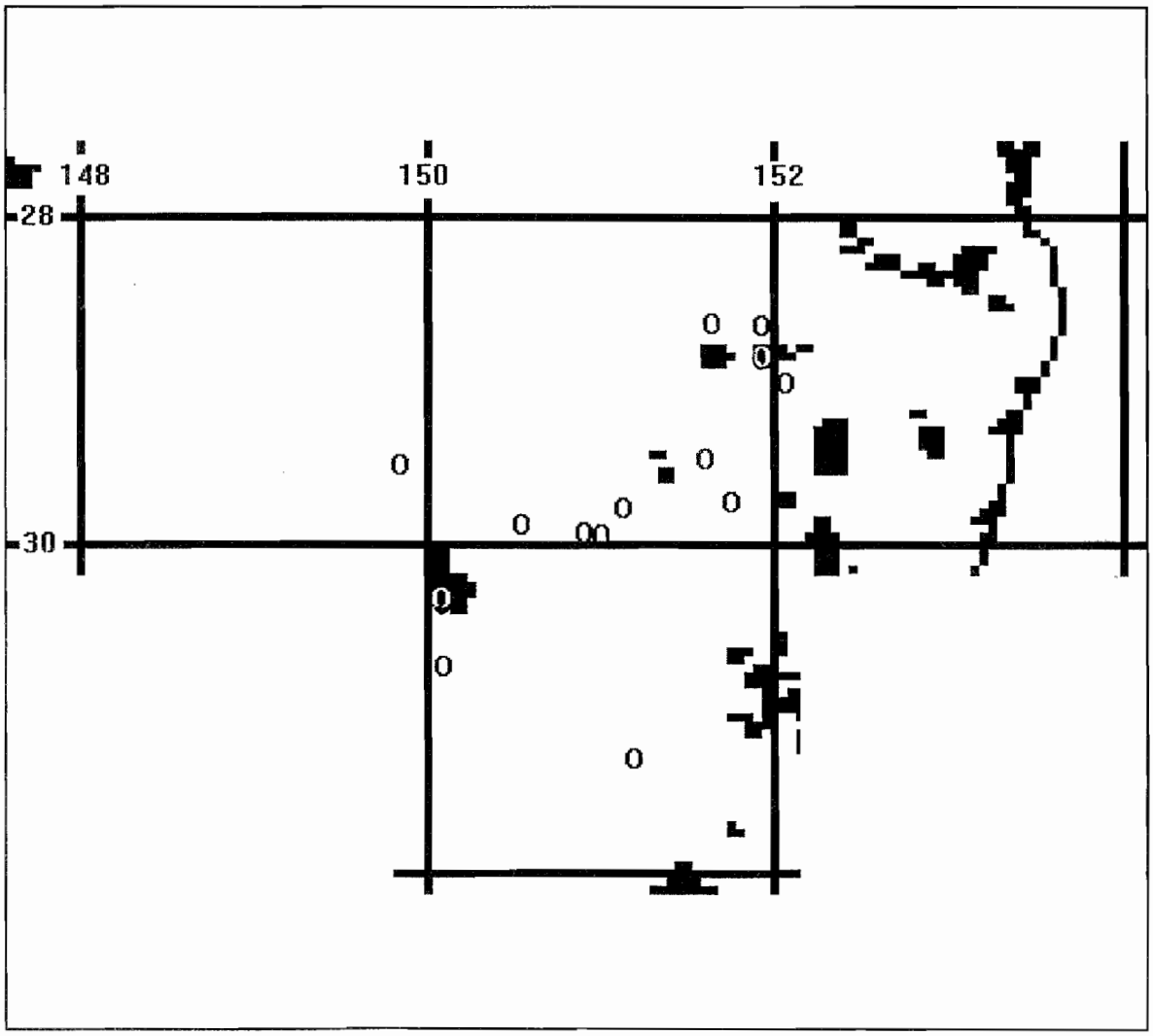
Czechura, G.V. and Covacevich, J. 1985. Poorly known reptiles in Queensland. pp. 471-476 in G. Grigg, R. Shine and H. Ehmann (eds) The Biology of Australasian Frogs and Reptiles. Royal Zoological Society of New South Wales, Sydney.

Cogger, H.G. 1992. Reptiles and Amphibians of Australia. Reed Books, Sydney. 775 pp.



Distribution of

Underwoodisaurus sphyrurus



1. Family:	Pygopodidae
2. Scientific Name:	*Aprasia aurita* Kluge, 1974
3. English Name:	Mallee Worm-lizard

4. Infraspecific taxa: None

5. Species survival status: Endangered.

6. Former distribution: Recorded from the Woomelang and Ouyen area of north-western Victoria early this century; most of the land in the Ouyen and Woomelang area has now been alienated and cleared except for a few small remnants.

7. Current distribution: Wathe State Wildlife Reserve, north-western Victoria, appears to contain the last remaining population of this species. The reserve has a total area of about 6000 ha but the worm-lizard has only been recorded from four localities within a 400 ha portion of the reserve.

8. Habitat: Tall shrubland and open heath.

Appears to be restricted to mallee and heathy vegetation which has not been burnt for at least 40 years, growing on sandy soils. Individuals have been found in sand beneath mallee roots (Backhouse and Robertson, 1992).

9. Reasons for decline: Probably a combination of factors, including clearance of habitat for agriculture, crop production, fire regime involving too frequent burning of mallee. "Being confined to the one locality and in apparently low numbers would suggest that the species is vulnerable to catastrophes such as fire and disease" (Backhouse and Robertson, 1992). In November 1991 a wildfire burnt about 800 ha of Wathe SWR, including two of the four known *A. aurita* sites.

The Victorian DCNR Scientific Advisory Committee in 1991 determined that the species is in a demonstrable state of decline which is likely to result in extinction, and it is very rare in terms of abundance and distribution.

10. Conservation reserves on which species occurs (including a list of other Action Plan species in each conservation reserve): Wathe State Wildlife Reserve (which is managed as a Fauna and Flora Reserve); the Malleefowl (listed as Vulnerable in The Action Plan for Australian Birds) also occurs there.

10A. Other conservation reserves where species might be expected to occur: Currently there is no evidence that the target species occurs, or is likely to occur, on any other reserves. Wyperfeld National Park (which is connected to Wathe SWR by a corridor of public land) contains vegetation communities similar to those occurring in Wathe, but it has a history of more frequent fires (Robertson *et al.*, 1989).

11. Other public land on which species occurs: Unknown; the 1-km wide corridor linking Wyperfeld NP and Wathe SWR is gazetted as State Forest but managed as a Flora and Fauna Reserve (Ian Sluiter, pers. comm.).

12. Other land on which species occurs: None known.

13. Is knowledge about species adequate for objectives and actions to be defined accurately?: No.

13.1: Further ground surveys need to be conducted to determine the full range of the species within Wathe SWR and adjacent land and to confirm its habitat preferences.

13.2: Research is needed into the basic biology and ecology of the species in the field; it should include long term monitoring of changes in population size, habitat use and geographic range.

13.3: Research is needed to document the extent of the species' decline and to identify the major factors contributing to that decline.

14. Recovery Plan objectives:

14.1: To obtain sufficient information on the species' biology, ecology and distribution to formulate appropriate management

strategies.

14.2: To ensure that secure, viable populations of the species are maintained within a reserve system.

14.3: To implement land management practices which promote the maintenance of secure, viable populations of the species outside reserves.

15. Management actions already initiated:

15.1: Listed on Schedule 1 of the Commonwealth's *Endangered Species Protection Act 1992* and listed as "threatened" on the 1993 Schedule 2 of the *Victorian Flora and Fauna Guarantee Act 1988*.

15.2: The species was recorded by Victorian Department of Conservation and Environment during a survey of the mallee area of north-western Victoria (Robertson *et al.*, 1989).

15.3: Action Statement for the species has been prepared by Victorian DCNR.

15.4: Section of the corridor between Wathe SWR and Wyperfeld NP which had been cleared, is being revegetated by the Victorian DCNR.

16. Management actions required:

16.1: Survey known and potential habitat in Wathe Reserve; a survey in the spring of 1993 is planned by Victorian DCNR with funding from ANCA (Peter Robertson, pers. comm.).

16.2: Survey suitable habitat in Eastern Big Desert Land System and any other nearby reserves; (see above).

16.3: Establish appropriate reserves if the existing reserve system is found to be inadequate to secure the survival of the species. Purchase private land adjacent to Wathe Reserve if it contains suitable habitat.

16.4: Develop and promote guidelines and provide incentives for landowners to protect remnant blocks of mallee vegetation on adjoining freehold land and to report any sightings of worm-lizards.

16.5: Continue to exclude fire from vicinity of Wathe Reserve and undertake study of fire regimes which promote continued survival of suitable habitat.

17. Organisations responsible for conservation of species and individuals involved: Victorian Department of Conservation and Natural Resources (Gary Backhouse, Peter Robertson, Ian Sluiter).

18. Other organisations and individuals involved: John Coventry (Museum of Victoria).

19. Can recovery plan be carried out with existing resources?: No, but ANCA has funded a further survey to the value of $15,000.

1:	Survey of geographic range, habitat preferences and occurrence in reserves: 2 workers for 2 months per year for 2 years - $26,667 salary; $13,333 expenses.	**$40K**
2:	Research into basic biology and ecology, including assessment of threatening processes: 1 worker for 4 months per year for 2 years - $26,667 salary; $13,333 expenses.	**$40K**
3:	Preparation of management strategies: 1 worker for 3 months - $10,000 salary; $2,000 expenses.	**$12K**
4:	Purchase of land for the reserve system: uncosted.	
		Total $92K

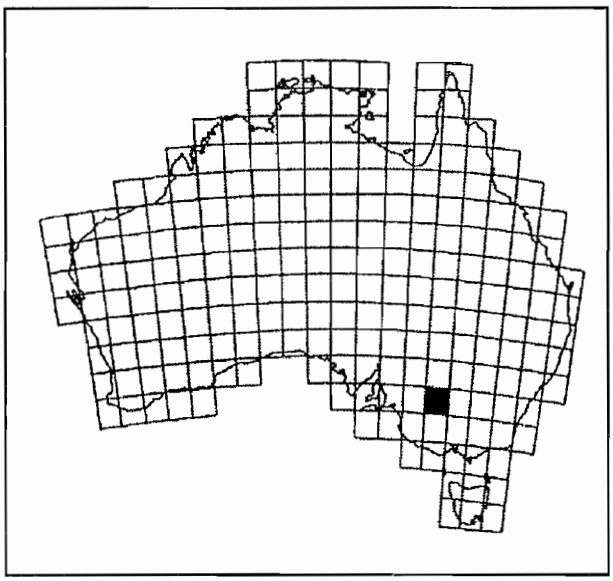
20. Remarks: 15 specimens documented in Australian museum collections. All recent records of the species relate to a single remnant population.

Only about 15 individuals have been recorded since 1985; a juvenile taken in 1989 for electrophoretic analysis and four individuals were recorded as recently as September 1993 in the area that had been burnt in 1991.

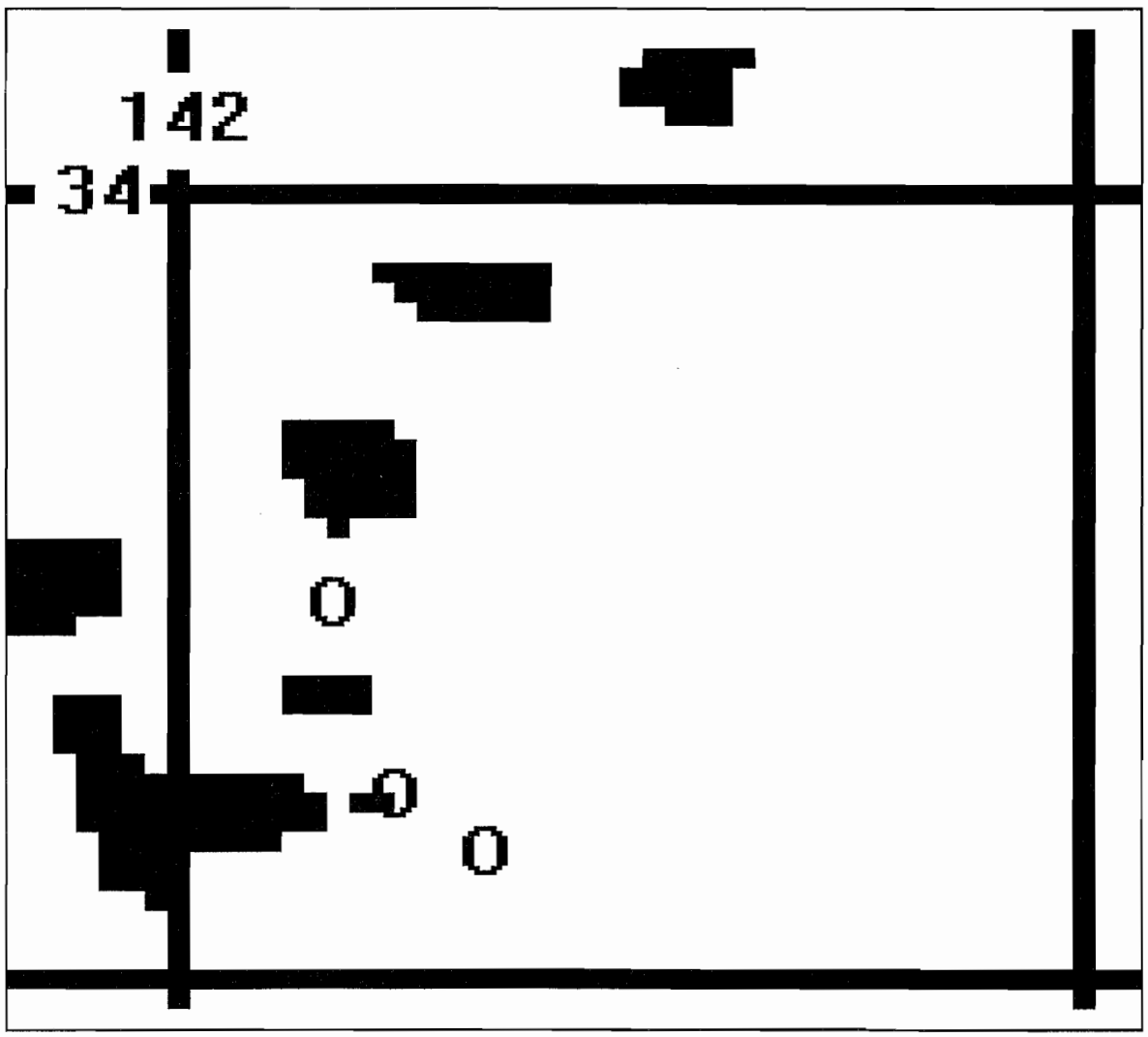
References:

Backhouse, G. and Robertson, P. 1992. Action Statement 20: Mallee Worm-Lizard *Aprasia aurita*. Victorian Department of Conservation and Environment, East Melbourne. 4 pp.

Robertson, P., Bennett, A.F., Lumsden, L.F., Silveira, C.E., Johnson, P.G., Yen, A.L., Milledge, G.A., Lillywhite, P.K. and Pribble, H.J. 1989. Fauna of the mallee study area north-western Victoria. Arthur Rylah Institute Technical Report No. 87: 1-91.



Distribution of *Aprasia aurita*



1. **Family:**	Pygopodidae
2. **Scientific Name:**	*Aprasia pseudopulchella* Kluge, 1974
3. **English Name:**	Flinders Ranges Worm-lizard

4. **Infraspecific taxa**: None, but "morphologically and electrophoretically this species is only doubtfully distinct from *Aprasia parapulchella* of NSW and Victoria" (Mark Hutchinson, *in litt.*).

5. **Species survival status**: Vulnerable.

6. **Former distribution**: Not known to have differed from current distribution.

7. **Current distribution**: Flinders Ranges south to the western slopes of northern and central Mount Lofty Ranges, South Australia and extending to the northern suburbs of Adelaide (Salisbury, Elizabeth).

8. **Habitat**: Open woodland, native tussock grassland, riparian habitats, rocky isolates.

Found under stones on clayey soils.

9. **Reasons for decline**: Probably a combination of factors, including clearance of habitat, overgrazing by stock, cropping, pasture improvement, urbanisation.

Most of the original vegetation occurring in the Mount Lofty Ranges has been destroyed by clearance and grazing sheep (Glenn Shea, pers. comm.).

10. **Conservation reserves on which species occurs** (including a list of other Action Plan species in each conservation reserve): Mount Remarkable NP; *Notechis ater* (Vulnerable) also occurs in Mount Remarkable NP.

10A. **Other conservation reserves where species might be expected to occur**: Black Rock CP, Clements Gap CP, Flinders Ranges NP, Gammon Ranges NP, Spring Gully CP, Telowie Gorge CP, Yalpara CP.

11. **Other public land on which species occurs**: Cobbler Creek RP, Salisbury East (Mitchell, 1993), Mambray Creek Reserve.

12. **Other land on which species occurs**: Private properties in the Burra and Mount Bryan areas, and in several outer north-western suburbs of Adelaide.

13. **Is knowledge about species adequate for objectives and actions to be defined accurately?**: No.

13.1: Ground surveys need to be conducted to determine the full geographic range of the species, its habitat preferences, and the extent of its occurrence in existing reserves.

13.2: Research is needed into the basic biology and ecology of the species in the field; it should include long term monitoring of changes in population size, habitat use and geographic range.

13.3: Research is needed to document the extent of the species' decline and to identify the major factors contributing to that decline.

13.4: Genetic study needed to determine the taxonomic status of this taxon and its relationship to *Aprasia parapulchella*.

14. **Recovery Plan objectives**:

14.1: To obtain sufficient information on the species' biology, ecology and distribution to determine its current conservation status and formulate appropriate management strategies.

14.2: To ensure that secure, viable populations of the species are maintained within a reserve system.

14.3: To implement land management practices which promote the maintenance of secure, viable populations of the species outside reserves.

15. **Management actions already initiated**:

15.1: Allozyme study by Steve Donnellan and Mark Hutchinson (South Australian Museum).

16. **Management actions required**:

16.1: Survey known and potential habitat in

reserves within the species' known range.

16.2: Survey known habitat outside reserves within the species' known range.

16.3: Establish appropriate reserves if the existing reserve system is found to be inadequate to secure the survival of the species.

16.4: Develop and promote guidelines for landowners and users to reduce the impact of current land use practices on the species outside reserves.

16.5: Develop community awareness within the species' known range.

17. Organisations responsible for conservation of species and individuals involved: South Australian Department of Environment and Land Management.

18. Other organisations and individuals involved: Mark Hutchinson and Steve Donnellan (South Australian Museum).

19. Can recovery plan be carried out with existing resources?: No.

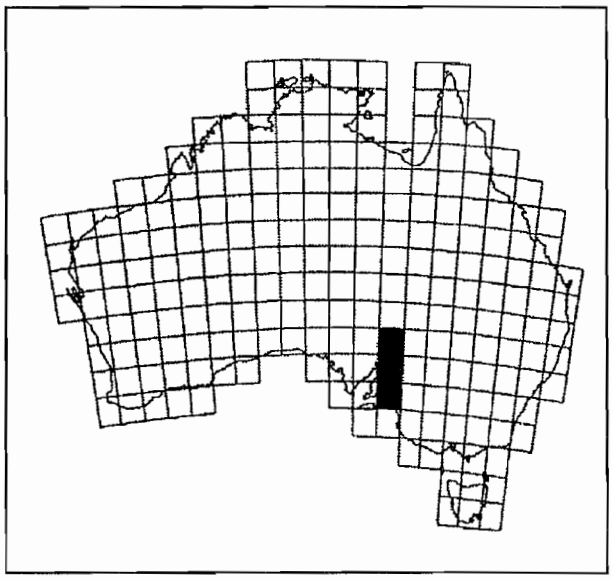
1:	Survey of geographic range, habitat preferences and occurrence in reserves: 2 workers for 2 months per year for 2 years - $26,667 salary; $13,333 expenses.	**$40K**
2:	Research into basic biology and ecology, including assessment of threatening processes: 1 worker for 4 months each year for 2 years - $26,667 salary; $13,333 expenses.	**$40K**
3:	Preparation of management strategies: 1 worker for 3 months - $10,000 salary; $2,000 expenses.	**$12K**
4:	Purchase of land for the reserve system: uncosted.	
		Total $92K

20. Remarks: 26 specimens documented in Australian museum collections. Mitchell (1993) recorded eight individuals over a period of 30 months during a survey of the herpetofauna of the Cobbler Creek Recreation Park.

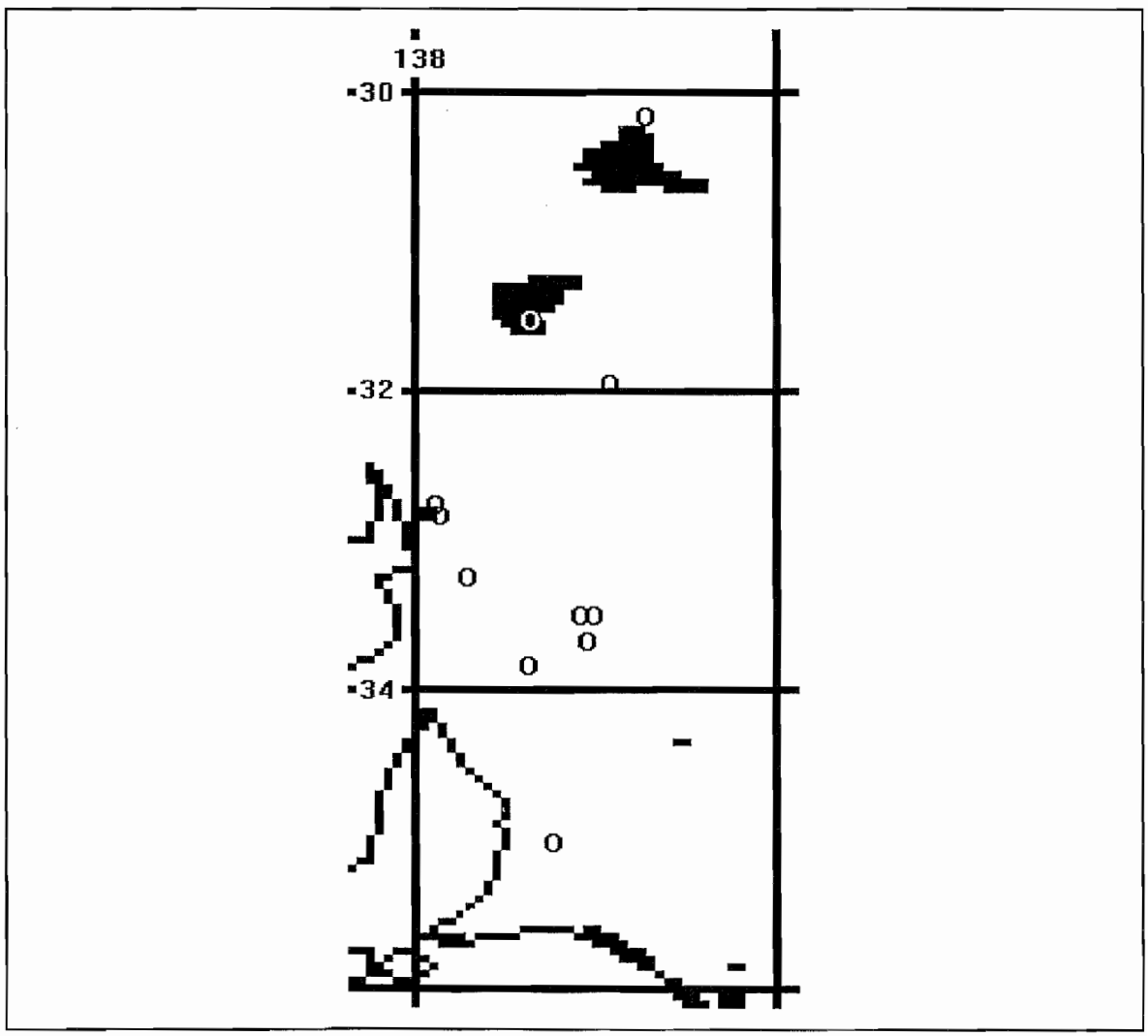
References:

Ehmann, H.F.W. 1992. Encyclopedia of Australian Animals: Reptiles. Australian Museum with Angus and Robertson, Sydney. xv + 495 pp.

Mitchell, D.J. 1993. A survey of the reptiles of the Cobbler Creek Recreation Park, Salisbury Park, South Australia. Herpetofauna 22(2): 36-37.



Distribution of *Aprasia pseudopulchella*



1. Family:	Pygopodidae
2. Scientific Name:	*Aprasia rostrata rostrata* Parker, 1956
3. English Name:	Hermite Island Worm-lizard

4. Infraspecific taxa: *A. rostrata fusca* (Exmouth Gulf region, WA, but taxonomic status indeterminate (Glenn Shea, pers. comm.), *A. rostrata rostrata* (Montebello Island Group, WA).

5. Subspecies survival status: Vulnerable.

6. Former distribution: Not known to have differed from current distribution.

7. Current distribution: Known only from Hermite Island, Montebello Group, north-western Western Australia.

8. Habitat: Hummock grassland, rocky isolates.

Hermite Island is a rocky island derived from highly calcareous sandstone; *Triodia* hummock grassland is the dominant vegetation and low shrubs, tussock grasses and herbs grow in the gullies (Burbidge, 1971).

9. Reasons for decline: Not known to have declined, but its restriction to a single small island makes it very vulnerable to threatening processes which include human disturbance and predation by cats and rats (*Rattus rattus*).

In the 1950s there was considerable human activity on the island associated with the testing of nuclear weapons by the British Atomic Weapons Research Establishment. Hill (1955) reported the presence of cats which had apparently exterminated the two marsupials recorded on the island in 1914 (Montague in Hill, 1955) and cats are known predators of other species of *Aprasia* (Brooker, 1978).

10. Conservation reserves on which subspecies occurs: None.

10A. Other conservation reserves where subspecies might be expected to occur: None.

11. Other public land on which subspecies occurs: Hermite Island, Montebello Group; currently Commonwealth land but in the process of being transferred to State control.

12. Other land on which subspecies occurs: None.

13. Is knowledge about subspecies adequate for objectives and actions to be defined accurately?: No.

13.1: Ground surveys need to be conducted to confirm its continued survival and to determine its habitat preferences and the extent of its occurrence on Hermite Island.

13.2: Research is needed into the basic biology and ecology of the subspecies in the field; it should include long term monitoring of changes in population size and habitat use.

13.3: Research is needed to determine if the subspecies is declining and if so, to identify the major factors contributing to that decline.

13.4: Genetic study needed to determine the taxonomic status of this population and its relationship to *Aprasia rostrata fusca*.

14. Recovery Plan objectives:

14.1: To obtain sufficient information on the subspecies' biology and ecology to determine its current conservation status and formulate appropriate management strategies.

14.2: To ensure that secure, viable populations of the subspecies are maintained within a reserve system.

15. Management actions already initiated:

15.1: Burbidge (1971) recommended Hermite Island be made an 'A' class reserve for the "Conservation of Fauna and Flora" and that it be vested in the Western Australian Wildlife Authority (now CALM).

15.2: Montebello Islands in process of being transferred to State control, following which they will be declared a national

park and marine park reserve.

16. Management actions required:

16.1: Survey Hermite Island for this species.

16.2: Establish reserve on the island.

16.3: Implement control program for cats (and rats) if they still occur on the island.

17. Organisations responsible for conservation of subspecies and individuals involved: Western Australian Department of Conservation and Land Management (Andrew Burbidge, Peter Kendrick).

18. Other organisations and individuals involved: None known.

19. Can recovery plan be carried out with existing resources?: No.

1: Survey of habitat preferences and occurrence on Hermite Island: 2 workers for 1 month per year for 2 years - $13,333 salary; $10,000 expenses (1.5 x standard expenses for remote region). **$23.333K**

2: Research into basic biology and ecology, including assessment of threatening processes: 1 worker for 2 months per year for 2 years - $13,333 salary; $10,000 expenses (1.5 x standard expenses for remote region). **$23.333K**

3: Preparation of management strategies: 1 worker for 3 months - $10,000 salary; $2,000 expenses. **$12K**

Total $58.7K

20. Remarks: Only two museum specimens known. Collected on a single occasion, in 1952; not recorded by Montague in 1914 (Hill, 1955) or in 1970 by Burbidge (1971).

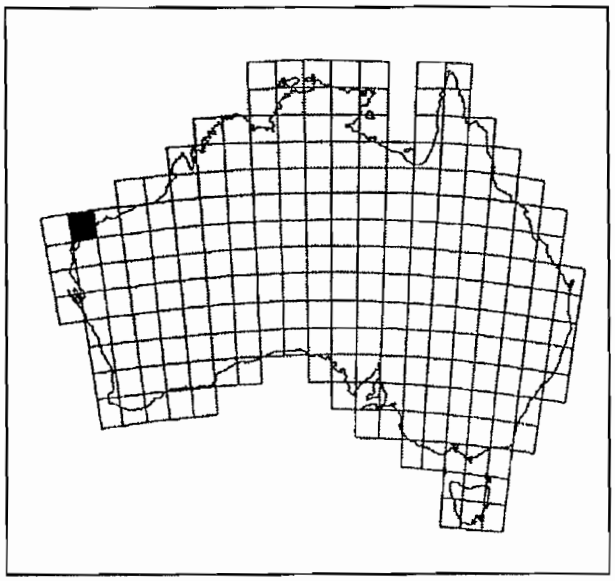
References:

Brooker, M.G. 1978. Some notes on the mammalian fauna of the western Nullarbor Plain. Western Australian Naturalist 14(1): 2-15.

Burbidge, A.A. 1971. The fauna and flora of the Monte Bello Islands. Western Australia Department of Fisheries and Fauna Report 9: 1-15.

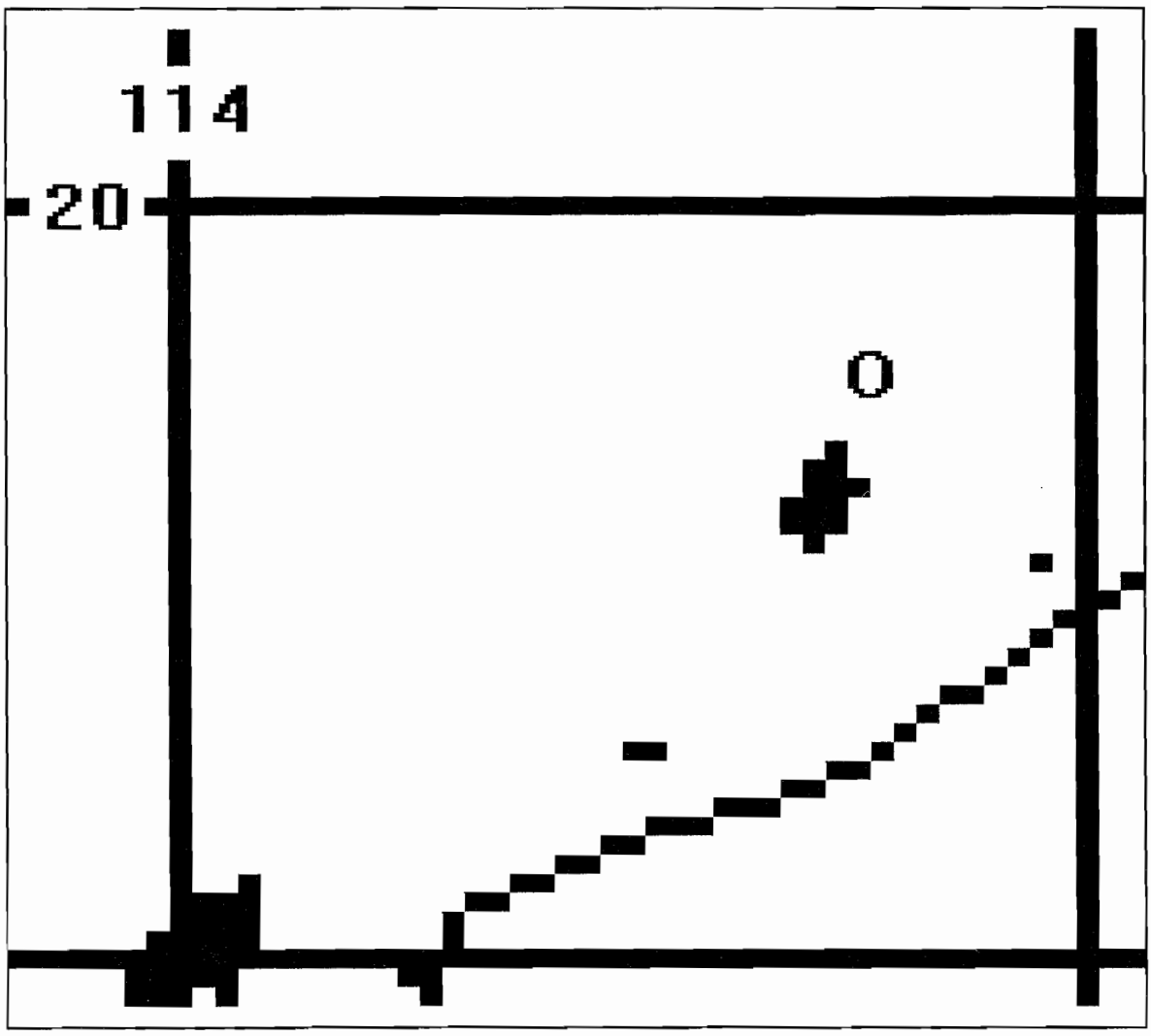
Hill, F.L. 1955. Notes on the natural history of the Monte Bello Islands. Proceedings of the Linnean Society of London 165(2): 113-124.

Kluge, A.G. 1974. A taxonomic revision of the lizard family Pygopodidae. Miscellaneous Publications of the Museum of Zoology, University of Michigan 147: i-vi + 1-221.



Distribution of

Aprasia rostrata rostrata



1. Family:	Pygopodidae
2. Scientific Name:	*Delma impar* Fischer, 1882
3. English Name:	Striped Legless Lizard

4. Infraspecific taxa: None

5. Species survival status: Vulnerable.

6. Former distribution: The Australian Capital Territory, south-west slopes and Southern Tableland of New South Wales, central and southern Victoria and extreme south-eastern corner of South Australia.

7. Current distribution: In the ACT found in only three localities around Canberra (Williams and Kukolic, 1991); in New South Wales, the only recent records are from Batlow (1977), and Goulburn in 1992 (Grant Husband, in prep.). The range in Victoria appears to have contracted to the southern part of the state, with concentrations in the outer western and northern suburbs of Melbourne and in the Western District of the state. No longer found in the inner metropolitan areas of Melbourne. May no longer occur in South Australia (the most recent specimens were collected in 1969 and the area now appears unlikely to support a population) (Coulson, 1990).

8. Habitat: Tussock grassland.

Preferred habitat appears to be dense, relatively undisturbed lowland native grassland dominated by perennial *Stipa* and *Themeda* species; typically the grasslands occur on flat or gently undulating plains (Coulson, 1990; Kukolic and Osborne, 1992). In Victoria, microhabitat usually includes a moderate cover or mat of native or introduced grasses together with basalt rocks on the surface or embedded in the soil (usually a cracking clay derived from basalt).

9. Reasons for decline: Probably a combination of factors, including clearance of habitat for agriculture and grazing, prolonged heavy grazing by stock, pasture improvement, crop production, urban development, rock removal, inappropriate fire regimes, habitat fragmentation and weed invasion.

In the Melbourne metropolitan area and the ACT, a large proportion of the suitable known habitat has been lost to, or is threatened by, urbanisation (for example, massive road works and new suburb development) (Richard Longmore, pers. comm.). Cool fires in grassland reserves have caused mortality (Coulson, 1990).

In rural areas the suitable grasslands have been extensively modified by grazing, cropping and the introduction of non-native pasture species. The survival of populations of *Delma impar* varies with the intensity of agricultural and grazing practices - they appear to be able to survive light grazing but have disappeared following continual heavy grazing or cultivation. Large-scale removal of rocks for landscape gardening may contribute to their decline (Robertson *et al.*, 1989; Coulson, 1990).

10. Conservation reserves on which species occurs: Australian Capital Territory: does not occur in any existing or proposed reserve (Kukolic and Osborne, 1992).
Victoria: Derrimut Grasslands Reserve.
South Australia: Bool Lagoon Game Reserve (last recorded in 1969).

10A. Other conservation reserves where species might be expected to occur:
Australian Capital Territory: None.
New South Wales: Avisford NR, Conimbla NP, Copperhannia NR, Curumbenya NR, Dananbilla NR, Kosciusko NP, Nangar NP, Tarlo River NP.
Victoria: most Victorian reserves in the vicinity of *impar* records have little or no suitable habitat.
South Australia: Big Heath CP, Fairview CP.

11. Other public land on which species occurs: Australian Capital Territory: Gungahlin (CSIRO Divn of Wildlife and Ecology research station and leased paddocks, Telecom transmission site and site of proposed urban development of Gungahlin township); Majura Valley (Civil Aviation Authority); National Museum of Australia site;
Victoria: Defence Dept Albion Explosives

Factory, Australian Army Rockbank Receiving Station; roadside reserves near Hamilton, Creswick, Caramut and Rokewood (Coulson, 1990).

12. Other land on which species occurs:

New South Wales: at least one private property on the outskirts of Goulburn (Grant Husband, pers. comm.).

Victoria: a number of private properties between Melbourne and the South Australian border, including the districts of Deer Park, Derrimut, Colac, Cressy and Ballarat.

13. Is knowledge about species adequate for objectives and actions to be defined accurately?:

Generally yes for habitat requirements.

13.1: Ground surveys are required in southern New South Wales and in south-eastern South Australia, to determine its full geographic range and the extent of its occurrence in existing reserves.

13.2: Further research is needed into the basic biology and ecology of the species in the field; it should include long term monitoring of changes in population size, habitat use and geographic range.

13.3: Research is needed to document the extent of the species' decline and to identify the major factors contributing to that decline.

14. Recovery Plan objectives:

14.1: To obtain sufficient information on the species' biology, ecology and distribution to determine its current conservation status in all states and territories within its geographic range, and to formulate appropriate management strategies.

14.2: To ensure that secure, viable populations of the species are maintained within a reserve system.

14.3: To implement land management practices which promote the maintenance of secure, viable populations of the species outside reserves.

15. Management actions already initiated:

15.1: Listed on Schedule 1 of the Commonwealth's *Endangered Species Protection Act 1992*, listed as "vulnerable and rare" in 1992 Revised (Interim) Schedule 12 of the *NSW Endangered Fauna (Interim Protection) Act 1991*, as "special protection status" in the 1991 Section 6 Schedule of the *ACT Nature Conservation Act 1980* and as "threatened" on the 1993 Schedule 2 of the *Victorian Flora and Fauna Guarantee Act 1988*.

Australian Capital Territory:

15.2: Survey of 56 sites in the ACT by the ACT Parks and Conservation Service. Further distributional survey funded by ESU as part of the ACT Grasslands Recovery Program is now under way.

15.3: Identification by the ACT Parks and Conservation Service (Wildlife Research Unit, 1991 and 1992) of a range of management actions.

Victoria:

15.4: Preparation of Management Plan for Derrimut Grasslands Reserve.

15.5: Preparation of Flora and Fauna Guarantee Action Statement.

15.6: Establishment of Striped Legless Lizard Working Group.

15.7: Initial study of distribution and ecological requirements conducted for the Dept of Conservation and Natural Resources.

15.8: Initiation of public awareness campaign.

15.9: Development of contingency plan to relocate individuals threatened by construction of housing estates.

15.10: Establishment of small captive colony at Melbourne Zoo.

15.11: Grants offered to postgraduate students to conduct research on the species.

16. Management actions required:

16.1: In south-eastern New South Wales and the Bool Lagoon area of South Australia, survey known and potential habitat in reserves.

16.2: In Victoria, near Melbourne, conduct ground survey of potentially suitable grasslands in areas close to Derrimut Reserve and along the Werribee and Plenty Growth Corridors; in central, western and north-eastern Victoria, utilise local news media and conservation groups to conduct indirect survey of grasslands outside reserves.

16.3: Establish appropriate reserves (including *Themeda* and *Stipa* grasslands at Gungahlin, ACT) if the existing reserve system is found to be inadequate to secure the survival of the species throughout its range.

16.4: Develop and promote guidelines and provide incentives for landowners and users to reduce the impact of current

land use practices on the species outside reserves.

16.5: Continue and expand programs for community awareness within the species' known range.

16.6: Encourage captive breeding program for re-introduction of the species into reserves within its known range.

Most of these actions recommended by Coulson (1990) and adopted in the Victorian Action Statement (Webster *et al.*, 1992).

17. Organisations responsible for conservation of species and individuals involved: Australian Capital Territory Parks and Conservation Service (Kruno Kukolic, Will Osborne); New South Wales National Parks and Wildlife Service; Victorian Department of Conservation and Natural Resources (Peter Robertson, Alan Webster, Rob Humphries); South Australian Department of Environment and Land Management.

18. Other organisations and individuals involved: Graeme Coulson (University of Melbourne); John Coventry (Museum of Victoria); Chris Banks (Melbourne Zoo); Alex Kutt (Biosis Research).

19. Can recovery plan be carried out with existing resources?: No, although some responsible agencies are already directing some of their resources into recovery activities; for example, VDCNR's resource costing estimates over 10 year period are $121,000 (Alan Webster, *in. litt.*).

1:	Survey of geographic range, habitat preferences and occurrence in reserves: 2 workers for 4 months each year for 2 years - $53,333 salary; $26,667 expenses.	**$80K**
2:	Research into basic biology and ecology, including assessment of threatening processes: 1 worker for 6 months each year for 2 years - $40,000 salary; $20,000 expenses.	**$60K**
3:	Preparation of management strategies: 1 worker for 3 months - $10,000 salary; $2,000 expenses.	**$12K**
4:	Establishment of captive breeding program: 1 worker for 2 months each year for 2 years - $13,333 salary; $2,667 expenses.	**$16K**
5:	Purchase of land for the reserve system: uncosted.	
		Total $168K

20. Remarks: 89 specimens documented in Australian museum collections. 405 individuals recorded in survey of 56 sites in the ACT between 1990 and 1992 (Kukolic, in prep.). 124 specimen and observation records in the Atlas of Victorian Wildlife in 1991 (Peter Robertson, pers. comm.).

References:

ACT Parks and Conservation Service Wildlife Research Unit. 1991. Lowland native grassland communities in the Australian Capital Territory and region: a recovery plan. Unpublished report to the ANPWS Endangered Species Unit.

ACT Parks and Conservation Service Wildlife Research Unit. 1992. Recovery Plan. Lowland native grassland ecosystems in the Australian Capital Territory. Progress report to the ANPWS Endangered Species Unit.

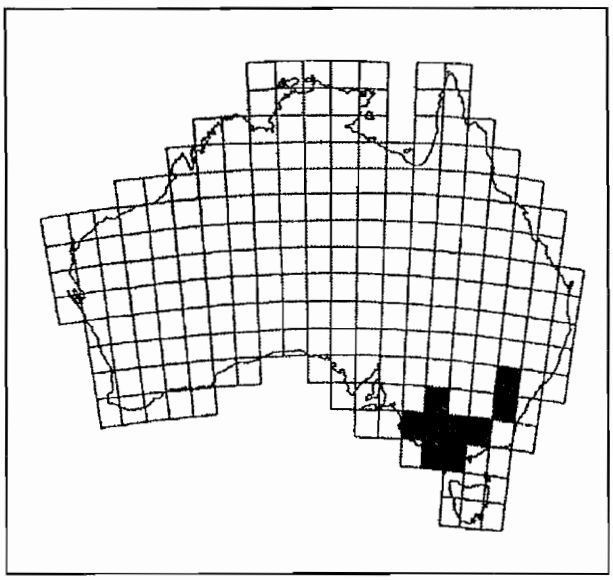
Coulson, G. 1990. Conservation biology of the Striped Legless Lizard (*Delma impar*); an initial investigation. Arthur Rylah Institute for Environmental Research Technical Report Series 106: i-viii + 1-40.

Kukolic, K. and Osborne, W.S. 1992. *Delma impar* (Striped Legless Lizard). pp. 23-27 *in* Recovery Plan: lowland native grassland ecosystems in the Australian Capital Territory. Unpublished progress report to the Australian National Parks and Wildlife Service Endangered Species Unit. Wildlife Research Unit, ACT Parks & Conservation Service.

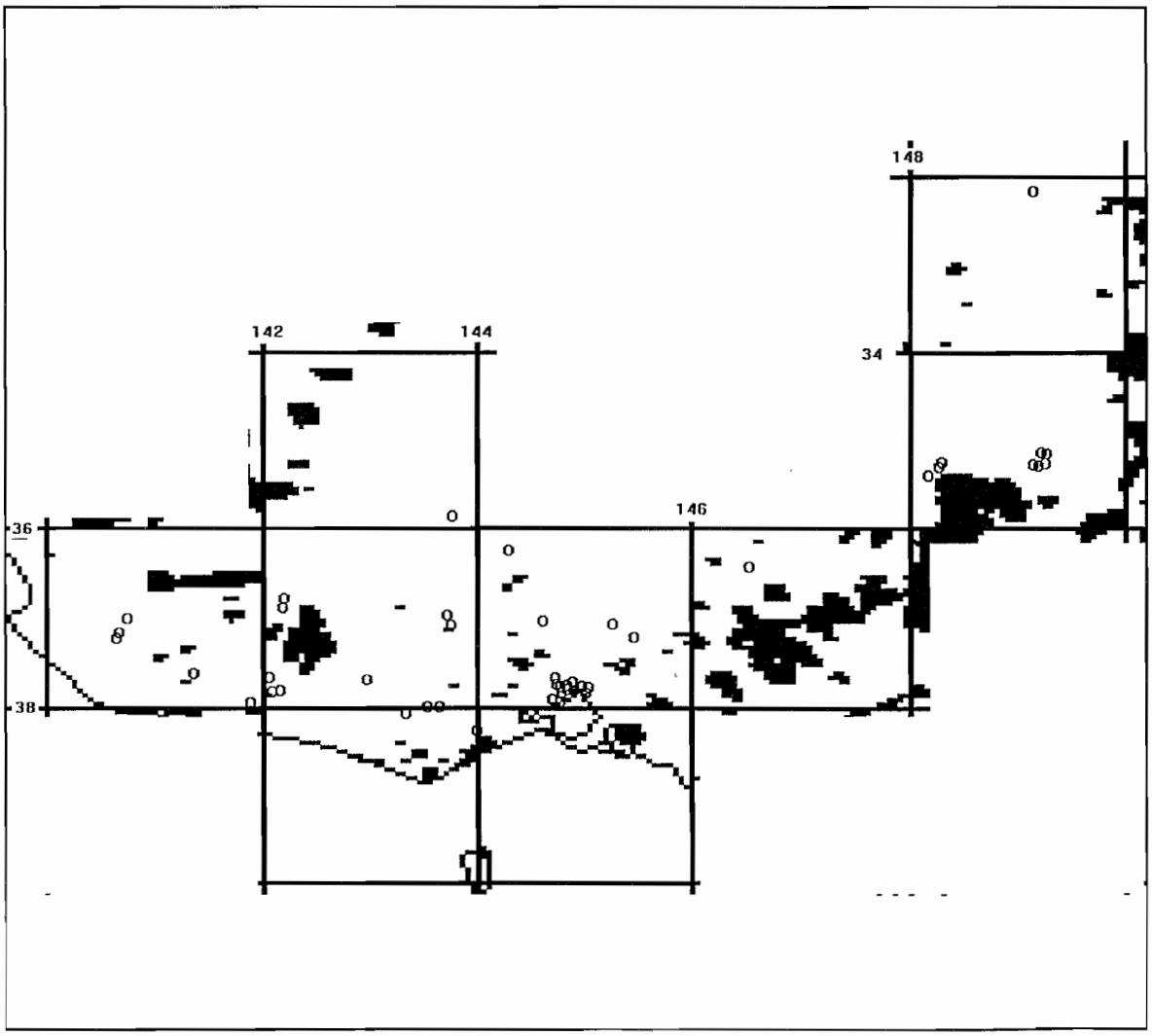
Robertson, P., Bennett, A.F., Lumsden, L.F., Silveira, C.E., Johnson, P.G., Yen, A.L., Milledge, G.A., Lillywhite, P.K. and Pribble, H.J. 1989. Fauna of the mallee study area north-western Victoria. Arthur Rylah Institute Technical Report No. 87: 1-91.

Webster, A., Fallu, R. and Preece, K. 1992. Action Statement 17: Striped Legless Lizard, *Delma impar*. Victorian Department of Conservation and Environment, East Melbourne. 8 pp.

Williams, K. and Kukolic, K. 1991. Fauna of the ACT's native grasslands. pp. 11-19 *in* R. Falconer (ed.) The ACT's Native Grasslands. Proceedings of a workshop. Conservation Council of the South-east Region and Canberra.



Distribution of *Delma impar*



1. **Family**: Pygopodidae

2. **Scientific Name**: *Delma labialis* Shea, 1987

3. **English Name**: Striped-tailed Delma

4. **Infraspecific taxa**: None

5. **Species survival status**: Vulnerable.

6. **Former distribution**: Not known to have differed from current distribution.

7. **Current distribution**: Magnetic Island north of Townsville, north Queensland and a few localities on the mainland near Townsville.

8. **Habitat**: Tall open forest, open forest, open woodland.

Holotype from north of Townsville found in low open forest with a grassy understorey; on Magnetic Island found in wet sclerophyll forest and open woodland in sites close to the beach. One individual found in litter and another under sheets of iron; two were active during the day.

9. **Reasons for decline**: Probably a combination of factors, including overgrazing by stock, clearance of habitat for agriculture and urbanisation, disturbance by frequent visitation. Magnetic Island is a popular tourist destination and "clearing for real estate and farming" (Keith McDonald, *in litt.*) is likely to threaten the population of *Delma labialis* there and on the mainland.

10. **Conservation reserves on which species occurs**: Townsville Town Common Environmental Park, Magnetic Island National Park.

10A. **Other conservation reserves where species might be expected to occur**: Bowling Green Bay NP, Cape Upstart NP, Mount Spec/Crystal Creek NP.

11. **Other public land on which species occurs**: None known.

12. **Other land on which species occurs**: Potentially present in suitable habitat on private properties on Magnetic Island and in the vicinity of Townsville.

13. **Is knowledge about species adequate for objectives and actions to be defined accurately?**: No.

13.1: Ground surveys need to be conducted to determine the full geographic range of the species, its habitat preferences, and the extent of its occurrence in existing reserves.

13.2: Research is needed into the basic biology and ecology of the species in the field; it should include long term monitoring of changes in population size, habitat use and geographic range.

13.3: Research is needed to document the extent of the species' decline and to identify the major factors contributing to that decline.

14. **Recovery Plan objectives**:

14.1: To obtain sufficient information on the species' biology, ecology and distribution to determine its current conservation status and formulate appropriate management strategies.

14.2: To ensure that secure, viable populations of the species are maintained within a reserve system.

14.3: To implement land management practices which promote the maintenance of secure, viable populations of the species outside reserves.

15. **Management actions already initiated**:

15.1: Listed on Schedule 1 of the Commonwealth's *Endangered Species Protection Act 1992*.

16. **Management actions required**:

16.1: Survey known and potential habitat in reserves within the species' known range.

16.2: Survey known habitat outside reserves within the species' known range.

16.3: Establish appropriate reserves if the existing reserve system is found to be inadequate to secure the survival of the species.

16.4: Develop and promote guidelines and

provide incentives for landowners and tourism operators to reduce the impact of current land use practices on the species outside reserves.

16.5: Develop community awareness within the species' known range.

17. Organisations responsible for conservation of species and individuals involved: Queensland Department of Environment and Heritage (Keith McDonald).

18. Other organisations and individuals involved: Glenn Shea (University of Sydney).

19. Can recovery plan be carried out with existing resources?: No.

1: Survey of geographic range, habitat preferences and occurrence in reserves: 2 workers for 2 months each year for 2 years - $26,667 salary; $13,333 expenses. **$40K**

2: Research into basic biology and ecology, including assessment of threatening processes: 1 worker for 4 months each year for 2 years - $26,667 salary; $13,333 expenses. **$40K**

3: Preparation of management strategies: 1 worker for 3 months - $10,000 salary; $2,000 expenses. **$12K**

Total $92K

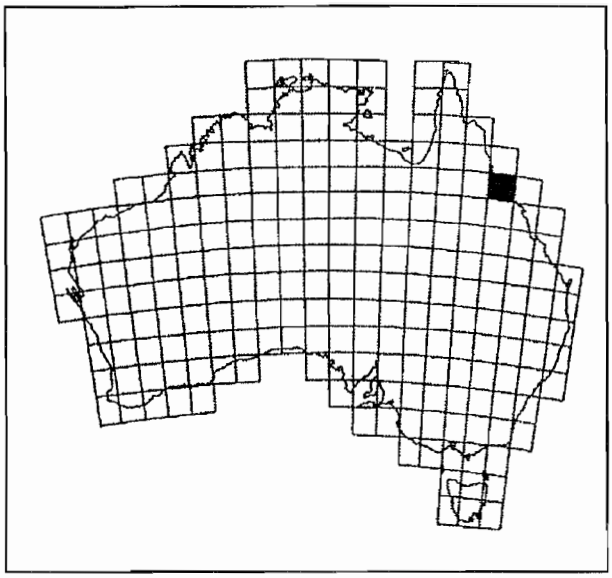
20. Remarks: Eight specimens documented in Australian museum collections; 4 additional individuals have been photographed and/or observed in the field (Shea, 1987).

References:

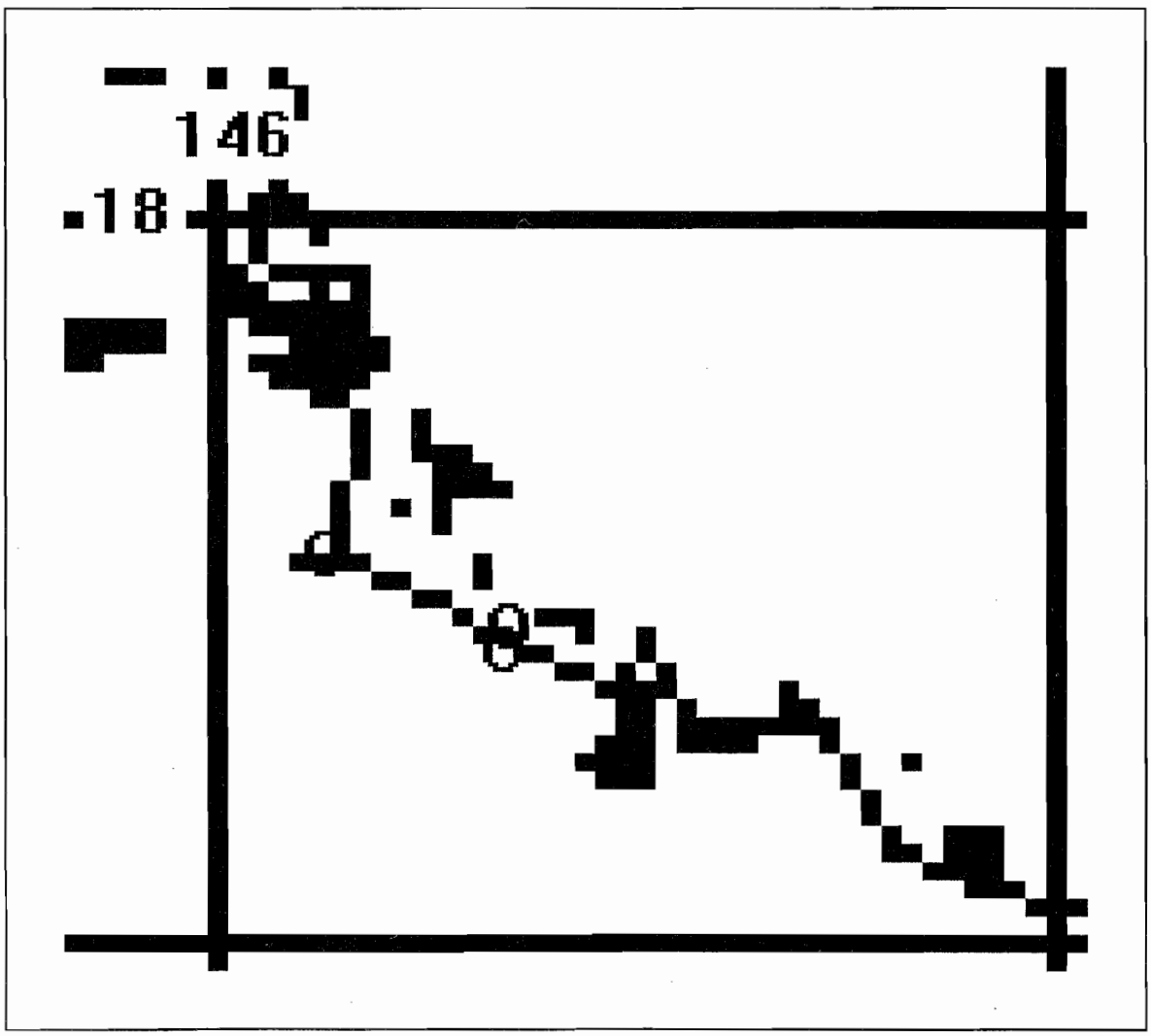
Low, T. 1978. The reptiles of Magnetic Island, nth Queensland. Herpetofauna 9(2): 10-14.

McDonald, K.R., Covacevich, J.A., Ingram, G.J. and Couper, P.J. 1991. The status of frogs and reptiles. pp. 338-345 in G.J. Ingram and R.J. Raven (eds) An Atlas of Queensland's Frogs, Reptiles, Birds and Mammals. Queensland Museum, Brisbane.

Shea, G.M. 1987. Two new species of *Delma* (Lacertilia: Pygopodidae) from north-eastern Queensland and a note on the status of the genus *Aclys*. Proceedings of the Linnean Society of NSW 109(3): 203-212.



Distribution of *Delma labialis*



1. Family:	Pygopodidae
2. Scientific Name:	*Delma torquata* Kluge, 1974
3. English Name:	Collared Delma

4. Infraspecific taxa: None

5. Species survival status: Vulnerable.

6. Former distribution: "south-eastern Queensland, from Ulam [near Rockhampton] in the north to Kenmore in the south" (Kluge, 1974); the Ulam record may have represented an isolated population some distance north of the range of the main population (Glenn Shea, pers. comm.).

7. Current distribution: Based on recent museum records, northern limit of range may have contracted to Gympie; in the Brisbane region, restricted to the outer western suburbs.

8. Habitat: Open woodland.

Found on rocky hillsides on basalt and lateritic soils supporting scattered eucalypts and shrubs with a grassy understorey; also reported from eucalypt woodland adjacent to semi-evergreen vine thicket (Wilson and Knowles, 1988).

9. Reasons for decline: Probably a combination of factors, including overgrazing by stock, clearance of habitat for agriculture and grazing, pasture improvement and urban development.

This species has a restricted distribution in an area of high human impact; much of its habitat has been lost to land clearance for pastoralism and urbanisation (McDonald et al, 1991). The holotype was collected on the "spur of a small grassy hill where cattle had been grazing. Most of the trees (gums) had been dozed over and heaped" (Low, in Kluge, 1974).

10. Conservation reserves on which species occurs: Crows Nest NP, Bunya Mountains NP. There is little habitat suitable for the species within these parks and it is not known if it still occurs there (Rob Porter, *in litt.*).

10A. Other conservation reserves where species might be expected to occur: Conondale NP.

11. Other public land on which species occurs: Brisbane City Council water catchment reserve in the vicinity of Mount Crosby.

12. Other land on which species occurs: Private properties within the suburbs of Mount Crosby and Karana Downs; potentially present in suitable habitat on private properties throughout the species' range.

13. Is knowledge about species adequate for objectives and actions to be defined accurately?: No.

13.1: Ground surveys need to be conducted to determine the full geographic range of the species, its habitat preferences, and the extent of its occurrence in existing reserves.

13.2: Research is needed into the basic biology and ecology of the species in the field; it should include long term monitoring of changes in population size, habitat use and geographic range.

13.3: Research is needed to document the extent of the species' decline and to identify the major factors contributing to that decline.

14. Recovery Plan objectives:

14.1: To obtain sufficient information on the species' biology, ecology and distribution to determine its current conservation status and formulate appropriate management strategies.

14.2: To ensure that secure, viable populations of the species are maintained within a reserve system.

14.3: To implement land management practices which promote the maintenance of secure, viable populations of the species outside reserves.

15. Management actions already initiated:

15.1: Listed on Schedule 1 of the

Commonwealth's *Endangered Species Protection Act 1992*.

15.2: Recovery plan prepared by QDEH.

15.3: Field study of population at Mount Crosby commenced by Lone Pine Koala Sanctuary, which proposes to undertake a captive breeding program after it has developed suitable techniques using two analogous species

15.4: The Sanctuary has also initiated a community media program to promote public awareness of the species and it is hoped, to lead to the identification of other locations where it occurs.

16. Management actions required:

16.1: Survey known and potential habitat in reserves within the species' known range.

16.2: Survey known habitat outside reserves within the species' known range.

16.3: Establish appropriate reserves if the existing reserve system is found to be inadequate to secure the survival of the species.

16.4: Develop and promote guidelines for landowners and users to reduce the impact of current land use practices on the species outside reserves.

16.5: Continue to develop community awareness within the species' known range.

16.6: Encourage captive breeding program for re-introduction of the species into reserves within its known range.

17. Organisations responsible for conservation of species and individuals involved: Queensland Department of Environment and Heritage.

18. Other organisations and individuals involved: Rob Porter (Lone Pine Koala Sanctuary).

19. Can recovery plan be carried out with existing resources?: No.

1: Survey of geographic range, habitat preferences and occurrence in reserves: 2 workers for 2 months each year for 2 years - $26,667 salary; $13,333 expenses. **$40K**

2: Research into basic biology and ecology, including assessment of threatening processes: 1 worker for 4 months each year for 2 years - $26,667 salary; $13,333 expenses. **$40K**

3: Preparation of management strategies: 1 worker for 3 months - $10,000 salary; $2,000 expenses. **$12K**

4: Establishment of captive breeding program: 1 worker for 2 months each year for 2 years - $13,333 salary; $2,667 expenses. **$16K**

Total $108K

20. Remarks: 14 specimens documented in Australian museum collections. Up to 10 individuals are being found on each visit to the Mount Crosby area by the Lone Pine staff (Rob Porter, *in litt.*).

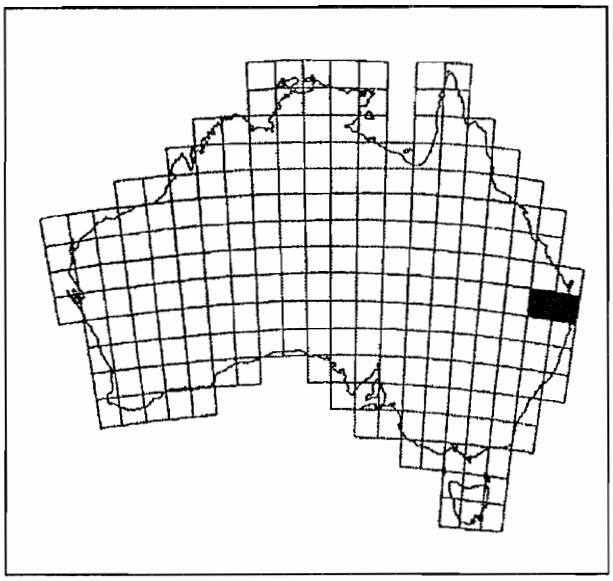
References:

Ehmann, H.F.W. 1992. Encyclopedia of Australian Animals: Reptiles. Australian Museum with Angus and Robertson, Sydney. xv + 495 pp.

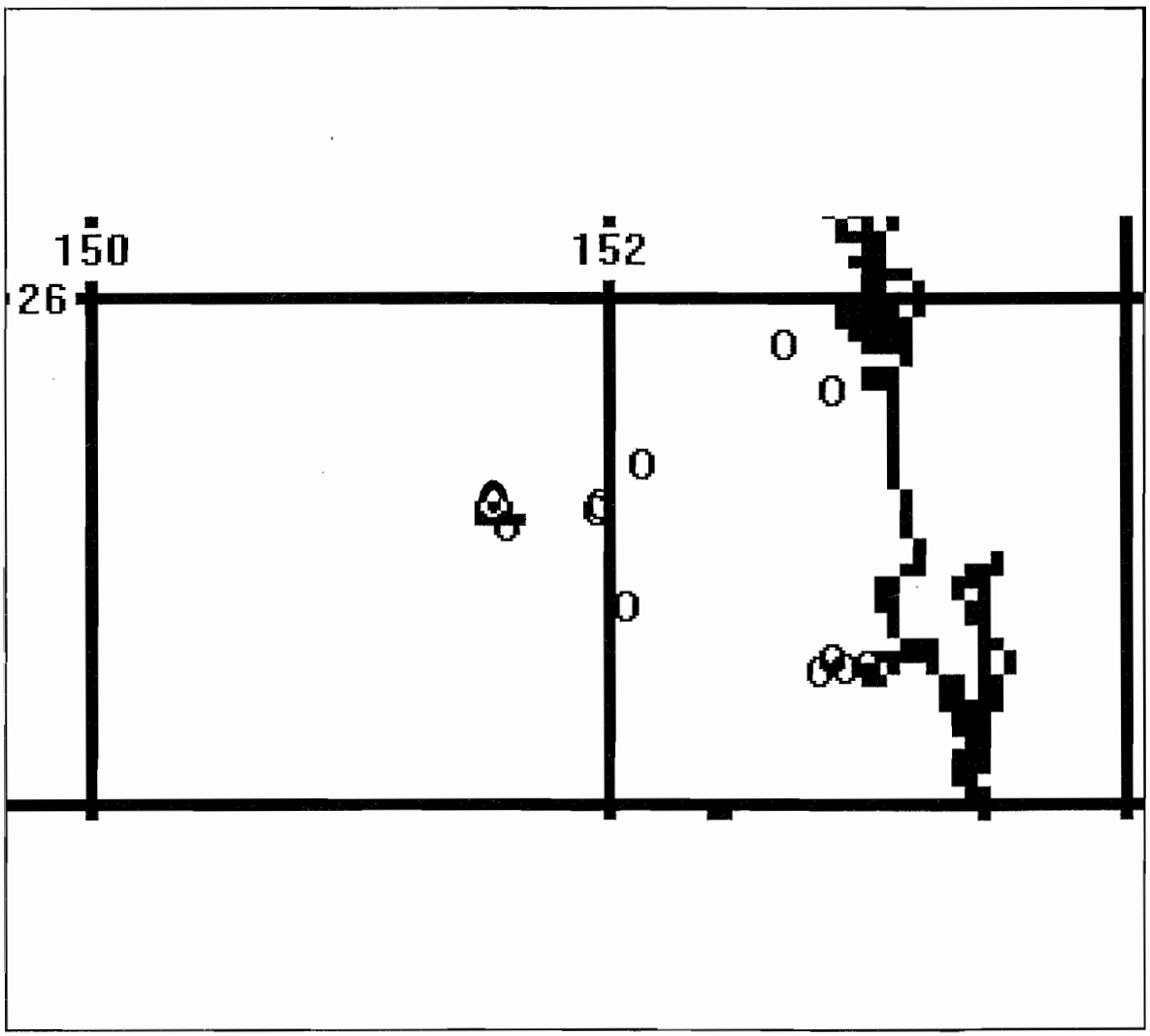
Kluge, A.G. 1974. A taxonomic revision of the lizard family Pygopodidae. Miscellaneous Publications of the Museum of Zoology, University of Michigan 147: i-vi + 1-221.

McDonald, K.R., Covacevich, J.A., Ingram, G.J. and Couper, P.J. 1991. The status of frogs and reptiles. pp. 338-345 in G.J. Ingram and R.J. Raven (eds) An Atlas of Queensland's Frogs, Reptiles, Birds and Mammals. Queensland Museum, Brisbane.

Wilson, S.K. and Knowles, D.G. 1988. Australia's Reptiles; a photographic reference to the terrestrial reptiles of Australia. Collins Publishers, Australia. 447 pp.



Distribution of *Delma torquata*



1. Family:	Pygopodidae
2. Scientific Name:	*Ophidiocephalus taeniatus* Lucas and Frost, 1897
3. English Name:	Bronzeback Snake-lizard

4. Infraspecific taxa: None

5. Species survival status: Vulnerable.

6. Former distribution: Southern Northern Territory and adjacent regions of South Australia, as far south as Coober Pedy. Original specimen collected in the 1890s from the vicinity of Charlotte Waters, in the far south of the Northern Territory just west of the Simpson Desert, but it has not since been recorded in the Northern Territory. The population at Abminga appears to have undergone a severe decline in the late 1980s (Ehmann, 1992).

7. Current distribution: Watercourse country of northern South Australia, from Abminga on the Northern Territory border to Coober Pedy. May extend throughout the drainage basins of the Finke River and the western watershed of Lake Eyre (Ehmann, 1981). Last recorded in 1986, in Breakaways Reserve 25 km north-north-west of Coober Pedy, South Australia (Hutchinson, 1992). There are anecdotal reports of its occurrence in the George Gill Ranges in the Northern Territory (Nick Gambold, *in litt.*).

8. Habitat: Open woodland.

Found along temporary watercourses lined by Gidgee (*Acacia cambagei*) open woodland with a low open shrub understorey; microhabitat is deep leaf litter and loose sandy loam soil overlying well-drained deep cracking clays, at the base of trees or chenopod shrubs.

9. Reasons for decline: Not known to have declined, but has only been recorded from four scattered localities and it is vulnerable to a number of threats including overgrazing by cattle, grazing by rabbits, soil compaction and erosion, loss of litter, and possibly also severe flooding.

Present patchy distribution may be natural or due to past habitat modification by cattle which compact the soil and disperse litter by trampling; such damage is obvious only near permanent water and under shade trees. Severe flooding, resulting in the scouring of loose surface layers and elsewhere in the deposition of compacted silt or pebbles over the litter "blanket", may have adversely affected the Abminga population (Ehmann, 1992). However, it "is possible that severe local population fluctuations are a normal part of the ecology of the Bronzeback" (Ehmann, *op. cit.*).

10. Conservation reserves on which species occurs: South Australia: Breakaways Reserve.

10A. Other conservation reserves where species might be expected to occur: South Australia: Witjira NP.

11. Other public land on which species occurs: None known.

12. Other land on which species occurs: Grazing leases in the Abminga area and mining leases and township gardens in Coober Pedy; potentially present in suitable habitat on private properties throughout the species' range.

13. Is knowledge about species adequate for objectives and actions to be defined accurately?: No.

13.1: Ground surveys need to be conducted to determine the full geographic range of the species and the extent of its occurrence in existing reserves.

13.2: Research is needed into the basic biology and ecology of the species in the field; it should include long term monitoring of changes in population size, habitat use and geographic range.

13.3: Research is needed to determine if the species is declining and if so, to identify the major factors contributing to that decline.

14. Recovery Plan objectives:

14.1: To obtain sufficient information on the species' biology, ecology and distribution

to determine its current conservation status and formulate appropriate management strategies.

14.2: To ensure that secure, viable populations of the species are maintained within a reserve system.

14.3: To implement land management practices which promote the maintenance of secure, viable populations of the species outside reserves.

15. Management actions already initiated:

15.1: Listed on Schedule 1 of the Commonwealth's *Endangered Species Protection Act 1992* and listed as "endangered" on the 1991 Schedule of the *SA National Parks and Wildlife Act 1972.*

16. Management actions required:

16.1: Survey known and potential habitat in reserves within the species' known range.

16.2: Survey known habitat outside reserves within the species' known range.

16.3: Establish appropriate reserves or extend boundaries of Witjira NP if the existing reserve system is found to be inadequate to secure the survival of the species.

16.4: Develop guidelines and provide incentives to landowners to protect the habitat of a suite of vertebrates (including *Ophidiocephalus taeniatus*) outside reserves. Adopt a species with a higher profile eg a mammal, to promote the guidelines (Dave Gibson, *in litt.*).

16.5: Develop community awareness within the species' known range.

16.6: Implement control program for rabbits if they are demonstrated to have an adverse effect on the species through destruction of habitat.

17. Organisations responsible for conservation of species and individuals involved: Conservation Commission of the Northern Territory, South Australian Department of Environment and Land Management.

18. Other organisations and individuals involved: Harald Ehmann (Sydney Institute of Technology).

19. Can recovery plan be carried out with existing resources?: No.

1: Survey of geographic range, habitat preferences and occurrence in reserves: 2 workers for 2 months each year for 2 years - $26,667 salary; $20,000 expenses (1.5 x standard expenses for remote region). **$46.667K**

2: Research into basic biology and ecology, including assessment of threatening processes: 1 worker for 4 months each year for 2 years - $26,667 salary; $20,000 expenses (1.5 x standard expenses for remote region). **$46.667k**

3: Preparation of management strategies: 1 worker for 3 months - $10,000 salary; $2,000 expenses. **$12K**

4: Purchase of land for the reserve system: uncosted.

Total $105.3K

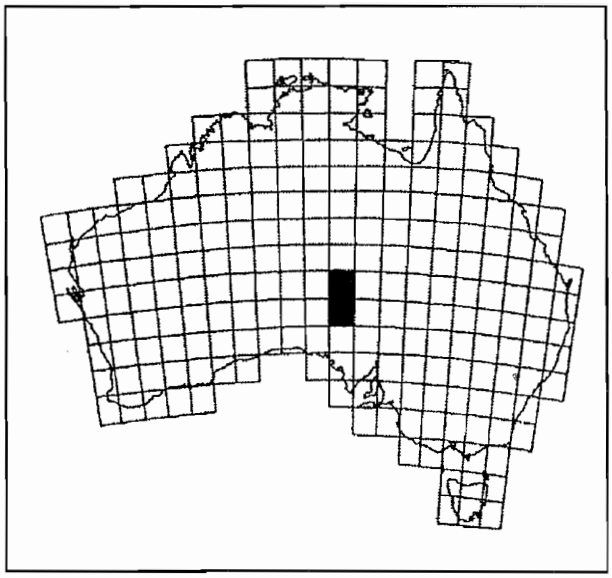
20. Remarks: 14 specimens documented in Australian museum collections. Field observations made on over 50 individuals in the Abminga region in the late 1970s by Harald Ehmann and colleagues.

References:

Ehmann, H.F.W. 1981. The natural history and conservation of the bronzeback (*Ophidiocephalus taeniatus* Lucas and Frost) (Lacertilia, Pygopodidae). pp.7-13 in C.B. Banks and A.A. Martin (eds) Proceedings of the Melbourne Herpetological Symposium, 1980. Zoological Board of Victoria, Melbourne.

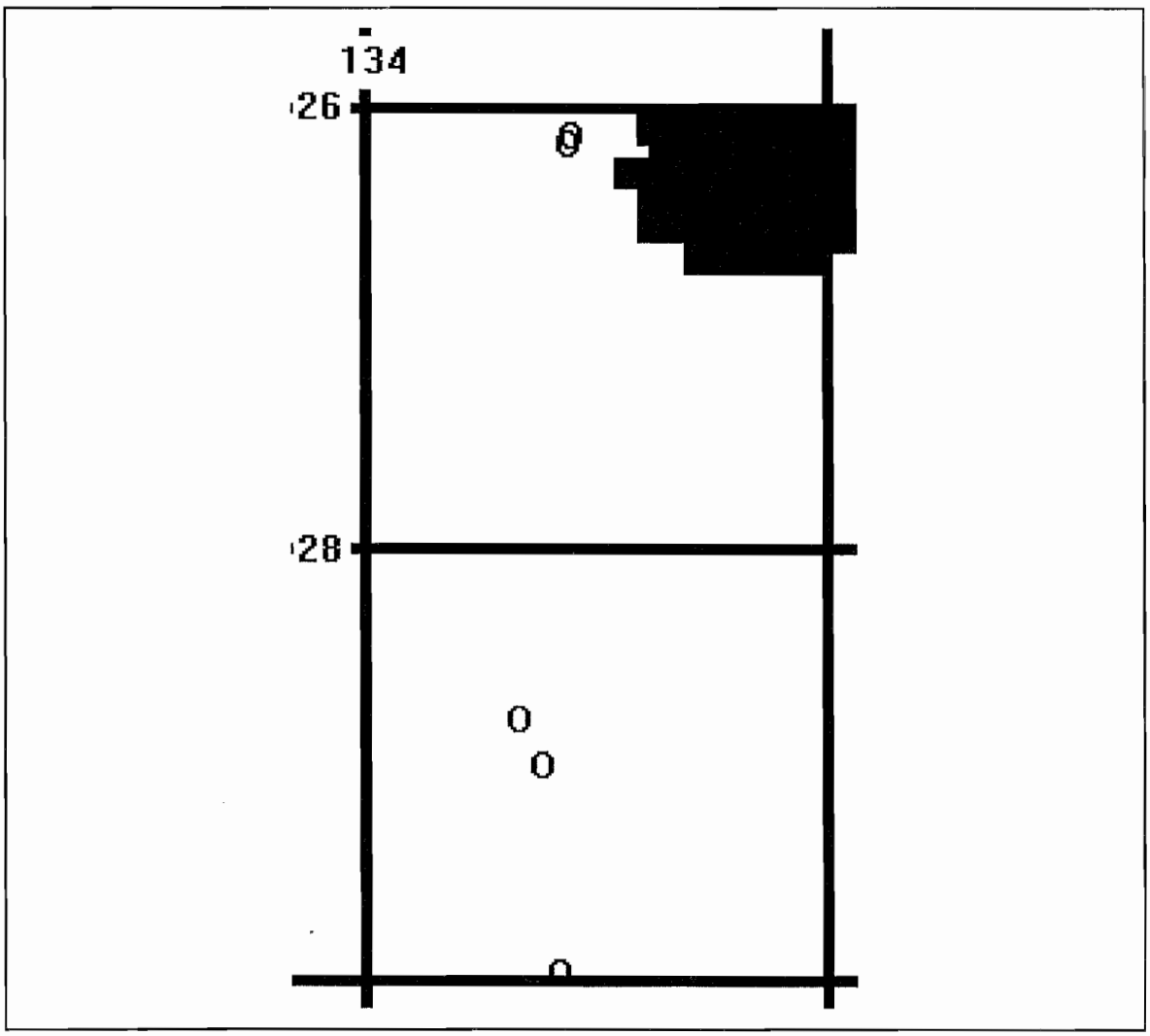
Ehmann, H.F.W. 1992. The apparent severe decline of the bronzeback legless lizard (*Ophidiocephalus taeniatus*) at Abminga. Herpetofauna 22(1): 31-33.

Hutchinson, M.N. 1992. Threatened reptiles in South Australia. Section 7 *in* S.P. Tay (ed.) Threatened species and habitats in South Australia: a catalyst for community action. South Australian Advisory Committee on Threatened Species, Adelaide.



Distribution of

Ophidiocephalus taeniatus



1. Family:	Pygopodidae
2. Scientific Name:	*Paradelma orientalis* (Günther, 1876)
3. English Name:	Brigalow Scaly-foot

4. Infraspecific taxa: None

5. Species survival status: Vulnerable.

6. Former distribution: Not known to have differed from current distribution.

7. Current distribution: The Brigalow Belt east of the Great Dividing Range in south-central Queensland. There is a concentration of museum specimens from the Moura and Cracow areas and it occurs at some localities (including Boyne Island) on the east coast near Gladstone.

8. Habitat: Open forest, woodland.

Found in remnant Brigalow (*Acacia harpophylla*) forest or eucalypt woodland with an understorey of Brigalow and sparse tussock grass ground cover, on grey cracking clay soils. Also found on sandstone ridges (Wilson and Knowles, 1988) and in *Acacia falciformis* woodland with a deep leaf litter layer, on Boyne Island (Peter Tremul, pers. comm.).

9. Reasons for decline: Probably a combination of factors including overgrazing by cattle, clearance of habitat for agriculture and cattle grazing, pasture improvement, crop production and native forest logging.

Much of the Brigalow Belt has been cleared for agriculture and pastoralism and only about 0.5% is conserved in reserves (McDonald *et al.*, 1991).

10. Conservation reserves on which species occurs: Queensland: Carnarvon NP (as Salvator Rosa NP).

10A. Other conservation reserves where species might be expected to occur: Castle Tower NP, Deepwater NP, Expedition Range NP (including the former Robinson's Gorge NP), Eurimbula NP, Isla Gorge NP, Nuga Nuga NP, Palm Grove NP, Precipice NP, Rundle Range NP.

11. Other public land on which species occurs: Coominglah SF (near the Rockhole), Dunmore SF, roadside reserve near Moura, Lily Hills Crown Land Reserve (Boyne Island).

12. Other land on which species occurs: Queensland: Wandoo Station near Moura, Kolonia Station near Wandoan, Golden Plateau via Cracow, Nathan Gorge between Cracow and Taroom; potentially present in suitable habitat on private properties throughout the species' range.

13. Is knowledge about species adequate for objectives and actions to be defined accurately?: No.

13.1: Ground surveys need to be conducted to determine the full geographic range of the species, its habitat preferences, and the extent of its occurrence in existing reserves.

13.2: Research is needed into the basic biology and ecology of the species in the field; it should include long term monitoring of changes in population size, habitat use and geographic range.

13.3: Research is needed to document the extent of the species' decline and to identify the major factors contributing to that decline.

14. Recovery Plan objectives:

14.1: To obtain sufficient information on the species' biology, ecology and distribution to determine its current conservation status and formulate appropriate management strategies.

14.2: To ensure that secure, viable populations of the species are maintained within a reserve system.

14.3: To implement land management practices which promote the maintenance of secure, viable populations of the species outside reserves.

15. Management actions already initiated: None known.

16. Management actions required:

16.1: Survey known and potential habitat in reserves within the species' known range.

16.2: Survey known habitat outside reserves within the species' known range.

16.3: Establish appropriate reserves if the existing reserve system is found to be inadequate to secure the survival of the species.

16.4: Develop and promote guidelines and provide incentives for landowners and users to reduce the impact of current land use practices on the species outside reserves.

16.5: Develop community awareness within the species' known range.

16.6: If *Acacia* shrubland characteristic of regeneration is demonstrated to be a significant habitat, develop a fire regime which maintains such habitat.

17. Organisations responsible for conservation of species and individuals involved: Queensland Department of Environment and Heritage.

18. Other organisations and individuals involved: Peter Robertson (Arthur Rylah Institute), Peter Tremul (Boyne Island), Steve Wilson (Queensland Museum).

19. Can recovery plan be carried out with existing resources?: No.

1: Survey of geographic range, habitat preferences and occurrence in reserves: 2 workers for 2 months each year for 2 years - $26,667 salary; $13,333 expenses. **$40K**

2: Research into basic biology and ecology, including assessment of threatening processes: 1 worker for 4 months each year for 2 years - $26,667 salary; $13,333 expenses. **$40K**

3: Preparation of management strategies: 1 worker for 3 months - $10,000 salary; $2,000 expenses. **$12K**

Total $92K

20. Remarks: 18 specimens documented in Australian museum collections.

This species has some unusual patterns of behaviour for a pygopodid: plant exudates appear to be an important component of its diet - it has been regularly observed licking sap from *Acacia* trunks (Peter Tremul, pers. comm.), it is almost exclusively nocturnal, and it is very slow-moving (Shea, 1987).

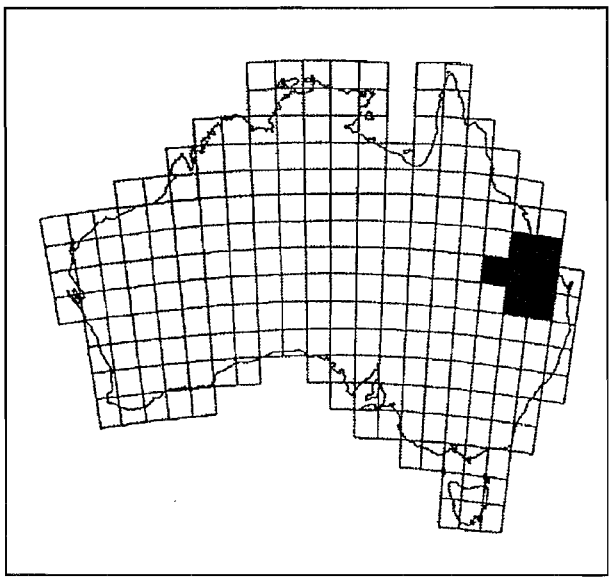
References:

McDonald, K.R., Covacevich, J.A., Ingram, G.J. and Couper, P.J. 1991. The status of frogs and reptiles. pp. 338-345 in G.J. Ingram and R.J. Raven (eds) An Atlas of Queensland's Frogs, Reptiles, Birds and Mammals. Queensland Museum, Brisbane.

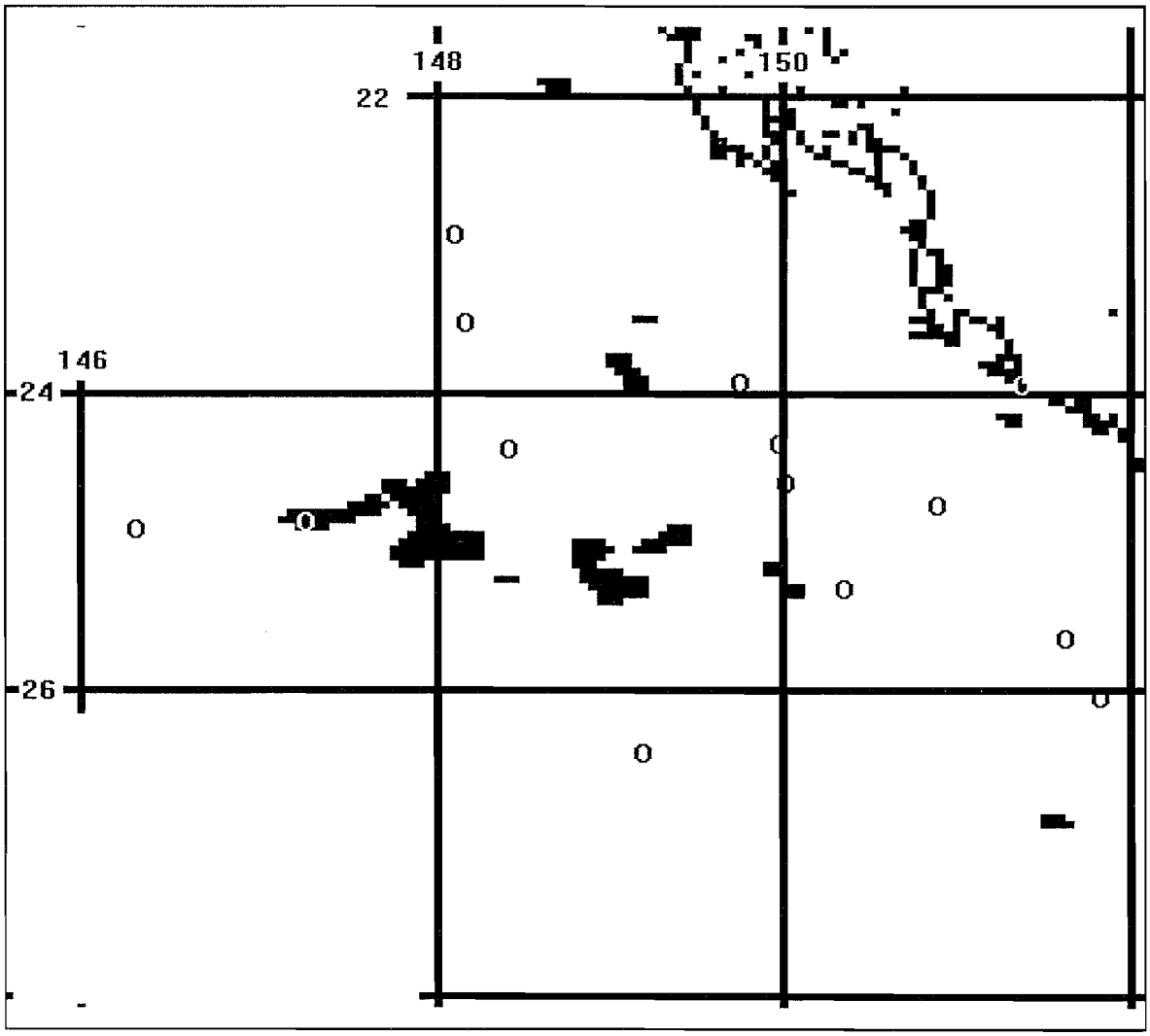
Robertson, P. and Tremul, P. in prep. Feeding behaviour of *Paradelma orientalis*. For submission to Herpetofauna.

Shea, G. M. (1987). Notes on the biology of *Paradelma orientalis*. Herpetofauna 17(1): 5-6.

Wilson, S.K. and Knowles, D.G. 1988. Australia's Reptiles; a photographic reference to the terrestrial reptiles of Australia. Collins Publishers, Australia. 447 pp.



Distribution of *Paradelma orientalis*



1. Family:	Agamidae
2. Scientific Name:	*Ctenophorus yinnietharra* (Storr, 1981) [also appears in the literature as *Amphibolurus yinnietharra*]
3. English Name:	Yinnietharra Rock Dragon

4. Infraspecific taxa: None

5. Species survival status: Vulnerable

6. Former distribution: Not known to have differed from current distribution.

7. Current distribution: Within an area of approximately 35 km^2 around the Gascoyne River on Yinnietharra Station, east of Carnarvon, Western Australia. Only recorded at two localities within this area.

8. Habitat: Tall open shrubland.

Inhabits granite outcrops separated by stony flats supporting sparse *Acacia* shrubs. Appears to be restricted to rocks of one origin - Archaean gneissic biotite granites and granodiorite - whilst nearby outcrops of Early Proterozoic migmatite are inhabited by a different dragon species, *Ctenophorus caudicinctus*. Has been found beneath exfoliating granite, in burrows under granite boulders, and in a hollow *Acacia* log.

9. Reasons for decline: Not known to have declined, but the occurrence of this species in small, isolated populations makes it vulnerable to pressure from pastoral activities, especially grazing by cattle.

10. Conservation reserves on which species occurs: None known.

10A. Other conservation reserves where species might be expected to occur: None.

11. Other public land on which species occurs: None known.

12. Other land on which species occurs: Yinnietharra Station.

13. Is knowledge about species adequate for objectives and actions to be defined accurately?: No.

13.1: Ground surveys need to be conducted to determine the full geographic range of the species, its habitat preferences, and the extent of its occurrence in existing reserves.

13.2: Research is needed into the basic biology and ecology of the species in the field; it should include long term monitoring of changes in population size, habitat use and geographic range.

13.3: Research is needed to determine if the species is declining and if so, to identify the major factors contributing to that decline.

14. Recovery Plan objectives:

14.1: To obtain sufficient information on the species' biology, ecology and distribution to determine its current conservation status and formulate appropriate management strategies.

14.2: To ensure that secure, viable populations of the species are maintained within a reserve system.

14.3: To implement land management practices which promote the maintenance of secure, viable populations of the species outside reserves.

15. Management actions already initiated:

15.1: Listed on Schedule 1 of the Commonwealth's *Endangered Species Protection Act 1992* and listed as "endangered" on the 1990 Schedule of the *WA Wildlife Conservation Act 1950*.

16. Management actions required:

16.1: Survey known and potential habitat within the species' known range.

16.2: Develop and promote guidelines and provide incentives for landowners and users to reduce the impact of current land use practices on the species outside reserves.

16.3: Establish appropriate reserves.
16.4: Develop community awareness within the species' known range.

17. Organisations responsible for conservation of species and individuals involved: Western Australian Department of Conservation and Land Management (Andrew Burbidge).

18. Other organisations and individuals involved: Magnus Peterson (Perth).

19. Can recovery plan be carried out with existing resources?: No.

1: Survey of geographic range, habitat preferences and occurrence in reserves: 2 workers for 1 month each for 2 years - $13,333 salary; $10,000 expenses (1.5 x standard expenses for remote region). **$23.333K**

2: Research into basic biology and ecology, including assessment of threatening processes: 1 worker for 6 months each year for 2 years - $40,000 salary; $30,000 expenses (1.5 x standard expenses for remote region). **$70K**

3: Preparation of management strategies: 1 worker for 3 months - $10,000 salary; $2,000 expenses. **$12K**

4: Purchase of land for the reserve system: uncosted.

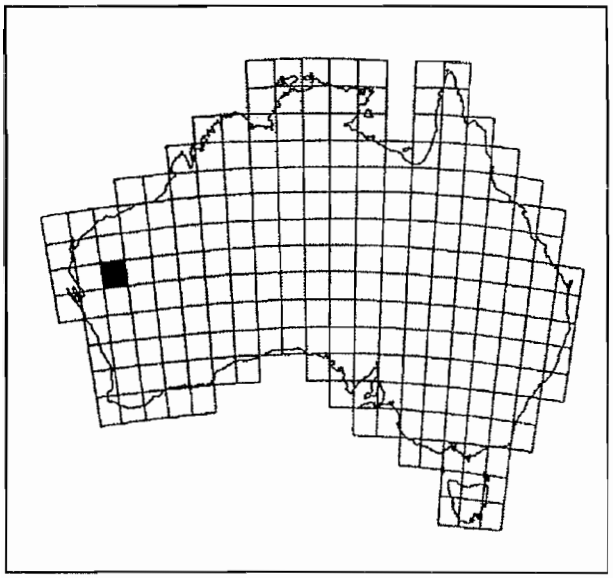
Total $105.3K

20. Remarks: 19 specimens documented in Australian museum collections, collected between 1974 and 1984. Based on the occurrence of suitable rock outcrops within the range of this species, the population may be no larger than 300 individuals (Magnus Peterson, pers. comm.).

References:

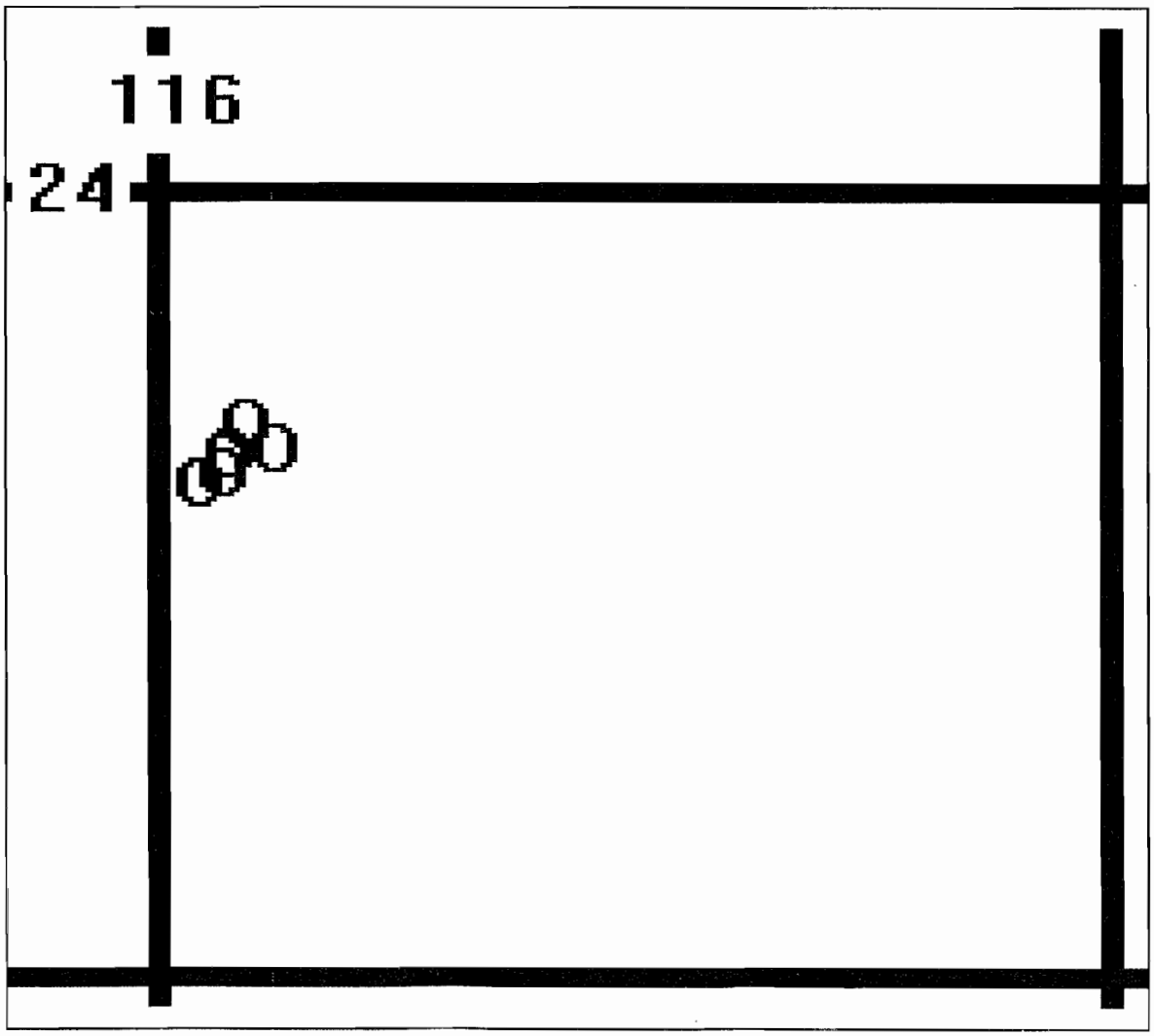
Storr, G.M. 1981. Three new agamid lizards from Western Australia. Records of the Western Australian Museum 8(4): 599-607.

Wilson, S.K. and Knowles, D.G. 1988. Australia's Reptiles; a photographic reference to the terrestrial reptiles of Australia. Collins Publishers, Australia. 447 pp.



Distribution of

Ctenophorus yinnietharra



1. Family:	Agamidae
2. Scientific Name:	*Tympanocryptis lineata pinguicolla* Mitchell, 1948
3. English Name:	South-eastern Lined Earless Dragon

4. Infraspecific taxa: Taxonomic status of most subspecies uncertain. *T. lineata centralis* (stony arid habitats with hummock grassland, in eastern WA, northern SA and NT), *T. lineata houstoni* (chenopod shrubland on limestone, Nullarbor Plain), *T. lineata lineata* (semi-arid shrublands of eastern SA, north-western VIC and the interior of NSW and QLD), *T. lineata macra* (black clay plains of southern and eastern Kimberley and western NT), *T. lineata pinguicolla* (basalt plains of southern VIC and the native grasslands of south-eastern NSW and ACT). "Preliminary examination of museum specimens indicates that the [last] subspecies probably should be elevated to species rank" (Osborne and Kukolic, 1992).

5. Subspecies survival status: Vulnerable.

6. Former distribution: In Victoria, once considered reasonably common on basalt plains north and west of Melbourne (Wilson and Knowles, 1988); a site at Bathurst NSW where it once occurred has been urbanised (Will Osborne, pers. comm.). Population in the ACT has apparently undergone severe decline in last 30 years; not recorded between 1963 and 1991, when it was again found, but only at four of 46 sites surveyed (Osborne and Kukolic, 1992).

7. Current distribution: Basalt plains of southern Victoria (the few recent records are all from localities just west of Melbourne *vide* Brereton and Backhouse, 1993), Southern Tablelands of NSW (including Jerrabombera grasslands) and ACT. Occupies higher altitudes and regions with cooler temperatures than any of the other subspecies of *Tympanocryptis lineata* (Jenkins and Bartell, 1980).

8. Habitat: Tussock grassland.

Found in naturally treeless native tussock grassland on black clay, brown clay loams and podzolic soils. Appears to prefer grasslands composed of *Themeda*, *Danthonia* and *Stipa* species, growing on gentle slopes or alluvial flats which have not been grazed, or grazed only lightly (Hogg, 1990; Osborne *et al.*, 1993; Brereton and Backhouse, 1993). In Victoria recent sightings have been in native tussock grassland on stony crests or rocky stream escarpment (Brereton and Backhouse, 1993) where the species has been found sheltering under surface rocks or in rocky outcrops; it "retreats into small holes, like those of the 'Trap-door Spider', in the ground when alarmed" (McCoy, 1889).

9. Reasons for decline: Probably a combination of factors, including habitat clearance, overgrazing by sheep and cattle and rabbits, cropping, pasture improvement, urban development, fragmentation of habitat, rock removal, irrigation, changed fire regimes (as a result of urban expansion) and invasion of weeds (Osborne and Kukolic, 1992; Brereton and Backhouse, 1993).

"Much [of the native grasslands of the ACT] has disappeared as a result of past pastoral activities and the conversion of native grasslands into improved pastures for sheep and cattle grazing. The remaining tracts ... are relatively restricted in area and discontinuously distributed throughout the lower altitudes of the Territory ... and coincide with areas earmarked for future urban development" (Anonymous, 1991).

"[Another reason for the] decline of this form from within southern Victoria at least, is the removal of the stones from the basalt plains as a specific method of pasture improvement" (John Coventry, *in litt.*). Only 1 per cent of the original grasslands of western Melbourne remain, and less than 2 km^2 of native grassland is in conservation reserves (Brereton and Backhouse, 1993).

10. Conservation reserves on which subspecies occurs:

Australian Capital Territory: none;

New South Wales: none known;
Victoria: Holden Flora Reserve.

10A. Other conservation reserves where subspecies might be expected to occur: New South Wales: Kosciusko NP;
Victoria: Brisbane Ranges NP, Cathedral Range SP, Mount Ida FFR, You Yangs FP.

11. Other public land on which subspecies occurs: Aircraft navigation facility north of Canberra Airport.

12. Other land on which subspecies occurs: ACT: "Woden" pastoral property south-east of Canberra;
New South Wales: "The Poplars" grazing property near Queanbeyan;
Victoria: Little River Gorge west of Werribee and Merri Creek at Bald Hill north of Donnybrook. Potentially present in suitable habitat on private properties throughout the species' range.

13. Is knowledge about subspecies adequate for objectives and actions to be defined accurately?: No.

13.1: Ground surveys need to be conducted to determine the full geographic range of the subspecies, its habitat preferences, and the extent of its occurrence in existing reserves.

13.2: Research is needed into the basic biology and ecology of the subspecies in the field; it should include long term monitoring of changes in population size, habitat use and geographic range.

13.3: Research is needed to document the extent of the subspecies' decline and to identify the major factors contributing to that decline.

13.4: Genetic and morphological studies required to determine the taxonomic status of this subspecies and its relationship to *Tympanocryptis lineata lineata*; most recent study of the group was in 1948 by Mitchell, who examined the morphology of a small sample.

14. Recovery Plan objectives:

14.1: To obtain sufficient information on the subspecies' biology, ecology and distribution to determine its current conservation status and formulate appropriate management strategies.

14.2: To ensure that secure, viable populations of the subspecies are maintained within a reserve system.

14.3: To implement land management practices which promote the maintenance of secure, viable populations of the subspecies outside reserves.

15. Management actions already initiated:

15.1: Listed as "threatened" on the 1993 Schedule 2 of the *Victorian Flora and Fauna Guarantee Act 1988.*

Australian Capital Territory:

15.2: ACT Parks and Conservation Service has conducted a survey of the subspecies in the ACT.

15.3: Populations in the Canberra district are being monitored; data has been collected on relative abundance, population structure and habitat use, and measures will be undertaken to ensure the long-term conservation of this area.

Victoria:

15.4: Action Statement prepared by the Victorian DCNR under the Flora and Fauna Guarantee, Victoria.

15.5: Field surveys have been conducted by DCNR.

16. Management actions required:

16.1: Survey known and potential habitat in reserves within the subspecies' known range in NSW and VIC.

16.2: Survey known habitat outside reserves within the subspecies' known range in NSW and VIC.

16.3: Develop and promote guidelines and provide incentives for landowners and users to reduce the impact of current land use practices on the subspecies outside reserves. For example, "activities such as ploughing, clearing, rock removal, cultivation, pasture improvement, excessive livestock grazing, topsoil removal and urban development should be prevented [in the lowland grasslands of the ACT]" (Osborne and Kukolic, 1992).

16.4: Establish appropriate reserves (including native grasslands on the Southern Tablelands of NSW).

16.5: Develop community awareness within the subspecies' known range.

17. Organisations responsible for conservation of subspecies and individuals involved: Victorian Department of Conservation and Natural Resources (Gary Backhouse, Peter Robertson), New South Wales National Parks and Wildlife Service, Australian Capital Territory Parks and Conservation Service (Will Osborne and Kruno Kukolic).

18. Other organisations and individuals involved: John Coventry (Museum of Victoria), ACT Herpetological Association.

19. Can recovery plan be carried out with existing resources?: No.

1:	Survey of geographic range, habitat preferences and occurrence in reserves: 2 workers for 3 months each year for 2 years - $40,000 salary; $20,000 expenses.	**$60K**
2:	Research into basic biology, systematics and ecology, including assessment of threatening processes: 1 worker for 4 months each year for 2 years - $26,667 salary; $13,333 expenses.	**$40K**
3:	Preparation of management strategies: 1 worker for 3 months - $10,000 salary; $2,000 expenses.	**$12K**
4:	Purchase of land for the reserve system: uncosted.	
		Total $112K

20. Remarks: 19 specimens documented in Australian museum collections. A few individuals captured in the field in the Majura Valley, ACT, in 1991 and 1992.

References:

Anonymous 1991. Letter to the Chief Minister ACT ... . ACT Herpetological Association Newsletter December 1991: 5.

Brereton, R. and Backhouse, G. 1993. Action Statement 35: Southern Lined Earless Dragon *Tympanocryptis lineata pinguicolla*. Victorian Department of Conservation and Environment, East Melbourne.

Hogg, D. 1990. The ecological resources of the ACT; a review of recent information. Report to the National Capital Planning Authority.

Jenkins, R.G.W. and Bartell, R. 1980. A Field Guide to the Reptiles of the Australian High Country. Inkata Press, Melbourne. 278 pp.

Kukolic, K. and Osborne, W.S. 1991. Rediscovery of the lined earless dragon *Tympanocryptis lineata* in the ACT. ACT Herpetological Association Inc. Newsletter, December 1991: 8-9.

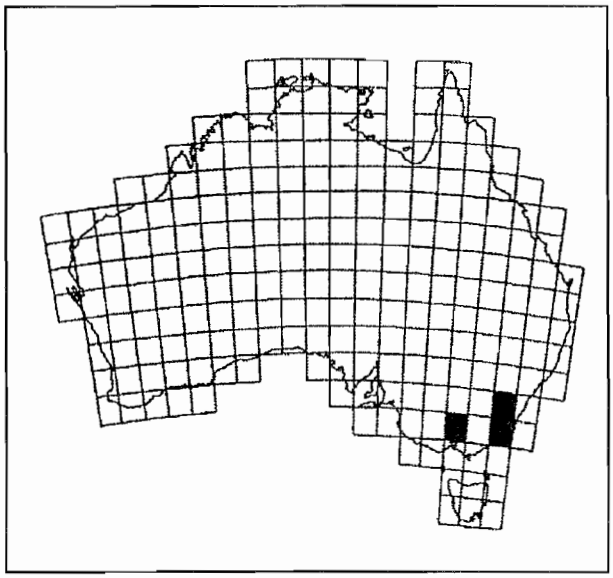
McCoy, F. 1889. The white-streaked earless dragon. Plate 181. Prodromus of the Zoology of Victoria 19: 297-298. Government Printer, Melbourne.

Mitchell, F.J. 1948. A revision of the lacertilian genus *Tympanocryptis*. Records of the South Australian Museum 9(1): 57-86.

Osborne, W.S. and Kukolic, K. 1992. *Tympanocryptis lineata pinguicolla* (Southern Lined Earless Dragon). pp. 32-35 *in* Recovery Plan: lowland native grassland ecosystems in the Australian Capital Territory. Unpublished progress report to the Australian National Parks and Wildlife Service Endangered Species Unit. Wildlife Research Unit, ACT Parks & Conservation Service.

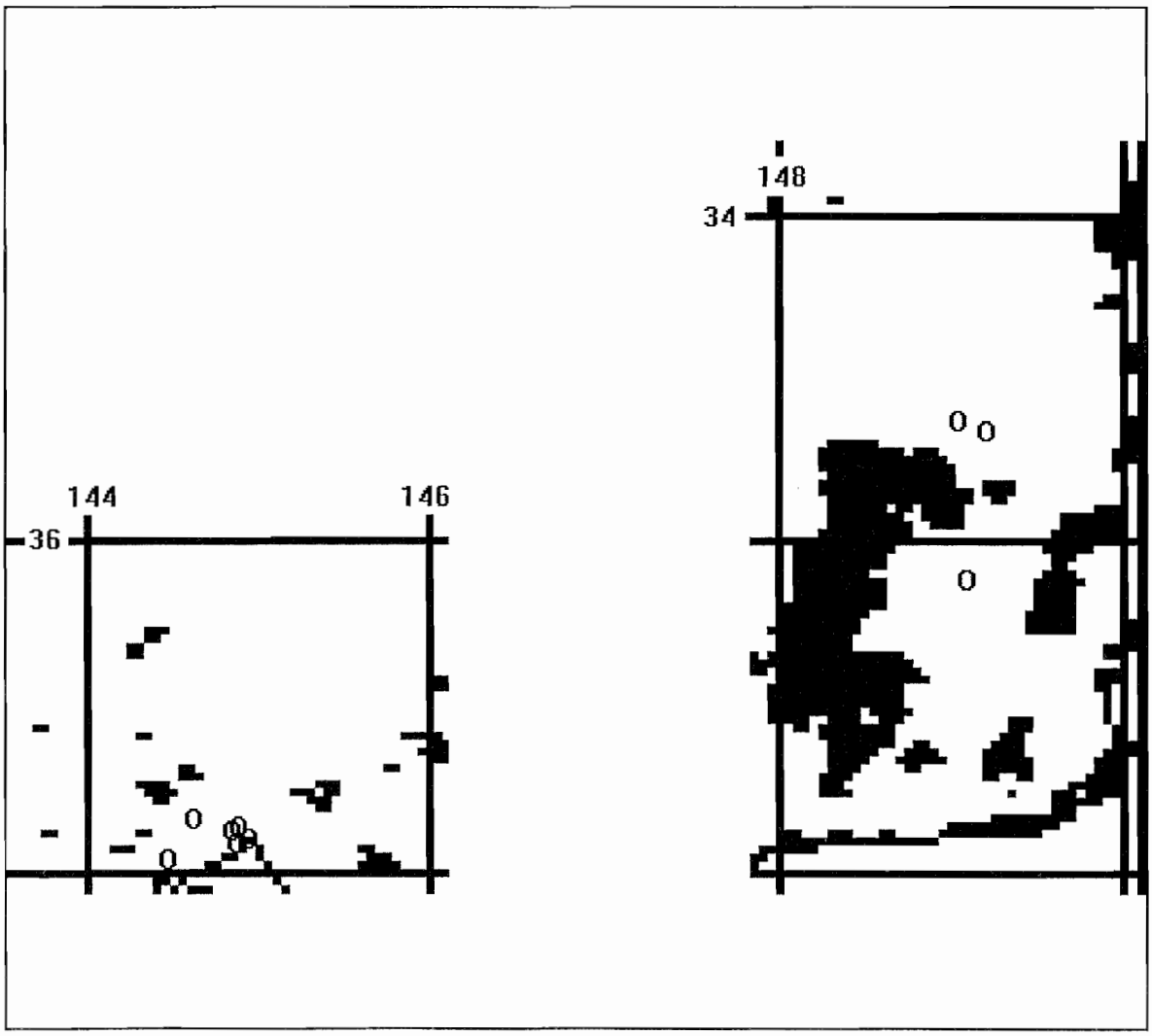
Osborne, W.S., Kukolic, K., Davis, M.S. and Blackburn, R. 1993. Recent records of the Earless Dragon *Tympanocryptis lineata pinguicolla* in the Canberra region and a description of its habitat. Herpetofauna 23(1): 16-25.

Wilson, S.K. and Knowles, D.G. 1988. Australia's Reptiles; a photographic reference to the terrestrial reptiles of Australia. Collins Publishers, Australia. 447 pp.



Distribution of

Tympanocryptis lineata pinguicolla



1. **Family:**	Scincidae
2. **Scientific Name:**	*Anomalopus mackayi* Greer and Cogger, 1985
3. **English Name:**	Long-legged Worm-skink

4. **Infraspecific taxa**: None

5. **Species survival status**: Vulnerable.

6. **Former distribution**: Total range appears to have contracted eastwards. Localities for museum specimens collected prior to 1970 include a number on the plains south and west of Moree, and as far west as Goodooga, NSW.

7. **Current distribution**: A relatively small area abutting the western edge of the Great Dividing Range in north-eastern New South Wales and south-eastern Queensland. Records in the past 20 years have come only from Oakey and the Dalby region of Queensland and Wallangra, Mungindi and Wee Waa regions of NSW. The Wallangra specimens recorded by Shea *et al.* (1987) link what were previously thought to be disjunct Qld and NSW populations.

8. **Habitat**: Open woodland.

Three specimens found beneath logs on red-black to black clay-loam soils in a gently sloping open paddock with even, low (c. 5-10 cm) grass cover and scattered eucalypts (Shea *et al.*, 1987). Four additional specimens found in a similar habitat and another found under a log in largely cleared woodland near granite outcrops. A single specimen from north of Oakey was found under a railway sleeper on sandy soil (Steve Wilson, *in litt.*).

9. **Reasons for decline**: Probably a combination of factors, including overgrazing by stock, clearance of habitat for agriculture (crop production) and grazing, soil compaction and erosion by grazing stock or ploughing, loss of ground litter, irrigation, possibly soil and water pollution from use of agricultural chemicals.

Very little un-degraded natural vegetation now remains within the known range of the species (Shea *et al.*, 1987; Steve Wilson, *in litt.*), and much of the area is heavily modified for agriculture, in particular, cotton and wheat farming.

Shea *et al.* (1987) listed three features which suggest *A. mackayi* is a rare and probably endangered species - there is little natural vegetation within known range and much of the land is regularly cropped; the majority of museum specimens were collected more than 20 years ago, with more recent searches in the same areas being unsuccessful; the very similar *A. leuckartii* is generally common and readily found where it occurs (even in degraded habitats), suggesting that the lack of recent specimens of *A. mackayi* reflects a reduced population.

10. **Conservation reserves on which species occurs**: None known.

10A. **Other conservation reserves where species might be expected to occur**:
Queensland: Lake Broadwater EP, Southwood NP, Sundown NP;
New South Wales: Gilgai FLR, Narran Lake NR, Severn River NR.

11. **Other public land on which species occurs**: Queensland: disused railway easement north of Oakey, possibly Dunmore SF (Steve Wilson, *in litt.*).

12. **Other land on which species occurs**: All museum specimens for which precise locality data are available have been found on privately-owned farming and grazing properties throughout the species' range.

13. **Is knowledge about species adequate for objectives and actions to be defined accurately?**: No.

13.1: Ground surveys need to be conducted to determine the full geographic range of the species, its habitat preferences, and the extent of its occurrence in existing reserves.

13.2: Research is needed into the basic

biology and ecology of the species in the field; it should include long term monitoring of changes in population size, habitat use and geographic range.

13.3: Research is needed to document the extent of the species' decline and to identify the major factors contributing to that decline.

14. Recovery Plan objectives:

14.1: To obtain sufficient information on the species' biology, ecology and distribution to determine its current conservation status and formulate appropriate management strategies.

14.2: To ensure that secure, viable populations of the species are maintained within a reserve system.

14.3: To implement land management practices which promote the maintenance of secure, viable populations of the species outside reserves.

15. Management actions already initiated:

15.1: Listed as "threatened" on the 1992 Revised (Interim) Schedule 12 of the *NSW Endangered Fauna (Interim Protection) Act 1991.*

16. Management actions required:

16.1 Defer granting of licenses to clear remnant woodland within the species' known range until the following actions have been carried out.

16.2: Survey known and potential habitat in reserves within the species' known range.

16.3: Survey known habitat outside reserves within the species' known range.

16.4: Develop and promote guidelines and provide incentives for landowners to reduce the impact of current land use practices on the species outside reserves.

16.5: Establish appropriate reserves if the existing reserve system is found to be inadequate to secure the survival of the species.

16.6: Develop community awareness within the species' known range.

17. Organisations responsible for conservation of species and individuals involved: Queensland Department of Environment and Heritage, New South Wales National Parks and Wildlife Service.

18. Other organisations and individuals involved: Ross Sadlier (Australian Museum), Glenn Shea (University of Sydney), Steve Wilson (Queensland Museum).

19. Can recovery plan be carried out with existing resources?: No.

1: Survey of geographic range, habitat preferences and occurrence in reserves: 2 workers for 2 months each year for 2 years - $26,667 salary; $13,333 expenses. **$40K**

2: Research into basic biology and ecology, including assessment of threatening processes: 1 worker for 4 months each year for 2 years - $26,667 salary; $13,333 expenses. **$40K**

3: Preparation of management strategies: 1 worker for 3 months - $10,000 salary; $2,000 expenses. **$12K**

4: Purchase of land for the reserve system: uncosted.

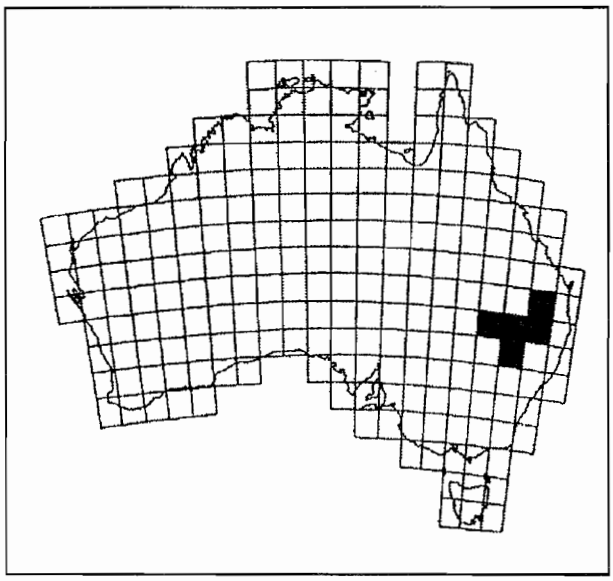
Total $92K

20. Remarks: 20 specimens documented in Australian museum collections.

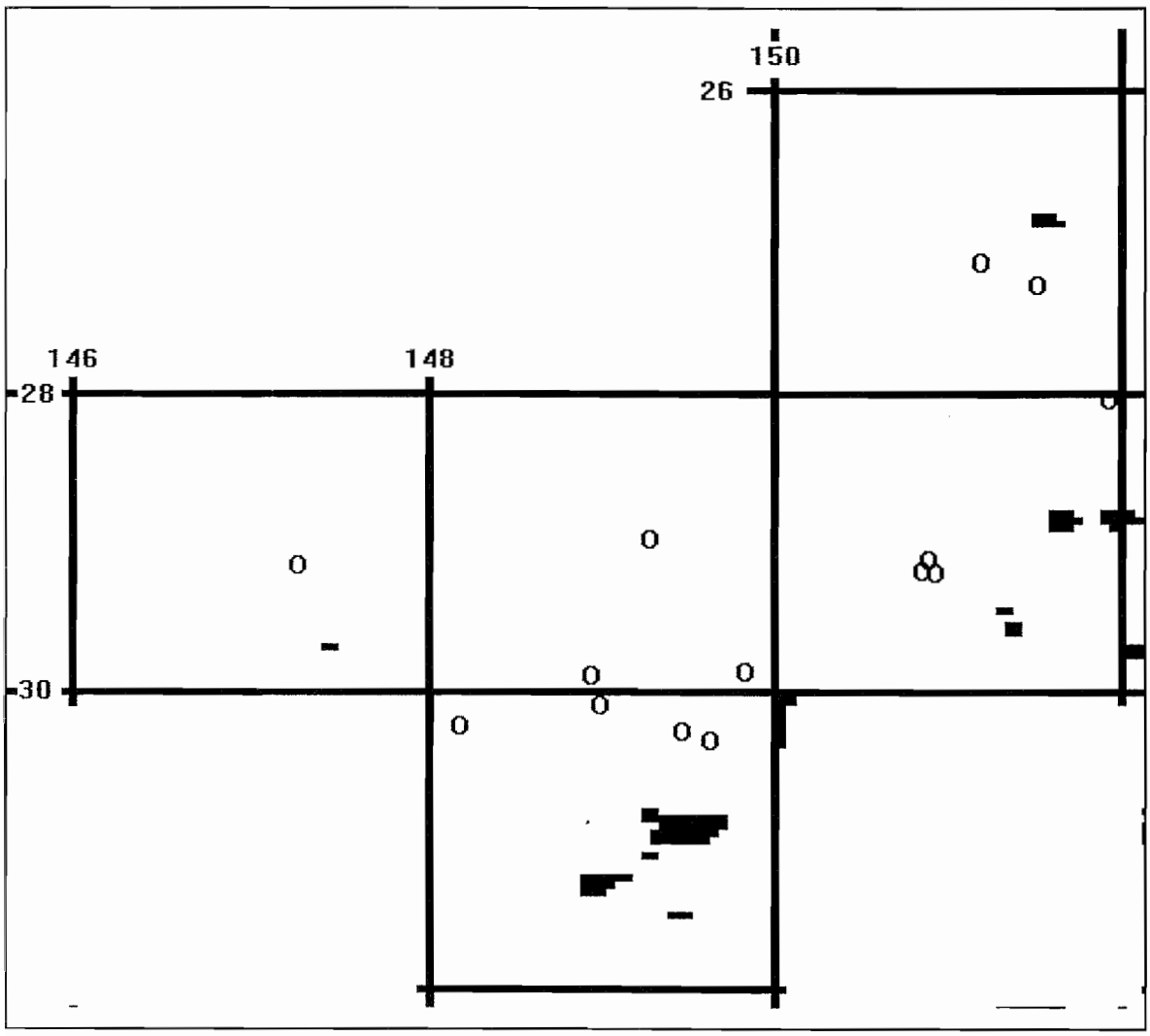
References:

Greer, A.E. and Cogger, H.G. 1985. Systematics of the reduced-limbed and limbless skinks currently assigned to the genus *Anomalopus* (Lacertilia: Scincidae). Records of the Australian Museum 37(1): 11-54.

Shea, G., Millgate, M. and Peck, S. 1987. A range extension for the rare skink *Anomalopus mackayi*. Herpetofauna 17(2): 16-19.



Distribution of *Anomalopus mackayi*



1. Family:	Scincidae
2. Scientific Name:	*Coeranoscincus reticulatus* (Günther, 1973) [also appears in the literature as *Anomalopus reticulatus*]
3. English Name:	Three-toed Snake-tooth Skink

4. Infraspecific taxa: None

5. Species survival status: Vulnerable.

6. Former distribution: Much of the lowland closed forest within the range of this species has been cleared, for example the Big Scrub in the Richmond district of NSW. Suitable habitat has generally been reduced to small isolated patches.

7. Current distribution: Forests on the coast and ranges of the Northern Rivers district of north-eastern New South Wales, and south-eastern Queensland, ranging from the Clarence River in the south to Cooloola in the north.

8. Habitat: Closed forest, tall open forest.

Generally recorded in moist layered forest on loamy basaltic soils, but also found in closed forest overlying silica sand dunes at Cooloola. Two published records of individuals in logged forest which had tall softwood regrowth. Within the forest usually found under leaf litter or moist rotting logs or in loose friable soil.

9. Reasons for decline: Probably a combination of factors, including overgrazing by stock, clearance of habitat for agriculture and grazing, pasture improvement, crop production, native forest logging, fragmentation of habitat.

Much of its former distribution in lowland closed forests has been cleared for pastoralism (including dairying) and tropical fruit production, or modified by forestry activities.

10. Conservation reserves on which species occurs: Queensland: Lamington NP, Cunninghams Gap NP, Cooloola NP, Main Range NP;
New South Wales: Border Ranges NP, Nightcap NP.

10A. Other conservation reserves where species might be expected to occur: Queensland: Conondale NP, Moreton Island NP, Mount Barney NP, Mount Mistake NP, Springbrook NP; New South Wales: Boat Harbour NR, Davis Scrub NR, Limpinwood NR, Moore Park NR, Mount Warning NP, Numinbah NR, Susan Island NR, Victoria Park NR, Washpool NP.

11. Other public land on which species occurs: Queensland: Cooloola SF; New South Wales: Tooloom Scrub in Beaury SF, Koreelah SF, Richmond Range SF, Whian Whian SF, Yabbra SF.

12. Other land on which species occurs: Potentially present in suitable habitat on private properties throughout the species' range.

13. Is knowledge about species adequate for objectives and actions to be defined accurately?: No, but more is known and has been published on the biology and ecology of this species than on most other threatened Australian reptiles.

13.1: Further ground surveys need to be conducted to determine the full geographic range of the species, its habitat preferences, and the extent of its occurrence in existing reserves.

13.2: Further research is needed into the basic biology and ecology of the species in the field; it should include long term monitoring of changes in population size, habitat use and geographic range.

13.3: Research is needed to document the extent of the species' decline and to identify the major factors contributing to that decline.

14. Recovery Plan objectives:

14.1: To obtain sufficient information on the species' biology, ecology and distribution to determine its current conservation status and formulate appropriate management strategies.

14.2: To ensure that secure, viable populations of the species are maintained within a reserve system.

14.3: To implement land management practices which promote the maintenance of secure, viable populations of the species outside reserves.

15. Management actions already initiated:

15.1: Listed as "vulnerable and rare" on the 1992 Revised (Interim) Schedule 12 of the *NSW Endangered Fauna (Interim Protection) Act 1991.*

15.2: Survey of rainforest of south-eastern Queensland funded by the National Rainforest Conservation Program (Couper, 1992).

16. Management actions required:

16.1: Survey known and potential habitat in reserves within the species' known range.

16.2: Survey known habitat outside reserves within the species' known range.

16.3: Establish appropriate reserves if the existing reserve system is found to be inadequate to secure the survival of the species; but note, in Queensland this species is much better represented in national parks than are most threatened reptiles.

16.4: Develop and promote guidelines and provide incentives for landowners and users to reduce the impact of current land use practices on the species outside reserves.

16.5: Develop community awareness within the species' known range.

17. Organisations responsible for conservation of species and individuals involved: Queensland Department of Environment and Heritage, New South Wales National Parks and Wildlife Service (Harry Hines).

18. Other organisations and individuals involved: Patrick Couper (Queensland Museum).

19. Can recovery plan be carried out with existing resources?: No.

1:	Survey of geographic range, habitat preferences and occurrence in reserves: 2 workers for 2 months each year for 2 years - $26,667 salary; $13,333 expenses.	**$40K**
2:	Research into basic biology and ecology, including assessment of threatening processes: 1 worker for 4 months each year for 2 years - $26,667 salary; $13,333 expenses.	**$40K**
3:	Preparation of management strategies: 1 worker for 3 months - $10,000 salary; $2,000 expenses.	**$12K**
		Total $92K

20. Remarks: 36 specimens documented in Australian museum collections.

References:

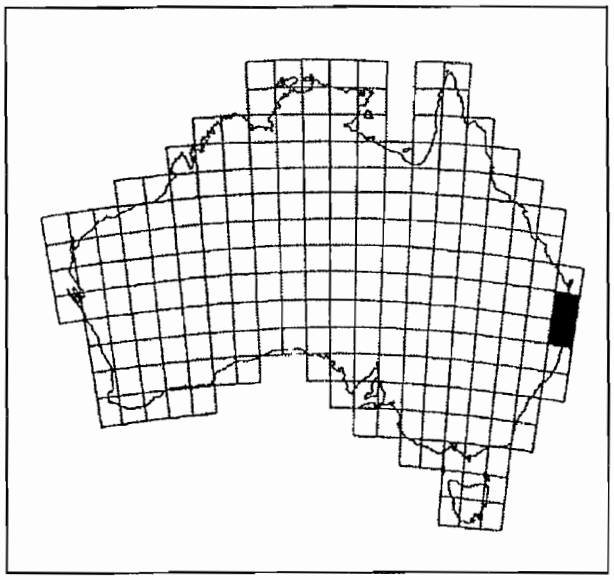
Couper, P.J., Whittier, J., Mason, R.T. and Ingram, G.J. 1992. A nesting record for *Coeranoscincus reticulatus*. Memoirs of the Queensland Museum 32(1): 60.

Czechura, G.V. 1974. A new south-east locality for the skink *Anomalopus reticulatus*. Herpetofauna 7(1): 24-25.

Ehmann, H. 1987. The habitat, microhabitat and feeding behaviour of the rainforest skink *Coeranoscincus reticulatus*. Herpetofauna 17(2): 14-15.

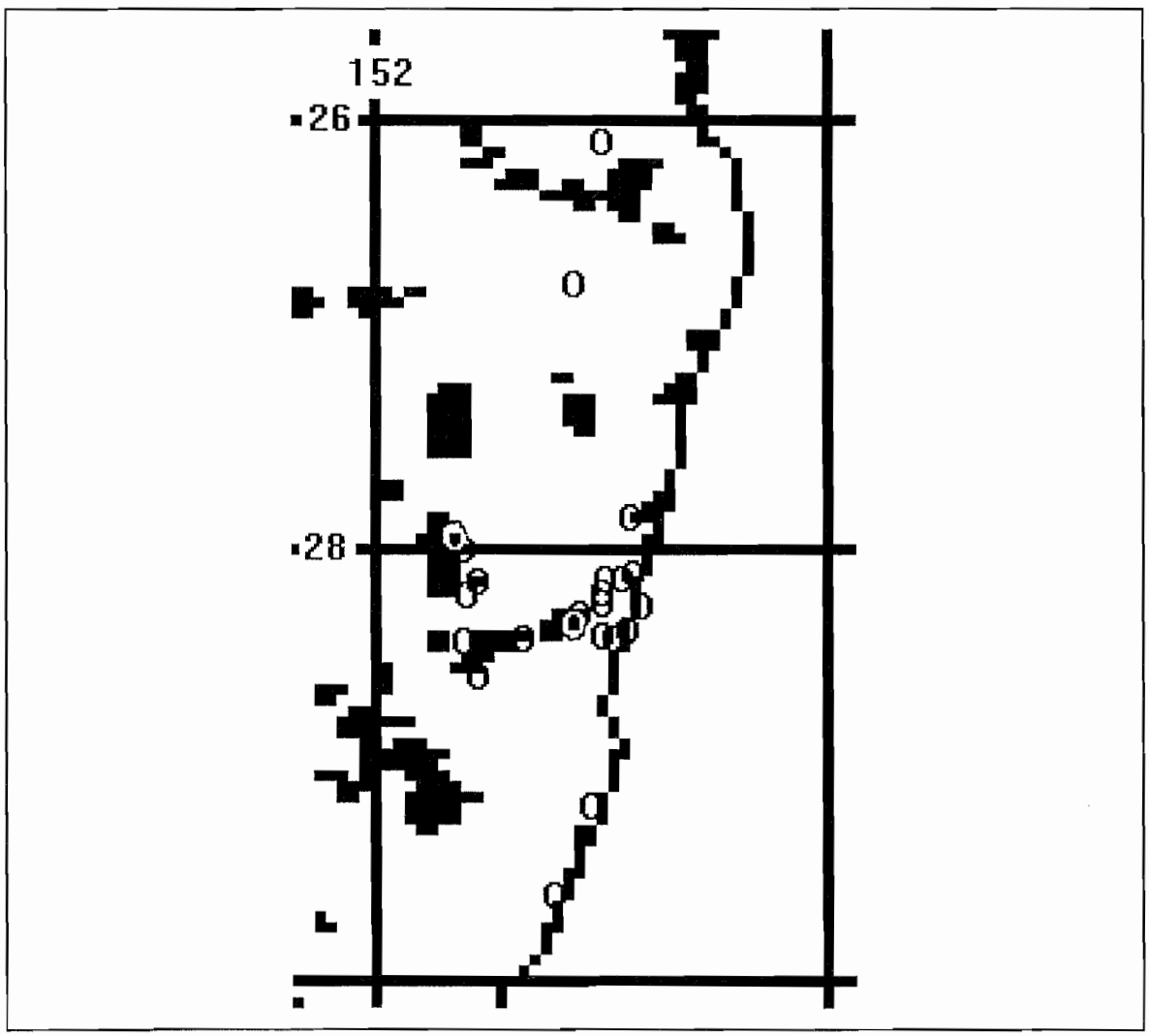
Greer, A.E. and Cogger, H.G. 1985. Systematics of the reduced-limbed and limbless skinks currently assigned to the genus *Anomalopus* (Lacertilia: Scincidae). Records of the Australian Museum 37(1): 11-54.

McDonald, K.R. 1977. Observations on the skink *Anomalopus reticulatus* (Gunther) (Lacertilia: Scincidae). Victorian Naturalist 94: 99-103.



Distribution of

Coeranoscincus reticulatus



1. **Family:**	Scincidae
2. **Scientific Name:**	*Ctenotus lancelini* Ford, 1969
3. **English Name:**	Lancelin Island Skink

4. **Infraspecific taxa**: None

5. **Species survival status**: Endangered. Under the Mace and Lande (1991) classification would qualify for Endangered (Critical) (see Appendix 10 - Table 3 and discussion).

6. **Former distribution**: Not known to have differed from current distribution.

7. **Current distribution**: Lancelin Island, a 7.6 ha Nature Reserve 80 km north of Perth, Western Australia.

8. **Habitat**: Rocky isolates, low shrubland.

Occurs only in association with three small limestone outcrops, on opposite ends of the island (Magnus Peterson, *in litt.*) and occupying a total area of about 1.5 ha (Andrew Burbidge, *in litt.*). Found in depressions in the sand under exfoliating slabs of limestone (Ford, 1963). "Low scrub and herbs on sand and limestone" (Burbidge and Jenkins, 1984).

9. **Reasons for decline**: Probably a combination of factors, including invasion of habitat by exotic weeds, disturbance by frequent human visitation and disturbance or predation by gulls.

A contributing factor may be the encroachment of a heavy cover of exotic grasses (*Lolium rigidum* and *Avena barbata*) and thistles on the limestone outcrops; the grass appears to have become established on sand which has only recently blown over the rocks (Browne-Cooper and Maryan, 1992). The grass also provides fuel for fires which could escape from camp fires lit illegally by visitors. Although the island is a nature reserve, the skink is vulnerable to habitat degradation caused by the many people who visit the island for recreational purposes. Silver Gulls (*Larus novaehollandiae*) breed on the limestone outcrops and appear to have increased in numbers; they may be degrading the lizard habitat, competing with the lizards for food, or preying on them (Burbidge, 1993). See "**Remarks**" below for record of decline.

10. **Conservation reserves on which species occurs**: Lancelin Island NR.

10A. **Other conservation reserves where species might be expected to occur**: None.

11. **Other public land on which species occurs**: None.

12. **Other land on which species occurs**: None.

13. **Is knowledge about species adequate for objectives and actions to be defined accurately?**: No.

13.1: A thorough ground survey needs to be conducted to establish the current status of the skink on Lancelin Island and to determine its habitat preferences and seasonal activity and abundance.

13.2: Research is needed into the basic biology and ecology of the species in the field; it should include long term monitoring of changes in population size, habitat use and distribution on the island.

13.3: Research is needed to identify the major factors contributing to the species' decline.

14. **Recovery Plan objectives**:

14.1: To obtain sufficient information on the species' biology, ecology and distribution to determine its current conservation status.

14.2: To improve existing management policies and develop a new management plan which ensures that a secure, viable population of the species is maintained in Lancelin Island NR.

15. **Management actions already initiated**:

15.1: Listed on Schedule 1 of the Commonwealth's *Endangered Species*

Protection Act 1992 and listed as "threatened" on the 1990 Schedule of the *WA Wildlife Conservation Act 1950.*

15.2: Lancelin Island is gazetted as a Nature Reserve.

15.3: A study of the species has been initiated by CALM (Andrew Burbidge, *in litt.*).

16. Management actions required:

16.1: Survey the species' status on Lancelin Island NR.

16.2: Develop a community awareness campaign on the adjacent mainland, including policies to control Silver Gulls around rubbish tips.

16.3: Develop guidelines for visitors to the island and enforce bans on fires and pets on the island, to reduce impact of visitation on the species.

16.4: Implement control program for exotic weeds if it is demonstrated that they have an adverse effect on the species.

16.5: Implement control program for Silver Gulls.

16.6: Initiate captive breeding program.

17. Organisations responsible for conservation of species and individuals involved: Western Australian Department of Conservation and Land Management (Andrew Burbidge, Jim Rolfe).

18. Other organisations and individuals involved: Robert Browne-Cooper, Brad Maryan, Magnus Peterson (Perth).

19. Can recovery plan be carried out with existing resources?: No.

1: Survey of Lancelin Island and study of the habitat preferences of the species: 2 workers for 1 month each for 2 years - $13,333 salary; $10,000 expenses (1.5 x standard expenses for remote region). **$23.333K**

2: Research into basic biology and ecology, including assessment of threatening processes: 1 worker for 2 months each year for 2 years - $13,333 salary; $10,000 expenses (1.5 x standard expenses for remote region). **$23.333K**

3: Preparation of management strategies: 1 worker for 3 months - $10,000 salary; $2,000 expenses. **$12K**

4: Establishment of captive breeding program: 1 worker for 2 months each year for 2 years - $13,333 salary; $2,667 expenses. **$16K**

Total $74.7K

20. Remarks: 12 specimens documented in Australian museum collections; 5 collected in 1961 and 7 in 1975. Documentation of the apparent decline of this species is more complete than it is for most other species in the Reptile Action Plan: 1959-1961: "not uncommon" (Ford, 1963)

1981: 10+ (Browne-Cooper and Maryan, 1992)

1983: 10+ (Browne-Cooper and Maryan, 1992)

1987: 3-4 (search effort = 1.5 person-hours, Andrew Burbidge *in litt.*)

1991: 0 (search effort = 10 person-hours, Browne-Cooper and Maryan, 1992)

1992: 1 (search effort = 8 person-hours by CALM, Andrew Burbidge *in litt.*)

1993: 0 (search effort = 8 person-hours by CALM, Andrew Burbidge *in litt.*)

References:

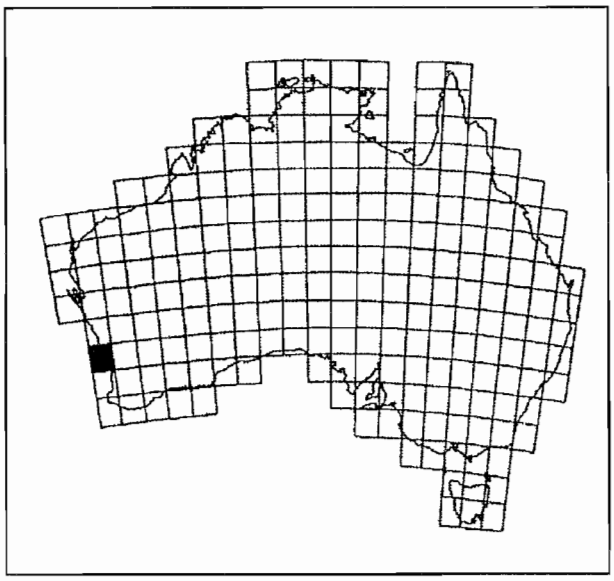
Browne-Cooper, R. and Maryan, B. 1992. Notes on the status of the skink lizard *Ctenotus lancelini*, on Lancelin Island. Western Australian Naturalist 19(1): 63-65.

Burbidge, A.A. and Jenkins, R.W. 1984. Endangered Vertebrates of Australia and its Island Territories; Report of the Working Group on Endangered Fauna of the Standing Committee of the Council of Nature Conservation Ministers. Australian National Parks and Wildlife Service, Canberra. 34 pp.

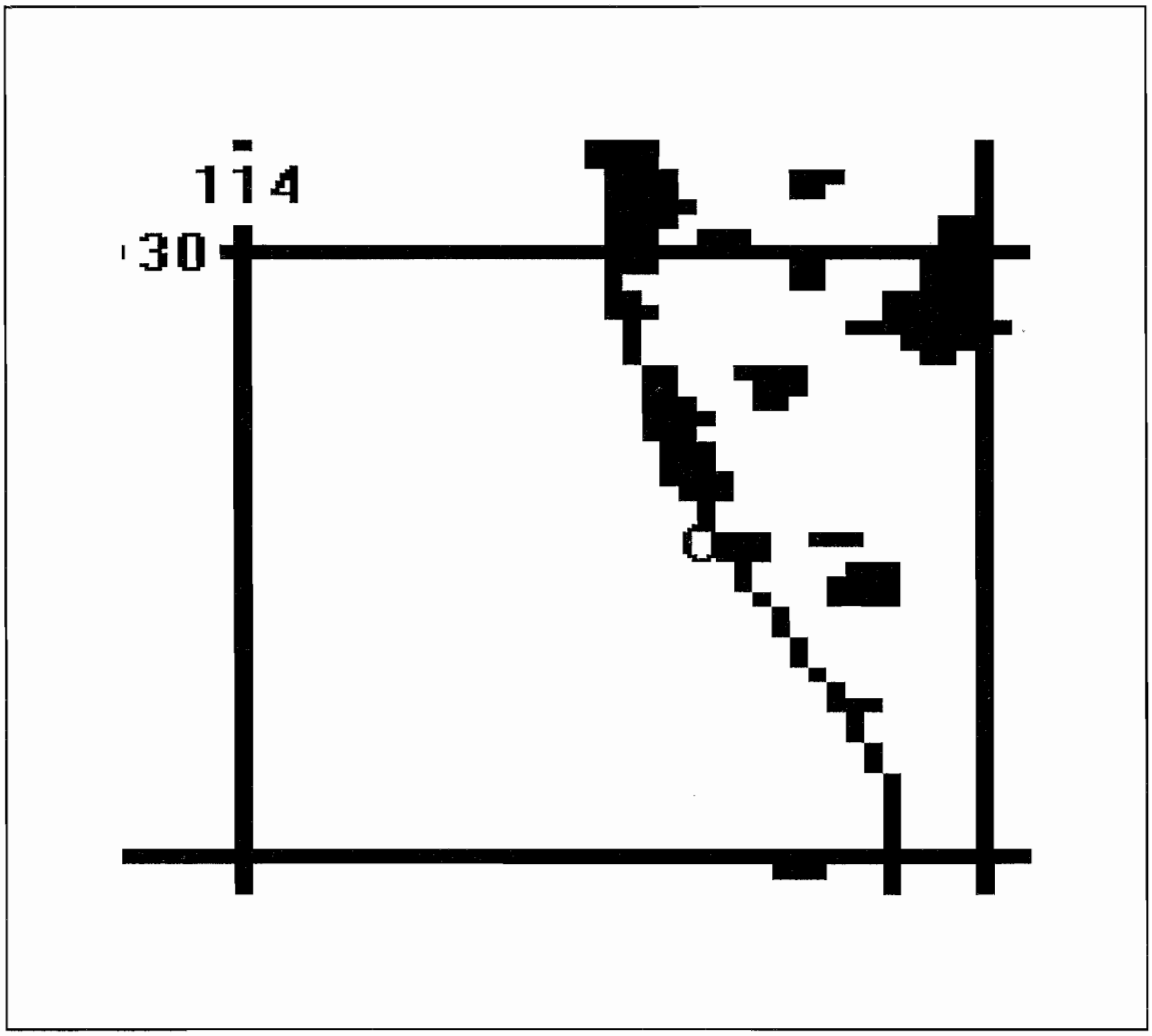
Burbidge, A.A. 1993. Application for funding under Endangered Species Program.

Ford, J. 1963. The reptilian fauna of the islands between Dongara and Lancelin, Western Australia. Western Australian Naturalist 8(6): 135-142.

Rolfe, J.K. 1993. Report to the Western Australian Threatened Species and Communities Unit on a survey to determine the current status of the Lancelin Island Skink *Ctenotus lancelini* (Ford, 1969). Unpublished report, Department of Conservation and Land Management, Perth.



Distribution of *Ctenotus lancelini*



1. Family:	Scincidae
2. Scientific Name:	*Ctenotus zastictus* Storr, 1984
3. English Name:	Hamelin Ctenotus

4. Infraspecific taxa: None

5. Species survival status: Vulnerable.

6. Former distribution: Not known to have differed from current distribution.

7. Current distribution: Known only from a single patch of mallee on two adjacent properties - Hamelin and Coburn Stations - south of Shark Bay, Western Australia (Storr, 1984).

8. Habitat: Tall open shrubland.

Confined to a small area of mallee (*Eucalyptus* spp.) with an understorey of hummock grassland (*Triodia* sp.) growing on red sandplains (Laurie Smith, *in litt.*). The area is surrounded by unsuitable habitat (*Acacia* shrubland) and this species is unlikely to be found elsewhere (Glenn Shea, *in litt.*).

9. Reasons for decline: Not known to have declined, but its small isolated distribution makes it vulnerable.
Probably a combination of factors threaten it, primarily overgrazing by stock but frequent visitation could lead to general disturbance and increased likelihood of a wildfire.

Hamelin Station and Coburn Station are both pastoral properties. The Shark Bay area, including Hamelin Pool, is attracting an increasing number of tourists.

10. Conservation reserves on which species occurs: None known.

10A. Other conservation reserves where species might be expected to occur: None known (Glenn Shea, *in litt.*).

11. Other public land on which species occurs: None known.

12. Other land on which species occurs: Hamelin and Coburn Stations.

13. Is knowledge about species adequate for objectives and actions to be defined accurately?: No.

13.1: Ground surveys need to be conducted to determine the full geographic range of the species; searches of mallee patches east and north of the known distribution are advised (Glenn Shea, *in litt.*).

13.2: Research is needed into the basic biology and ecology of the species in the field; it should include long term monitoring of changes in population size, habitat use and range.

13.3: Research is needed to determine if the species is declining and if so, to identify the major factors contributing to that decline.

14. Recovery Plan objectives:

14.1: To obtain sufficient information on the species' biology, ecology and distribution to determine its current conservation status and formulate appropriate management strategies.

14.2: To ensure that secure, viable populations of the species are maintained within a reserve system.

14.3: To implement land management practices which promote the maintenance of secure, viable populations of the species outside reserves.

15. Management actions already initiated: None known.

16. Management actions required:

16.1: Survey known and potential habitat within the species' known range.

16.2: Develop and promote guidelines and provide incentives for landowners to reduce the impact of current land use practices on the species outside reserves.

16.3: Establish appropriate reserves.
16.4: Develop community awareness within the species' known range.
16.5: Develop fire control program.

17. Organisations responsible for conservation of species and individuals involved: Western Australian Department of Conservation and Land Management (Peter Kendrick).

18. Other organisations and individuals involved: Glenn Shea (University of Sydney).

19. Can recovery plan be carried out with existing resources?: No.

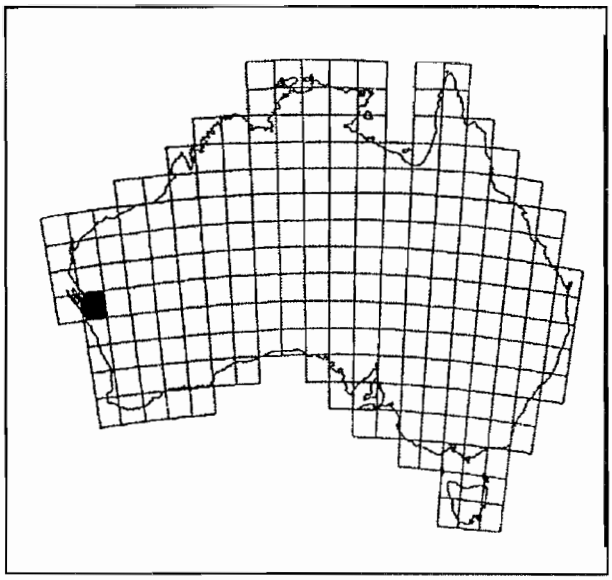
1:	Survey of geographic range, habitat preferences and occurrence in reserves: 2 workers for 2 months each year for 2 years - $26,667 salary; $13,333 expenses.	**$40K**
2:	Research into basic biology and ecology, including assessment of threatening processes: 1 worker for 3 months each year for 2 years - $20,000 salary; $10,000 expenses.	**$30K**
3:	Preparation of management strategies: 1 worker for 3 months - $10,000 salary; $2,000 expenses.	**$12K**
4:	Purchase of land for the reserve system: uncosted.	
		Total $82K

20. Remarks: Nine specimens documented in Australian museum collections.

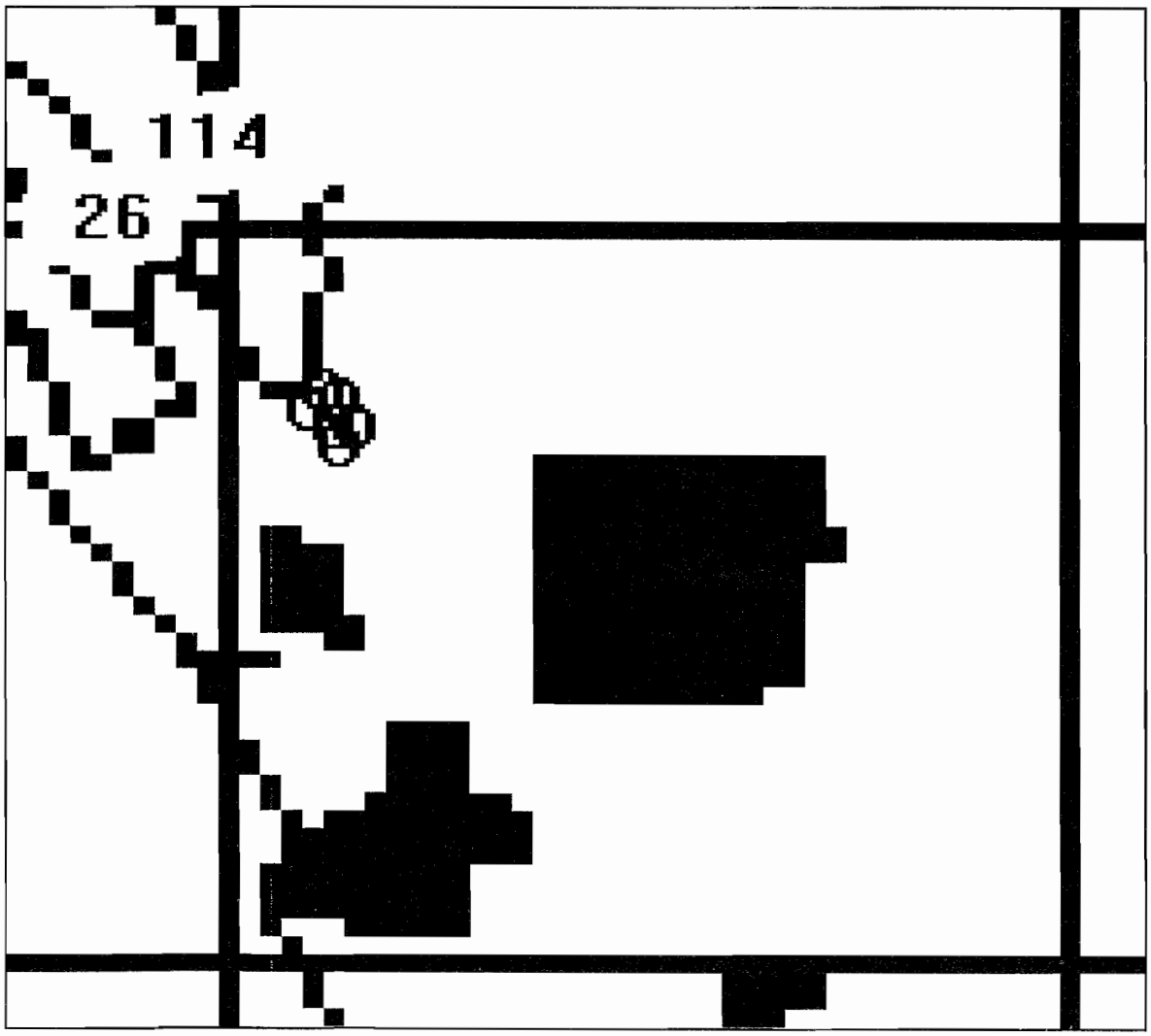
References:

Storr, G.M. 1984. A new *Ctenotus* (Lacertilia: Scincidae) from Western Australia. Records of the Western Australian Museum 11(2): 191-193.

Storr, G.M. and Harold, G. 1990. Amphibians and reptiles of the Shark Bay area, Western Australia. pp. 279-285 in P.F. Berry, S.D. Bradshaw and B.R. Wilson (eds) Research in Shark Bay; Report of the France-Australe Bicentenary Expedition Committee.



Distribution of *Ctenotus zastictus*



1. **Family:**	Scincidae
2. **Scientific Name:**	*Egernia kintorei* Stirling and Zietz, 1893
3. **English Name:**	Great Desert Skink

4. **Infraspecific taxa**: None

5. **Species survival status**: Vulnerable.

6. **Former distribution**: Eastern interior of Western Australia and adjacent regions of south-western Northern Territory and north-western South Australia, including the Great Sandy, Gibson, Great Victoria and Tanami Deserts.

7. **Current distribution**: No museum specimens have been recorded from Western Australia since 1964 and from South Australia since before 1936. The species may now be restricted to the Northern Territory.

8. **Habitat**: Tall open shrubland, hummock grassland.

Red sandplains and sand ridges as well as loamy and clayey soils, supporting hummock grasses which sometimes have an overstorey of scattered shrubs and trees.

9. **Reasons for decline**: Probably a combination of factors, including grazing by rabbits, inappropriate fire regime, predation by cats and foxes and Aboriginal hunting in some areas.

Within its range, occupies a restricted habitat which may be subject to grazing by feral herbivores and which may also carry many cats and foxes (Stephen Morton, *in litt.*). The traditional practice of seasonally burning a mosaic of vegetation in the Tanami Desert has been discontinued by the Aboriginal people and this may have affected *E. kintorei* in some way.

10. **Conservation reserves on which species occurs**: NT: Uluru-Kata Tjuta NP.

10A. **Other conservation reserves where the species might be expected to occur**: WA: Wanjarri NR, Wolfe Creek Crater NP;
NT: Finke Gorge NP, Rainbow Valley CR, Watarrka (Kings Canyon) NP.

11. **Other public land on which species occurs**: WA: Canning Stock Route.

12. **Other land on which species occurs**: NT: Aboriginal-owned lands in the Tanami Desert region; potentially present in suitable habitat on private land throughout its range.

13. **Is knowledge about species adequate for objectives and actions to be defined accurately?**: No.

13.1: Ground surveys need to be conducted to determine the full geographic range of the species, its habitat preferences, and the extent of its occurrence in existing reserves.

13.2: Research is needed into the basic biology and ecology of the species in the field; it should include long term monitoring of changes in population size, habitat use and geographic range. A technique for catching the lizards without destroying burrows, needs to be developed (David Carter, *in litt.*).

13.3: Research is needed to document the extent of the species' decline and to identify the major factors contributing to that decline.

14. **Recovery Plan objectives**:

14.1: To obtain sufficient information on the species' biology, ecology and distribution to determine its current conservation status and formulate appropriate management strategies.

14.2: To ensure that secure, viable populations of the species are maintained within a reserve system.

14.3: To implement land management practices which promote the maintenance of secure, viable populations of the species outside reserves.

15. Management actions already initiated:

15.1: Populations in the Uluru-Kata Tjuta NP are being investigated by ANCA.

16. Management actions required:

16.1: Survey known and potential habitat in reserves within the species' known range; Aboriginal knowledge and expertise should be utilised (David Carter, *in litt.*).

16.2: Survey known habitat outside reserves within the species' known range.

16.3: Establish appropriate reserves if the existing reserve system is found to be inadequate to secure the survival of the species.

16.4: Develop and promote guidelines for landowners and users to reduce the impact of current land use practices on the species outside reserves.

16.5: Develop community awareness within the species' known range.

16.6: Implement control programs for rabbits, cats and foxes if it is demonstrated that they have an adverse effect on the species.

16.7: Manipulate fire regime to promote regeneration of *Triodia* hummock grassland in which species occurs.

17. Organisations responsible for conservation of species and individuals involved: Australian Nature Conservation Agency (David Carter), Conservation Commission of the Northern Territory (Dave Gibson), Western Australian Department of Conservation and Land Management, South Australian Department of Environment and Land Management.

18. Other organisations and individuals involved: None known.

19. Can recovery plan be carried out with existing resources?: No, but the research and recovery plan formulated for the carnivorous marsupial, *Dasycercus cristicauda*, may also benefit *Egernia kintorei* (Dave Gibson, *in litt.*).

1: Survey of geographic range, habitat preferences and occurrence in reserves: 2 workers for 3 months for 3 years - $60,000 salary; $45,000 expenses (1.5 x standard expenses for remote region). **$105K**

2: Research into basic biology and ecology, including assessment of threatening processes: 1 worker for 4 months each year for 3 years - $40,000 salary; $30,000 expenses (1.5 x standard expenses for remote region). **$70K**

3: Preparation of management strategies: 1 worker for 3 months - $10,000 salary; $2,000 expenses. **$12K**

Total $187K

20. Remarks: 85 specimens documented in Australian museums, approximately two-thirds with locality data. In one month, Fyfe (1980) found more than 10 individuals trapped in a 9 km-long construction trench near Uluru, but rarely saw the species in areas surrounding the trench.

This species is called Tjakura by the Pitjantjatjira people to whom it is important as a food and law animal (David Carter, *in litt.*). The Aboriginal people know the *E. kintorei* colonies in their area and are very skilled at locating them by tracking.

Egernia kintorei often occurs with the Mulgara (Mammalia: *Dasycercus cristicauda*) which also appears to have declined markedly in South Australia and Western Australia although it is still relatively common in the Northern Territory (Dave Gibson, *in litt.*); research and recovery plans for the two species would probably benefit by an integrated approach.

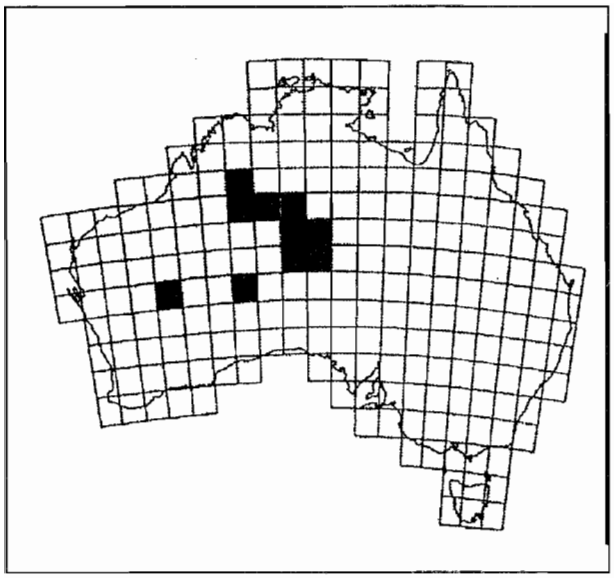
References:

Fyfe, G. 1980. A trench as an aid towards reptile captures. Victorian Herpetological Society Newsletter 17: 14-17.

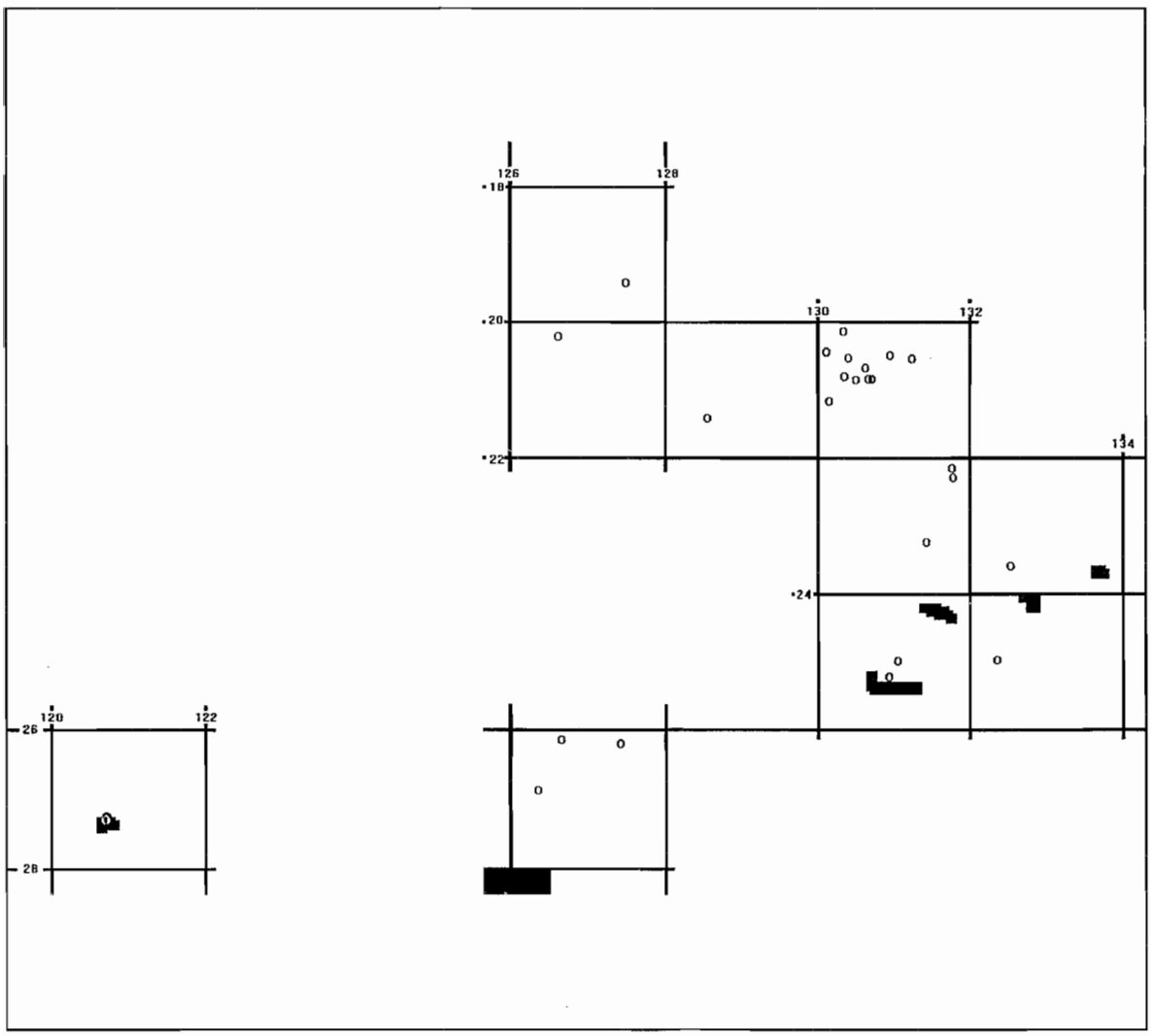
Horner, P. 1992. Skinks of the Northern Territory. Northern Territory Museum of Arts and Sciences, Darwin. xi + 174 pp.

Mitchell, F.J. 1950. The scincid genera *Egernia* and *Tiliqua* (Lacertilia). Records of the South Australian Museum 9(3): 275-308.

Storr, G.M. 1968. Revision of the *Egernia whitei* species-group (Lacertilia, Scincidae). Journal of the Royal Society of Western Australia 51(2): 51-62.



Distribution of *Egernia kintorei*



1. **Family**: Scincidae

2. **Scientific Name**: *Egernia pulchra longicauda* Ford, 1963

3. **English Name**: Jurien Bay Rock-skink

4. **Infraspecific taxa**: *Egernia pulchra longicauda* (islands of Jurien Bay, Western Australia), *E. pulchra pulchra* (lower west coast and south-western corner of Western Australia, separated from the Jurien Bay subspecies by about 300 km (Ford, 1963b)).

5. **Subspecies survival status**: Vulnerable.

6. **Former distribution**: Not known to have differed from current distribution.

7. **Current distribution**: Occurs on a group of four small continental islands (Escape, Favorite, Whitlock and Boullanger) in Jurien Bay, 200 km north of Perth, Western Australia; total area of these islands is only about 45 ha.

8. **Habitat**: Rock isolates, low shrubland.

Inhabits pre-existing cavities such as crevices amongst limestone rocks, and occasionally seabird burrows (Ford, 1963a). On Escape Island it has been found in dense ground litter beneath low scrub vegetation and under sheets of cardboard (Ford, 1965).

9. **Reasons for decline**: Not known to have declined, but its restriction to a few islands close to the mainland makes it vulnerable to threatening processes which include disturbance to habitat and accidental fire, both resulting from frequent visitation, competition with native and introduced vertebrates (including the House Mouse) and predation by introduced predators.

It has been confirmed that the House Mouse (*Mus musculus*) on Boullanger Island is already limiting the population size of the subspecies and may threaten its long-term survival on the island (Garry Connell, *in litt.*). The mouse population experiences booms each summer and eats vast quantities of insects, depleting the food resources of the island.

In reviewing the composition of reptile faunas on islands off the south-west coast of Western Australia, Ford (1963a) remarked "it appears that with the gradual reduction of island size, the distinction between ecological niches ceases to prevent undue competition so that one or the other species [*Egernia pulchra longicauda* and *E. bos*] is eliminated." Garry Connell (*in litt.*) has been studying these competitive interactions in the Alpha lizard guild of the Jurien Bay islands.

10. **Conservation reserves on which subspecies occurs**: Favorite, Whitlock and Boullanger Islands Nature Reserves.

10A. **Other conservation reserves where subspecies might be expected to occur**: None.

11. **Other public land on which subspecies occurs**: Escape Island, under the administration of the Federal Department of Transport and Communications.

12. **Other land on which subspecies occurs**: None known.

13. **Is knowledge about subspecies adequate for objectives and actions to be defined accurately?**: Yes. Garry Connell, University of Western Australia (*in litt.*) has collected data on the distribution, population size and structure, habitat utilisation patterns and basic biology and ecology of the subspecies on Escape, Favorite and Boullanger Islands. These data form the basis of a PhD thesis due for completion in early 1994. Data have also been collected on the competitive interactions between the subspecies and *Egernia multiscutata bos* and *Mus musculus*; the *Mus musculus* interaction data will be presented as a paper at the Second World Congress of Herpetology.

14. **Recovery Plan objectives**:

14.1: To formulate and implement appropriate management strategies based on existing knowledge of the subspecies' biology, ecology, distribution and current conservation

status, which will ensure that secure, viable populations of the subspecies are maintained within a reserve system.

15. Management actions already initiated:

15.1: Three of the four islands on which it has been recorded, are gazetted "A" Class Nature Reserves by the Western Australian Department of Conservation and Land Management.

16. Management actions required:

16.1: Survey the status of the subspecies on Whitlock Island.

16.2: Transfer title of Escape Island to the Western Australian Department of Conservation and Land Management and gazette it as an "A" Class Nature Reserve.

16.3: Develop community awareness program and implement guidelines for visitors to the islands, to reduce impact on the subspecies' habitat.

16.4: Implement surveillance program to prevent the introduction of exotic species, particularly introduced predators.

16.5: Implement eradication program for *Mus musculus* on the islands.

16.6: Periodically monitor the subspecies' populations on all the islands on which it occurs.

17. Organisations responsible for conservation of subspecies and individuals involved: Western Australian Department of Conservation and Land Management.

18. Other organisations and individuals involved: Garry Connell (University of Western Australia).

19. Can recovery plan be carried out with existing resources?: Perhaps, if the costs of visitor management, House Mouse eradication, survey and monitoring programs can be absorbed by running costs of the WA Department of Conservation and Land Management.

1: Survey of subspecies on Whitlock Island: 2 workers for 1 month each year for 2 years - $13,333 salary; $10,000 expenses (1.5 x standard expenses for remote area). **$23.333K**

2: Preparation of management strategies: 1 worker for 3 months - $10,000 salary; $2,000 expenses. **$12K**

Total $35.3K

20. Remarks: 19 specimens documented in Australian museum collections. A further 25 odd specimens with known locality data are being held for lodgement with the Western Australian Museum (Garry Connell, *in litt.*).

References:

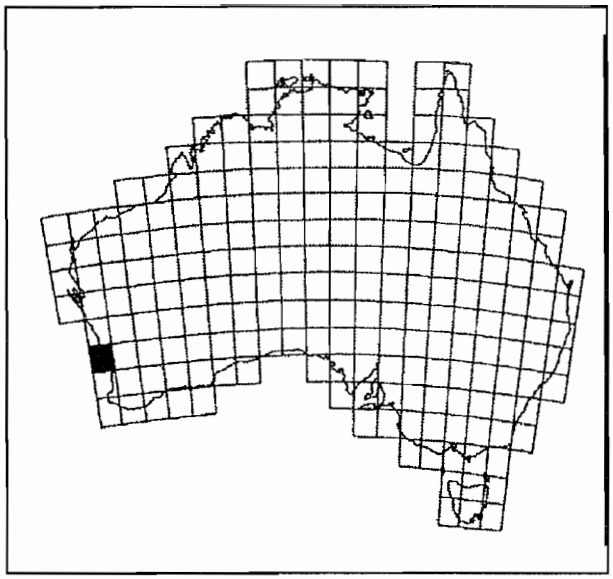
Connell, G. in prep. Structure of an Insular Lizard Guild: the influence of contemporary processes. PhD thesis to be presented at the University of Western Australia.

Connell, G. in prep. Interclass competition: the interaction between *Mus musculus* and an insular lizard guild. Paper to be presented at the Second World Congress of Herpetology, Adelaide, in December 1993/January 1994.

Ford, J.R. 1963a. The reptilian fauna of the islands between Dongara and Lancelin, Western Australia. Western Australian Naturalist 8(6): 135-142.

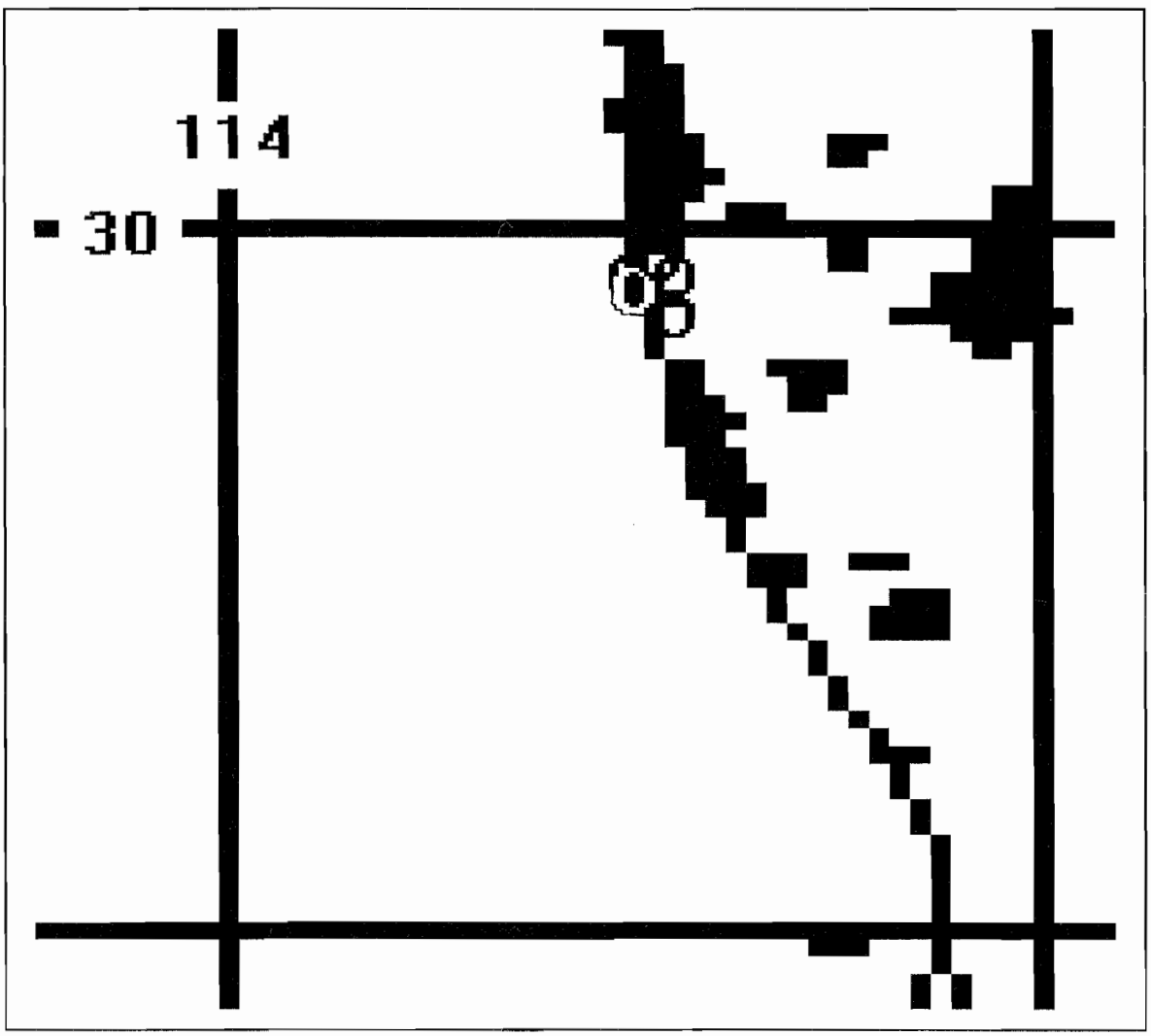
Ford, J.R. 1963b. The distribution and variation of the skinks *Egernia pulchra* and *E. bos* in Western Australia. Western Australian Naturalist 9(2): 25-29.

Ford, J.R. 1965. The reptilian fauna of the islands between Dongara and Lancelin, Western Australia: additional notes. Western Australian Naturalist 9(7): 174-175.



Distribution of

Egernia pulchra longicauda



1. Family:	Scincidae
2. Scientific Name:	*Egernia stokesii aethiops* Storr, 1978
3. English Name:	Baudin Island Spiny-tailed Skink

4. Infraspecific taxa: *E. stokesii aethiops* (Baudin Island, Freycinet Estuary, Shark Bay), *E. stokesii badia* (Dirk Hartog Island, Shark Bay and semi-arid zone of Western Australia extending from the Gascoyne River south-east to the north-eastern wheatbelt around Kununoppin), *E. stokesii stokesii* (Houtman Abrolhos, off the Western Australian coast opposite Geraldton). Populations of *Egernia stokesii* occurring in eastern Australia are geographically isolated from those in Western Australia and their taxonomic status is unresolved.

5. Subspecies survival status: Vulnerable.

6. Former distribution: Not known to have differed from current distribution.

7. Current distribution: Occurs only on Baudin Island, a small islet in Freycinet Estuary, Shark Bay, Western Australia.

8. Habitat: Rocky isolates, open heath.

Common under slabs of limestone; vegetation of the small islands in the Freycinet Estuary consists of coarse dune grass *Spinifex longifolius* and low shrubs (Storr and Harold, 1990).

9. Reasons for decline: Not known to have declined, but its restriction to a single small island makes it very vulnerable to threatening processes including introduced predators. Increased competition from other reptiles and/or accelerated weathering resulting from climatic change, may also threaten the subspecies.

10. Conservation reserves on which subspecies occurs: Baudin Island NR.

10A. Other conservation reserves where subspecies might be expected to occur: None.

11. Other public land on which subspecies occurs: None.

12. Other land on which subspecies occurs: None known.

13. Is knowledge about subspecies adequate for objectives and actions to be defined accurately?: No.

13.1: Ground surveys need to be conducted to determine the full extent of its range on the island and to confirm its habitat preferences.

13.2: Research is needed into the basic biology and ecology of the subspecies in the field; it should include long term monitoring of changes in population size, habitat use and distribution on the island.

13.3: Research is needed to determine if the subspecies is declining and if so, to identify the major factors contributing to that decline.

13.4: Genetic study needed to determine the taxonomic status of this population.

14. Recovery Plan objectives:

14.1: To obtain sufficient information on the subspecies' biology, ecology and distribution to determine its current conservation status and formulate appropriate management strategies.

14.2: To ensure that a secure, viable population of the subspecies is maintained within a reserve system.

15. Management actions already initiated:

15.1: Listed on Schedule 1 of the Commonwealth's *Endangered Species Protection Act 1992*

16. Management actions required:

16.1: Survey the subspecies' status on Baudin Island.

16.2: Develop guidelines for visitors to the island and enforce regulations such as fire bans, to reduce impact of visitation on the species.

16.3: Establish reserves on neighbouring islands and translocate individuals of

the subspecies if the existing reserve system is found to be inadequate to secure the survival of the species.

16.4: Initiate captive breeding program for introduction of the subspecies onto neighbouring island reserves.

17. Organisations responsible for conservation of subspecies and individuals involved: Western Australian Department of Conservation and Land Management (Andrew Burbidge, Keith Morris).

18. Other organisations and individuals involved: None known.

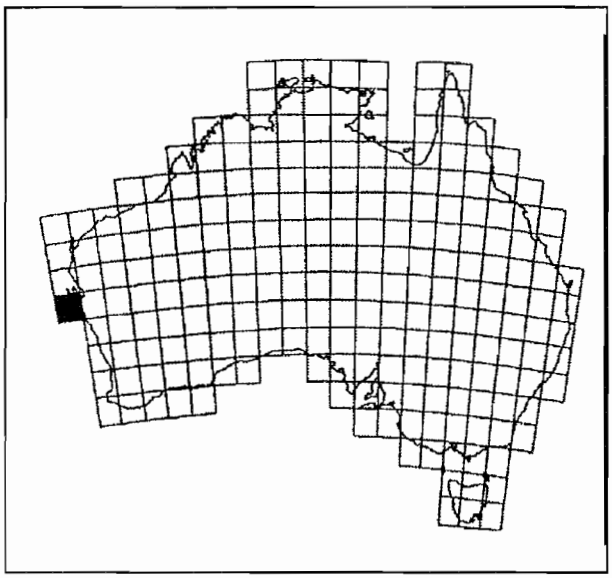
19. Can recovery plan be carried out with existing resources?: No.

1:	Survey of habitat preferences and distribution on Baudin Island: 2 workers for 1 month each year for 2 years - $13,333 salary; $10,000 expenses (1.5 x standard expenses for remote region).	**$23.333K**
2:	Research into basic biology, taxonomy and ecology, including assessment of threatening processes: 1 worker for 2 months each year for 2 years - $13,333 salary; $10,000 expenses (1.5 x standard expenses for remote region).	**$23.333K**
3:	Preparation of management strategies: 1 worker for 3 months - $10,000 salary; $2,000 expenses.	**$12K**
4:	Establishment of captive breeding program: 1 worker for 2 months each year for 2 years - $13,333 salary; $2,667 expenses.	**$16K**
		Total $74.7K

20. Remarks: 14 specimens documented in Australian museum collections. Keith Morris (CALM) has visited the island regularly over the past five years and reports that the species is easily located and observed.

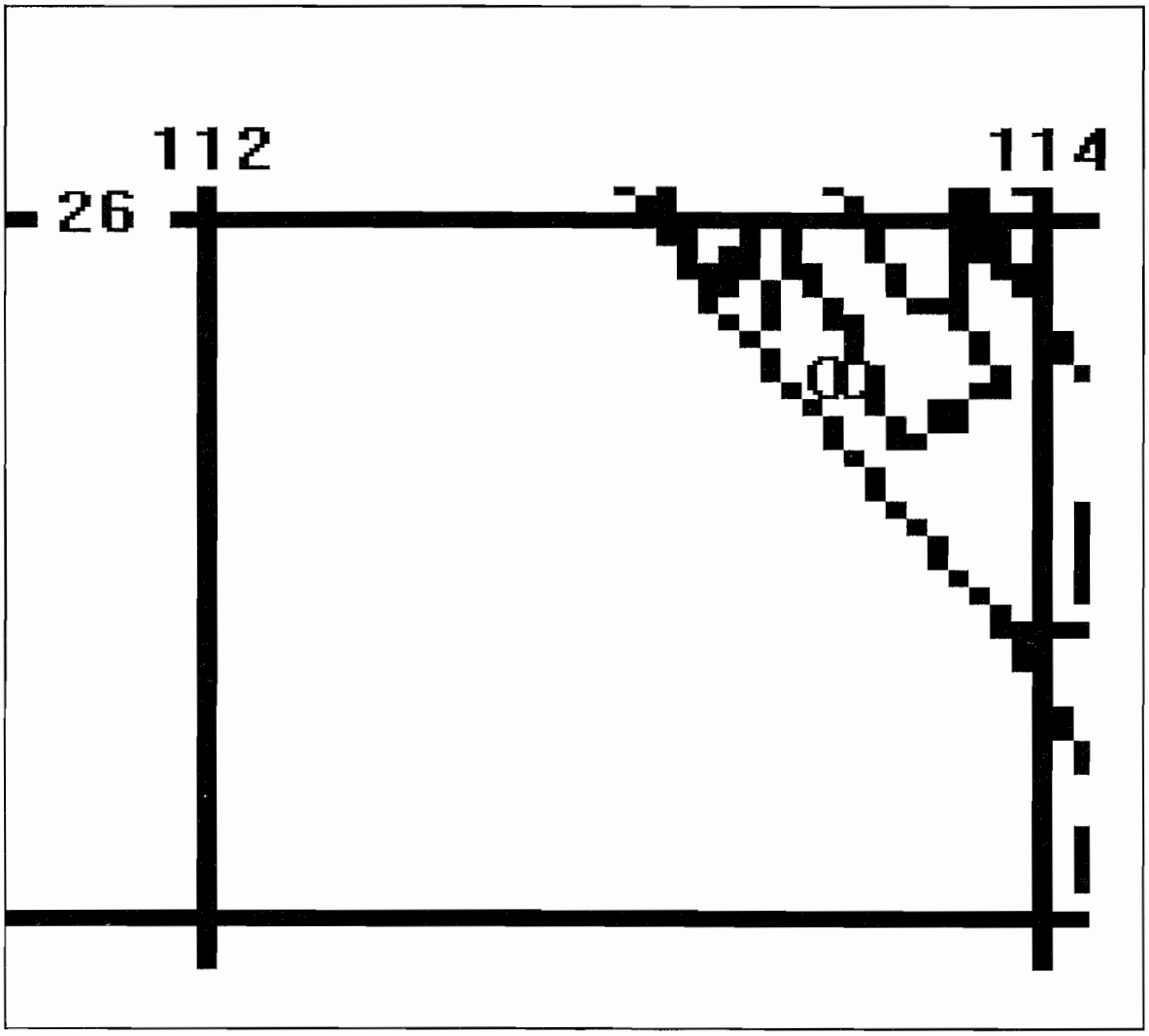
References:

Storr, G.M. and Harold, G. 1990. Amphibians and reptiles of the Shark Bay area, Western Australia. pp. 279-285 in P.F. Berry, S.D. Bradshaw and B.R. Wilson (eds) Research in Shark Bay; Report of the France-Australe Bicentenary Expedition Committee.



Distribution of

Egernia stokesii aethiops



1. Family:	Scincidae
2. Scientific Name:	*Egernia stokesii badia* Storr, 1978
3. English Name:	Western Spiny-tailed Skink

4. Infraspecific taxa: *E. stokesii aethiops* (Baudin Island, Freycinet Estuary, Shark Bay), *E. stokesii badia* (Dirk Hartog Island, Shark Bay and semi-arid zone of Western Australia extending from the Gascoyne River south-east to the north-eastern wheatbelt around Kununoppin), *E. stokesii stokesii* (Houtman Abrolhos, off the Western Australian coast opposite Geraldton). Populations of *Egernia stokesii* occurring in eastern Australia are geographically isolated from those in Western Australia and their taxonomic status is unresolved.

5. Subspecies survival status: Endangered.

6. Former distribution: Prior to 1960 recorded from a broad strip of south-western Western Australia extending south-south-east from Mullewa (west of Geraldton) to Minnivale (east-north-east of Perth). This region is now the north-eastern wheatbelt of Western Australia and suitable microhabitat for the subspecies no longer occurs in most of the region (Glenn Shea, Laurie Smith, *in litt.*).

7. Current distribution: Since 1960, few specimens have been acquired by the Western Australian Museum; most have come from arid localities north (Callagiddy Station south-east of Carnarvon, and Dirk Hartog Island in Shark Bay) and east (Kellerberrin, Kunonoppin) of the subspecies' former known distribution.

8. Habitat: Tall shrubland, open heath, woodland.

In the north-eastern wheatbelt, it occupied the heavier clay and loam soils supporting woodland of York Gums (*Eucalyptus loxophleba*) which provided shelter in the form of large hollow logs (Laurie Smith, *in litt.*). On Dirk Hartog Island, found under limestone slabs in low very open heath (Maryan *et al.*, 1984). "... largely along transition zone between eucalypt-dominated south and *Acacia*-dominated interior" (Wilson and Knowles, 1988).

9. Reasons for decline: Probably a combination of factors, including overgrazing by stock, clearance of habitat for agriculture and grazing, and crop production.

The region occupied by this subspecies was also that most suitable for the cultivation of wheat prior to the 1950s and most of it has been extensively cleared of standing and fallen timber (Laurie Smith, *in litt.*). Some habitat on Dirk Hartog Island had been heavily degraded by livestock (Maryan *et al.*, 1984). Sheep have been run on Callagiddy Station for most of this century (Brooker and Estbergs, 1976).

10. Conservation reserves on which subspecies occurs: Buntine NR.

10A. Other conservation reserves where subspecies might be expected to occur: Billyacatting Hill NR, Bindoo Hill NR, Durokoppin NR, East Nugadong NR, East Yorkrakine NR, East Yuna NR, Kodj Kodj NR, Marchagee NR, North Bungulla NR, Nugadong NR, Nugadong Forest NR, Wilroy NR, Yorkrakine NR. These nature reserves within the known distribution of *Egernia stokesii badia* were surveyed for vertebrates between 1971 and 1976 (Chapman and Dell, 1985) but the species was not found.

11. Other public land on which subspecies occurs: Rothsay SF.

12. Other land on which subspecies occurs: Callagiddy Station, south-east of Carnarvon, Dirk Hartog Island; potentially present in suitable habitat on private properties throughout the species' range.

13. Is knowledge about subspecies adequate for objectives and actions to be defined accurately?: No.

13.1: Ground surveys need to be conducted

to determine the full geographic range of the subspecies, its habitat preferences, and the extent of its occurrence in existing reserves.

13.2: Research is needed into the basic biology and ecology of the subspecies in the field; it should include long term monitoring of changes in population size, habitat use and geographic range.

13.3: Research is needed to document the extent of the subspecies' decline and to identify the major factors contributing to that decline.

13.4: Genetic study needed to determine the taxonomic status of this population.

14. Recovery Plan objectives:

14.1: To obtain sufficient information on the subspecies' biology, ecology and distribution to determine its current conservation status and formulate appropriate management strategies.

14.2: To ensure that secure, viable populations of the subspecies are maintained within a reserve system.

14.3: To implement land management practices which promote the maintenance of secure, viable populations outside reserves.

15. Management actions already initiated:

15.1: Twenty-four reserves in the WA wheatbelt were surveyed for vertebrates by the Western Australian Museum biological survey unit between 1971 and 1976 (Chapman and Dell, 1985).

16. Management actions required:

16.1: Survey known and potential habitat in reserves within the subspecies' known range.

16.2: Survey known habitat outside reserves within the subspecies' known range.

16.3: Establish appropriate reserves if the existing reserve system is found to be inadequate to secure the survival of the subspecies.

16.4: Develop and promote guidelines and provide incentives for landowners and users to reduce the impact of current land use practices on the subspecies outside reserves.

16.5: Develop community awareness within the subspecies' known range.

17. Organisations responsible for conservation of subspecies and individuals involved: Western Australian Department of Conservation and Land Management (Andrew Burbidge).

18. Other organisations and individuals involved: Laurie Smith (Western Australian Museum).

19. Can recovery plan be carried out with existing resources?: No.

1: Survey of geographic range, habitat preferences and occurrence in reserves: 2 workers for 4 months each year for 2 years - $53,333 salary; $26,667 expenses. **$80K**

2: Research into basic biology, taxonomy and ecology, including assessment of threatening processes: 1 worker for 4 months each year for 2 years - $26,667 salary; $13,333 expenses. **$40K**

3: Preparation of management strategies: 1 worker for 3 months - $10,000 salary; $2,000 expenses. **$12K**

Total $132K

20. Remarks: 49 specimens documented in Australian museum collections, but none acquired by the Western Australian Museum since 1977. Recorded on Dirk Hartog Island in 1972 and 1984.

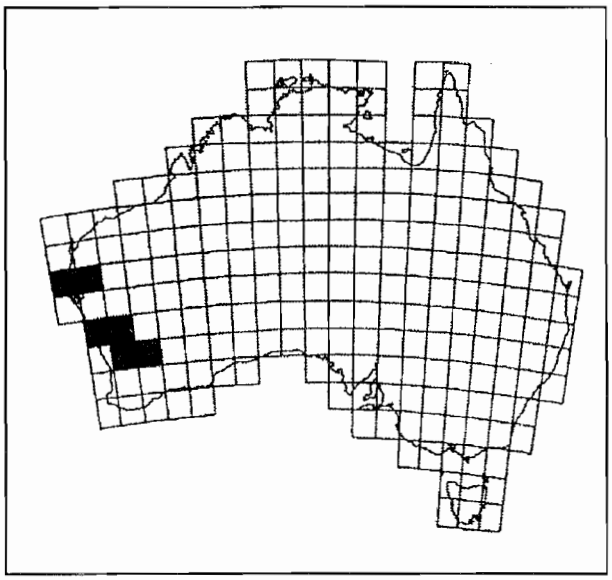
References:

Brooker, M.G. and Estebergs, A.J. 1976. A survey of terrestrial vertebrates in the Carnarvon region, W.A. Western Australian Naturalist 13(7): 160-170.

Chapman, A. and Dell, J. 1985. Biology and zoogeography of the amphibians and reptiles of the Western Australian wheatbelt. Records of the Western Australian Museum 12(1): 1-46.

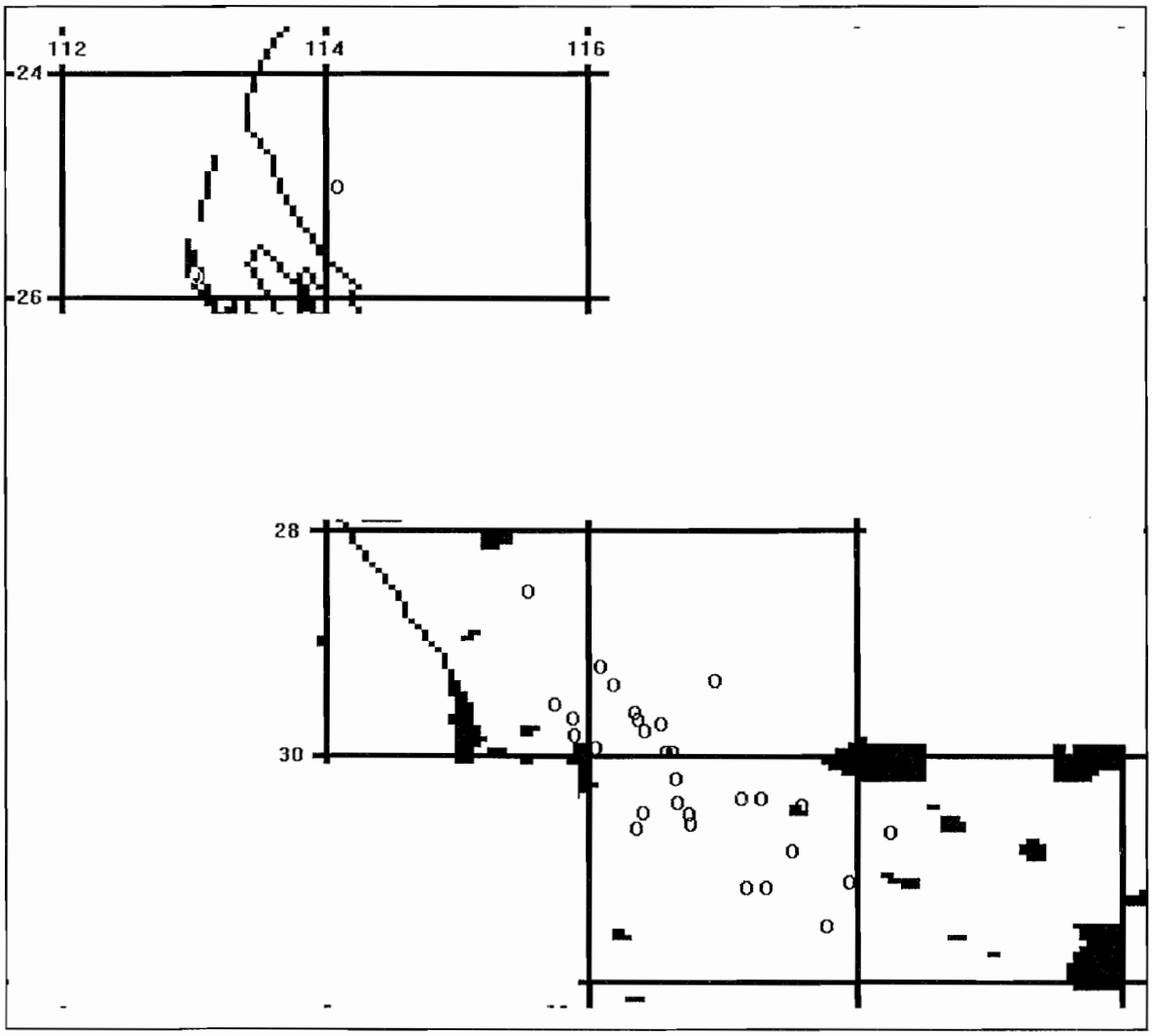
Maryan, B., Robinson, D. and Browne-Cooper, R. 1984. New records of reptiles on Dirk Hartog Island, Western Australia. Western Australian Naturalist 16(1): 8-10.

Wilson, S.K. and Knowles, D.G. 1988. Australia's Reptiles; a photographic reference to the terrestrial reptiles of Australia. Collins Publishers, Australia. 447 pp.



Distribution of

Egernia stokesii badia



1. Family:	Scincidae
2. Scientific Name:	*Egernia stokesii stokesii* (Gray, 1845)
3. English Name:	Houtman Abrolhos Spiny-tailed Skink

4. Infraspecific taxa: *E. stokesii aethiops* (Baudin Island, Freycinet Estuary, Shark Bay), *E. stokesii badia* (Dirk Hartog Island, Shark Bay and semi-arid zone of Western Australia extending from the Gascoyne River south-east to the north-eastern wheatbelt around Kununoppin), *E. stokesii stokesii* (Houtman Abrolhos, off the Western Australian coast opposite Geraldton). Populations of *Egernia stokesii* occurring in eastern Australia are geographically isolated from those in Western Australia and their taxonomic status is unresolved.

5. Subspecies survival status: Vulnerable.

6. Former distribution: Disappeared from Rat Island in the Easter Island Group of the Houtman Abrolhos between 1889 and 1913 (Storr *et al.*, 1983).

7. Current distribution: Wallabi, Pelsaert and Easter Island Groups of Houtman Albrolhos, off the west coast of Western Australia.

8. Habitat: Rocky isolates, open heath.

The islands are generally low flat expanses of limestone littered with piles of storm debris, but the larger Wallabi Islands support a "moderately rich scrub" growing on sand dunes (Storr, 1965); the lizards shelter under limestone slabs and in the hollow stems of dead shrubs.

9. Reasons for decline: Probably a combination of factors, including introduced predators.

The population on Rat Island is believed to have been exterminated by rats or cats introduced to the island (Alexander, 1922). Increased competition from other reptiles and/or accelerated weathering resulting from climatic change, may also threaten the subspecies.

10. Conservation reserves on which subspecies occurs: None known.

10A. Other conservation reserves where subspecies might be expected to occur: None known.

11. Other public land on which subspecies occurs: East Wallabi, West Wallabi, Middle, Murray, Tattler, Seagull and Pigeon Islands in Houtman Abrolhos; all islands in the Abrolhos are reserved for conservation of flora and fauna, tourism and purposes associated with the fishing industry (Andrew Burbidge, *in litt.*).

12. Other land on which subspecies occurs: None known.

13. Is knowledge about subspecies adequate for objectives and actions to be defined accurately?: No.

13.1: Ground surveys need to be conducted to determine the full geographic range of the subspecies, its habitat preferences, and the extent of its occurrence in existing reserves.

13.2: Research is needed into the basic biology and ecology of the subspecies in the field; it should include long term monitoring of changes in population size, habitat use and geographic range.

13.3: Research is needed to document the extent of the subspecies' decline and to identify the major factors contributing to that decline.

13.4: Genetic study needed to determine the taxonomic status of this population.

14. Recovery Plan objectives:

14.1: To obtain sufficient information on the subspecies' biology, ecology and distribution to determine its current conservation status and formulate appropriate management strategies.

14.2: To ensure that secure, viable populations of the subspecies are maintained within a reserve system.

14.3: To implement land management practices which promote the maintenance of secure, viable populations of the subspecies outside reserves.

15. Management actions already initiated:

15.1: Rats have been eradicated on Rat Island and cat control is underway (A. Burbidge, *in litt.*).

16. Management actions required:

16.1: Survey known and potential habitat on the islands where the subspecies occurs.

16.3: Establish appropriate reserves if the existing reserve system is found to be inadequate to secure the survival of the subspecies.

16.4: Develop and promote guidelines for landowners and potential visitors to the islands, to reduce the impact of current land use practices on the subspecies outside reserves.

16.5: Develop community awareness within the subspecies' known range.

16.6: Complete eradication of cats on Rat Island and reintroduce individuals of the subspecies

17. Organisations responsible for conservation of subspecies and individuals involved: Western Australian Department of Conservation and Land Management (Andrew Burbidge).

18. Other organisations and individuals involved: Ron Johnstone (Western Australian Museum).

19. Can recovery plan be carried out with existing resources?: No.

1: Survey of geographic range, habitat preferences and occurrence in reserves: 2 workers for 1 month each year for 2 years - $13,333 salary; $10,000 expenses (1.5 x standard expenses for remote region). **$23.333K**

2: Research into basic biology, taxonomy and ecology, including assessment of threatening processes: 1 worker for 2 months each year for 2 years - $13,333 salary; $10,000 expenses (1.5 x standard expenses for remote region). **$23.333K**

3: Preparation of management strategies: 1 worker for 3 months - $10,000 salary; $2,000 expenses. **$12K**

Total $58.7K

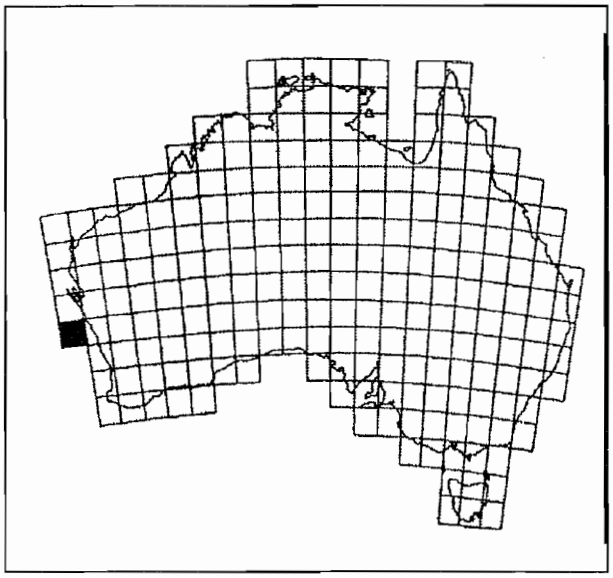
20. Remarks: 130 specimens documented in Australian museum collections.

References:

Alexander, W.B. 1922. The vertebrate fauna of Houtman's Abrolhos (Abrolhos Islands), Western Australia. Journal of the Linnean Society (Zoology) 34(230): 457-486.

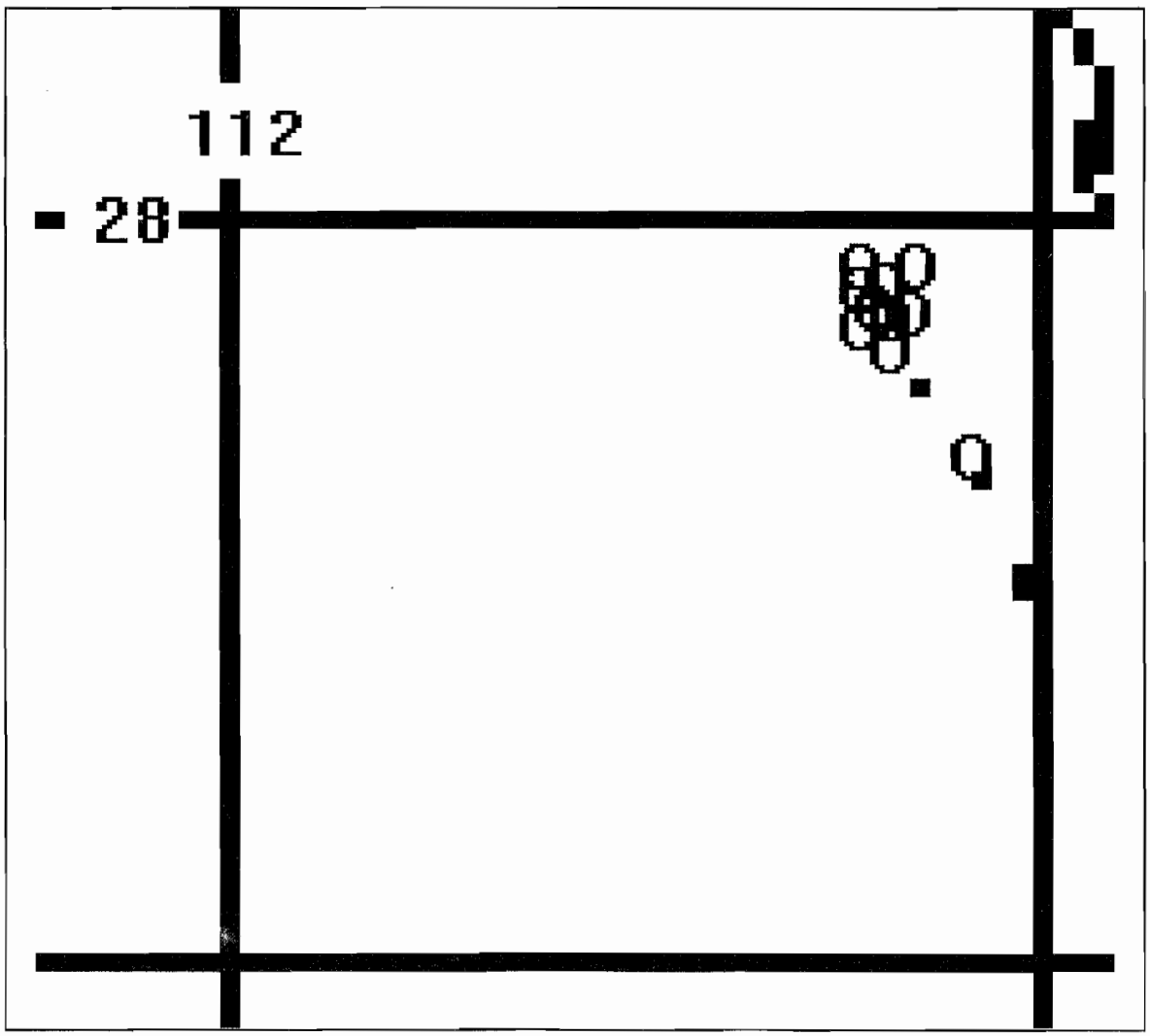
Storr, G.M., 1983. The physiography, vegetation and vertebrate fauna of the Wallabi Group, Houtman Abrolhos. Proceedings of the Royal Society of Western Australia 48(1): 1-14.

Storr, G.M., Hanlon, T.M.S. and Dunlop, J.N. 1983. Herpetofauna of the Geraldton region, Western Australia. Records of the Western Australian Museum 10(3): 215-234.



Distribution of

Egernia stokesii stokesii



1. Family:	Scincidae
2. Scientific Name:	*Eulamprus leuraensis* Wells and Wellington, 1984 [also appears in the literature as *Sphenomorphus leuraensis* and *Costinisauria leuraensis*]
3. English Name:	Blue Mountains Water Skink

4. Infraspecific taxa: None

5. Species survival status: Endangered.

6. Former distribution: May have occurred in more sites along Leura Falls Creek prior to the 1980s (LeBreton, 1992).

7. Current distribution: Apparently restricted to hanging sedge swamps at Wentworth Falls and Leura in the Blue Mountains and on Newnes Plateau, New South Wales; all sites more than 850 m asl.

8. Habitat: Heath, tussock grassland, swamps.

In the Blue Mountains found in dense clumps of swamp sedges and herbs (characterised by *Gymnoschoenus sphaerocephalus*, *Lepidosperma limicola* and *Xyris ustulata*) growing on peaty soils derived from sandstone (Matthew LeBreton, *in litt.*). On Newnes Plateau in shrub swamps bordering streams flowing over sandstone and surrounded by tall open forest.

9. Reasons for decline: Not known to have declined, but highly vulnerable to a number of immediate threats. In the Blue Mountains, urban development (known locations are almost completely surrounded by houses), soil and water pollution by light industry and sewerage works (through changes to hydrology and construction of roads and tracks), visitor disturbance (walkways are proposed around Wentworth Falls Lake recreation area) (Matthew LeBreton, *in litt.*), and possibly predation by cats; in Newnes State Forest, logging of native forest and planting of pines around swamps could threaten the species.

10. Conservation reserves on which species occurs: None known; "... has not yet been found in a National Park or even a Nature Reserve" (LeBreton, 1992).

10A. Other conservation reserves where species might be expected to occur: Blue Mountains NP, Kanangra-Boyd NP, Wollemi NP, Pantoney's Crown NR, forest and flora reserves within Newnes SF.

11. Other public land on which species occurs: Blue Mountains City Council "6a open space" reserves at Leura and Wentworth Falls Lake; Newnes SF.

12. Other land on which species occurs: None known.

13. Is knowledge about species adequate for objectives and actions to be defined accurately?: No.

13.1: Ground surveys need to be conducted to determine the full geographic range of the species, its habitat preferences (including winter refugia), and the extent of its occurrence in existing reserves.

13.2: Research is needed into the basic biology and ecology of the species in the field; it should include long term monitoring of changes in population size, habitat use and geographic range.

13.3: Research is needed to determine if the species is declining and if so, to identify the major factors contributing to that decline.

14. Recovery Plan objectives:

14.1: To obtain sufficient information on the species' biology, ecology and distribution to determine its current conservation status and formulate appropriate management strategies.

14.2: To ensure that secure, viable populations of the species are maintained within a reserve system.

14.3: To implement land management practices which promote the maintenance of secure, viable populations of the species outside

reserves.

15. Management actions already initiated:

15.1: Listed as "threatened" on the 1992 Revised (Interim) Schedule 12 of the *NSW Endangered Fauna (Interim Protection) Act 1991.*

16. Management actions required:

16.1: Survey known and potential habitat in reserves within the species' known range.

16.2: Survey known habitat outside reserves within the species' known range.

16.3: Establish appropriate reserves if the existing reserve system is found to be inadequate to secure the survival of the species. Carefully manage the hydrologic regimes which maintain the integrity of the species' habitat. Wentworth Falls Lake and its associated swamps have been recommended for total protection in a reserve for this species (Wells and Wellington, 1988).

16.4: Develop and promote guidelines for landowners and users to reduce the impact of current land use practices, including recreation, on the species outside reserves; these should include management of weeds and control of water pollution in and adjacent to swamps.

16.5: Develop community awareness within the species' known range, including awareness of the effect of domestic cats upon the species.

16.6: Implement control program for feral cats if they are demonstrated to have an adverse effect on the species.

16.7: Initiate captive breeding program, maintaining genetic integrity of individual populations, with the goal of re-introducing the species into reserves within its known range.

17. Organisations responsible for conservation of species and individuals involved: New South Wales National Parks and Wildlife Service, Forestry Commission of NSW, Blue Mountains City Council.

18. Other organisations and individuals involved: Matthew LeBreton (Blaxland).

19. Can recovery plan be carried out with existing resources?: No.

1:	Survey of geographic range, habitat preferences and occurrence in reserves: 2 workers for 2 months each year for 2 years - $26,667 salary; $13,333 expenses.	**$40K**
2:	Research into basic biology and ecology, including assessment of threatening processes: 1 worker for 3 months each year for 2 years - $20,000 salary; $10,000 expenses.	**$30K**
3:	Preparation of management strategies: 1 worker for 3 months - $10,000 salary; $2,000 expenses.	**$12K**
4:	Establishment of captive breeding program: 1 worker for 2 months each year for 2 years - $13,333 salary; $2,667 expenses.	**$16K**
5:	Purchase of land for the reserve system: uncosted.	
		Total $98K

20. Remarks: Eight specimens documented in Australian museum collections. More than 10 sight records at Leura in 1991.

References:

Keith, D.A. and Benson, D.H. 1990. The natural vegetation of the Katoomba 1:1 000 000 map sheet. Cunninghamia 2(1): 107-143.

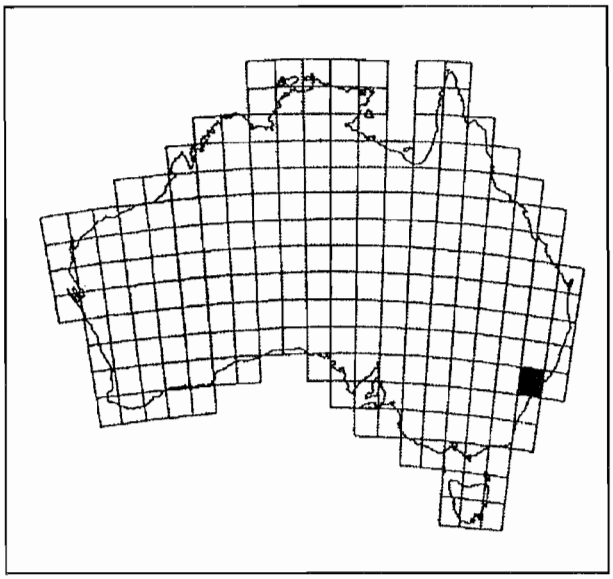
Kingston, T.J., Pulsford, I.F. and Smith, P. 1979. Faunal survey of the Newnes Plateau/Colo River area. Australian Museum, Sydney. 45 pp. [as alpine water skink, *Sphenomorphus kosciuskoi*].

LeBreton, M.J. 1990. Comments on the type locality of the Blue Mountains water skink, *Costinisauria leuraensis* (Wells and Wellington, 1984). Australian Herpetologist 536: 1-3.

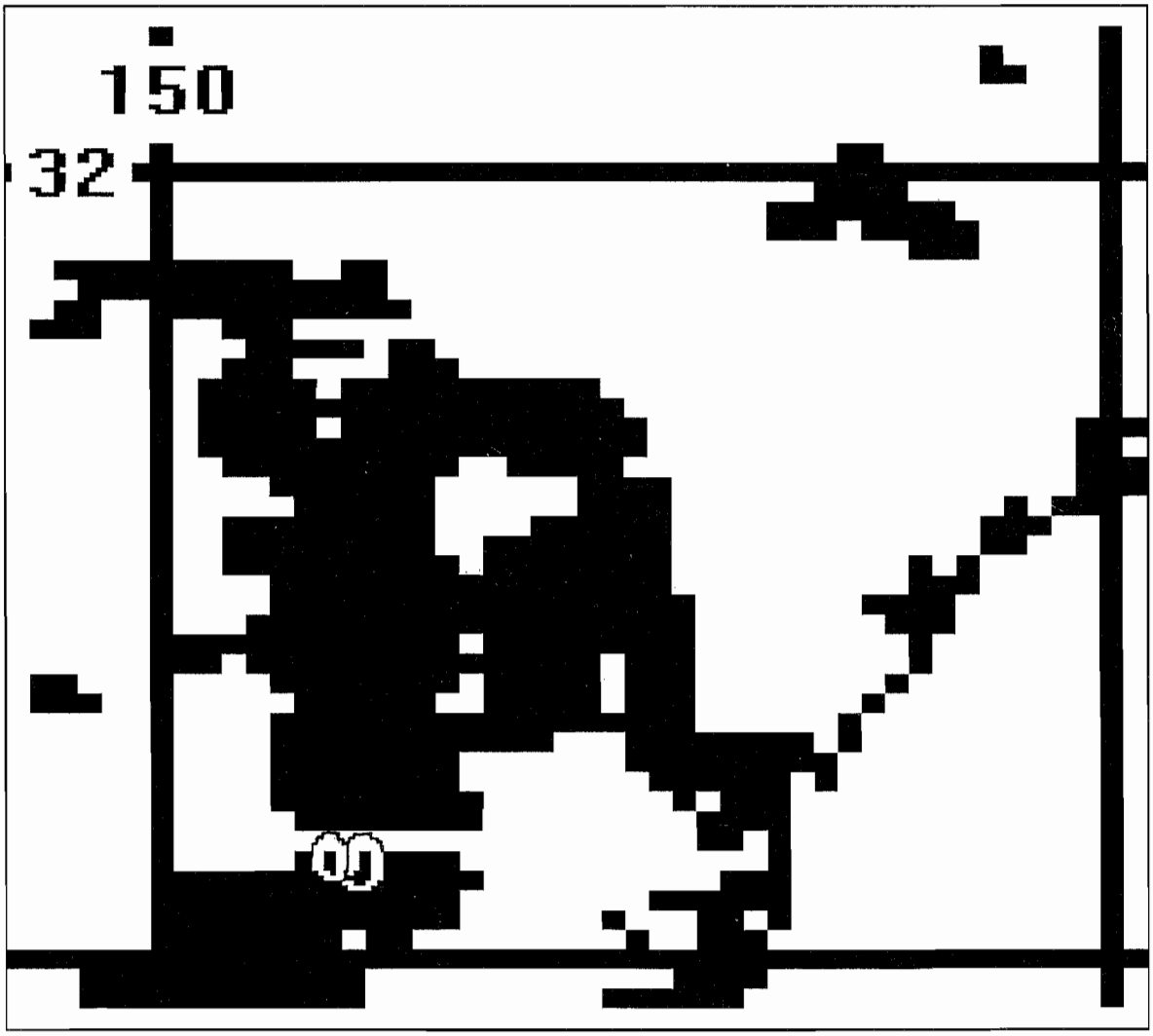
LeBreton, M.J. 1992. Notes on the Blue Mountains water skink, *Costinisauria leuraensis* (Wells and Wellington) (Lacertilia: Scincidae). Sydney Basin Naturalist 1: 101-103.

Shea, G.M. and Peterson, M. 1985. The Blue Mountains water skink, *Sphenomorphus leuraensis*

(Lacertilia: Scincidae): a redescription, with notes on its natural history. Proceedings of the Linnean Society of New South Wales 108(2): 141-148.
Wells, R.W. and Wellington, C.R. 1984. A synopsis of the class Reptilia in Australia. Australian Journal of Herpetology 1(3/4): 73-129.
Wells, R.W. and Wellington, C.R. 1988. The amphibians and reptiles of the Blue Mountains region, Sydney Basin, New South Wales, Australia. Australian Herpetologist 504: 1-12.



Distribution of *Eulamprus leuraensis*



1. Family:	Scincidae
2. Scientific Name:	*Eulamprus tympanum ssp. nov.* (basalt plains, VIC)
3. English Name:	Dreeite Water Skink

4. Infraspecific taxa: *E. tympanum tympanum* (cool temperate areas of south-eastern Australia from Mount Gambier, South Australia, through southern and eastern Victoria - south of the Grampians - to south-eastern New South Wales), *E. tympanum ssp. nov.* (basalt plains associated with inland lakes of the Western District of Victoria).

5. Subspecies survival status: Endangered.

6. Former distribution: Not known to have differed from current distribution.

7. Current distribution: Between Lake Bolac and the western side of Lake Colac in the Dreeite region of south-western Victoria. This subspecies occupies an "island" of specific habitat which is surrounded by unsuitable habitat occupied by the nominal subspecies (John Coventry & Mark Hutchinson, *in litt.*).

8. Habitat: Swamps, tussock grassland, open woodland.

Found in grassy open woodland and cleared pastures dotted with ephemeral swamps and lakes, on rocky basaltic soils. The lizards inhabit rocky mounds known locally as "stony rises", sheltering in rock crevices which provide a moist microhabitat, and basking in semi-shade; they also occupy man-made drystone walls which provide a network of habitat corridors for migration (Mark Hutchinson, pers. comm.). The Tree Violet, *Hymenanthera dentata*, commonly occurs as a tall shrub in these rocky habitats.

9. Reasons for decline: Probably a combination of factors, including clearance of habitat for agriculture and grazing, and rock removal.

Most of the habitat has been modified by clearance of woodland. Some of the mossy drystone walls are being demolished and removed for the landscape garden market and clearance of some of the stony rises and scattered basalt rocks has been undertaken to provide more grazing land. One of the first known populations of the subspecies was simultaneously discovered and eliminated during rock clearance in 1968.

10. Conservation reserves on which subspecies occurs: None known.

10A. Other conservation reserves where subspecies might be expected to occur: None.

11. Other public land on which subspecies occurs: None.

12. Other land on which subspecies occurs: Potentially present in suitable habitat on private properties throughout the range of the subspecies.

13. Is knowledge about subspecies adequate for objectives and actions to be defined accurately?: No.

13.1: Ground surveys need to be conducted to determine the full geographic range of the subspecies.

13.2: Research is needed into the basic biology and ecology of the subspecies in the field; it should include long term monitoring of changes in population size, habitat use and geographic range.

13.3: Research is needed to document the extent of the subspecies' decline.

14. Recovery Plan objectives:

14.1: To obtain sufficient information on the subspecies' biology, ecology and distribution to determine its current conservation status and formulate appropriate management strategies.

14.2: To implement land management practices which promote the maintenance of secure, viable populations of the subspecies outside reserves.

15. Management actions already initiated: None known.

16. Management actions required:

16.1: Survey known and potential habitat within the subspecies' known range.

16.2: Develop heritage agreements or property covenants and provide incentives for landowners to reduce the impact of current land use practices, including timber and rock clearance, on the subspecies outside reserves.

16.3: Halt destruction of drystone walls and promote their conservation as an historic heritage issue.

16.4: Develop community awareness within the subspecies' known range.

17. Organisations responsible for conservation of subspecies and individuals involved: Victorian Department of Conservation and Natural Resources.

18. Other organisations and individuals involved: Mark Hutchinson (South Australian Museum), John Coventry (Museum of Victoria).

19. Can recovery plan be carried out with existing resources?: No.

1: Survey of geographic range, habitat preferences and occurrence in reserves: 2 workers for 2 months each year for 2 years - $26,667 salary; $13,333 expenses. **$40K**

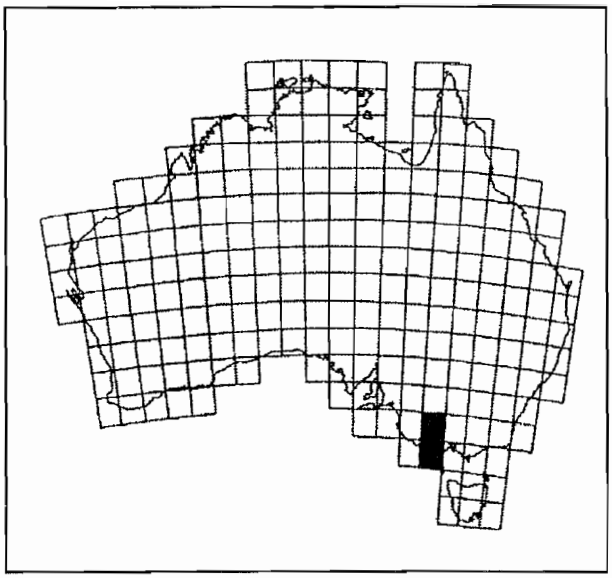
2: Research into basic biology and ecology, including assessment of threatening processes: 1 worker for 3 months for 2 years - $20,000 salary; $10,000 expenses. **$30K**

3: Preparation of management strategies: 1 worker for 3 months - $10,000 salary; $2,000 expenses. **$12K**

Total $82K

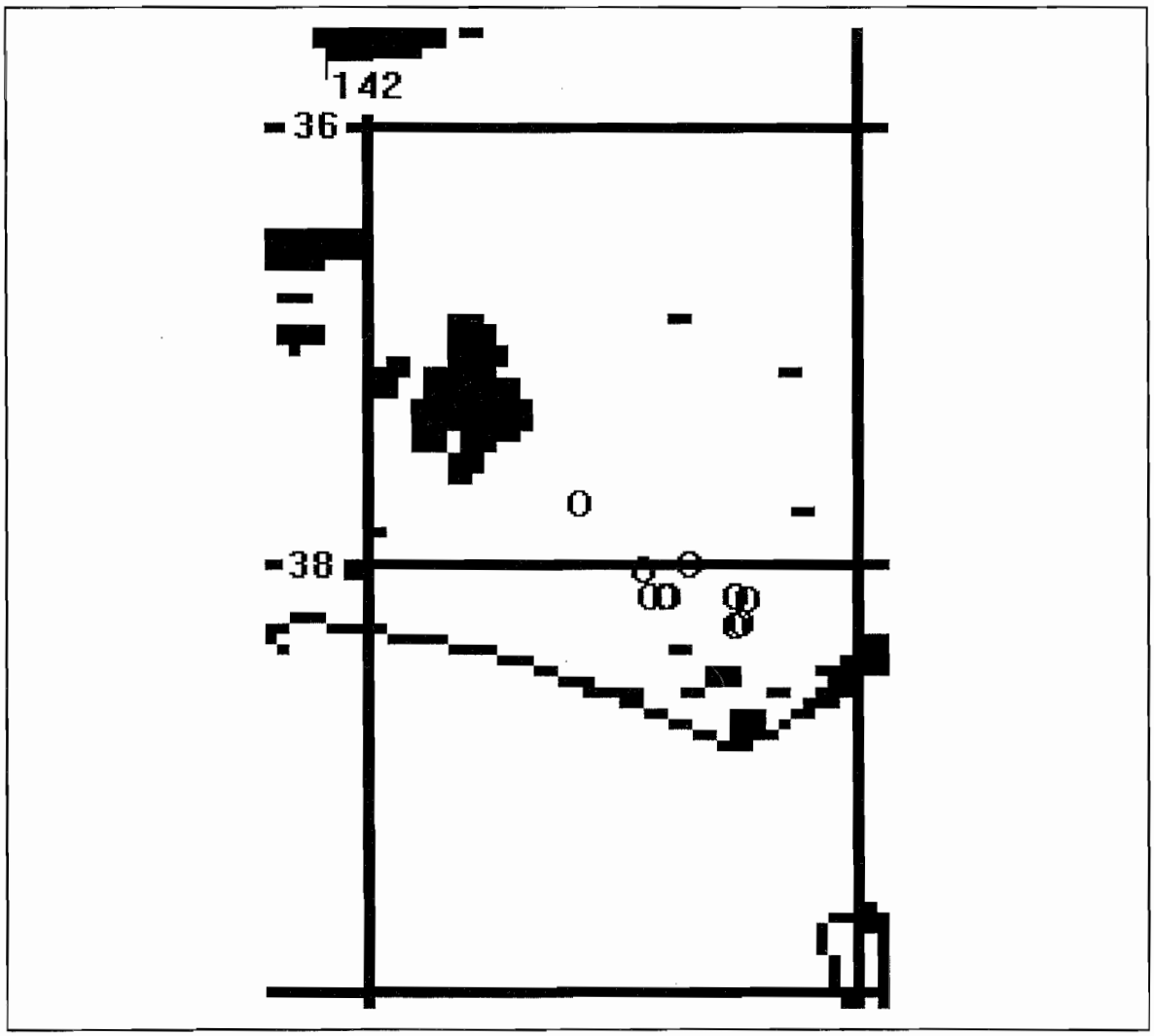
20. Remarks: 65 specimens documented in Australian museum collections.

This subspecies occupies an unusually dry habitat for a water skink and its continued survival in the area probably depends on the existence of the moist microhabitat within the stony rises and drystone walls (Mark Hutchinson, pers. comm.). The drystone walls appear to provide a refuge during arid periods for a variety of other reptiles, and their preservation may also assist the conservation of *Delma impar* (Vulnerable) in south-western Victoria (Mark Hutchinson, pers. comm.).



Distribution of

Eulamprus tympanum ssp. nov.



1. **Family**: Scincidae

2. **Scientific Name**: *Lerista allanae* (Longman, 1937)

3. **English Name**: Allan's Lerista

4. **Infraspecific taxa**: None

5. **Species survival status**: Endangered.

6. **Former distribution**: Not known to have differed from current distribution.

7. **Current distribution**: Recorded from an area of about 1,000 km^2 around the towns of Clermont and Capella in central Queensland but the localities where the species was recorded have all been dramatically altered and no specimens have been found since 1960.

8. **Habitat**: Tussock grassland.

Found in the root systems of grass tussocks on black soils.

9. **Reasons for decline**: Probably a combination of factors including overgrazing by stock, pasture improvement and intensive cropping.

Virtually all of its preferred habitat has been cultivated and no longer carries natural vegetation (Jeanette Covacevich and Patrick Couper, *in litt.*).

10. **Conservation reserves on which species occurs**: None known.

10A. **Other conservation reserves where species might be expected to occur**: None known.

11. **Other public land on which species occurs**: None known.

12. **Other land on which species occurs**: All known specimens have come from private properties, including Retro Station, Capella (in the 1930s) and Logan Downs Station (in 1948 or earlier).

13. **Is knowledge about species adequate for objectives and actions to be defined accurately?**: No.

13.1: Ground surveys need to be conducted to determine if the species is extant, and if so, its full geographic range and habitat preferences.

13.2: Research is needed into the basic biology and ecology of the species in the field; it should include long term monitoring of changes in population size, habitat use and geographic range.

13.3: Research is needed to document the extent of the species' decline and to identify the major factors contributing to that decline.

14. **Recovery Plan objectives**:

14.1: To obtain sufficient information on the species' biology, ecology and distribution to determine its current conservation status and formulate appropriate management strategies.

14.2: To ensure that secure, viable populations of the species are maintained within a reserve system.

14.3: To implement land management practices which promote the maintenance of secure, viable populations of the species outside reserves.

15. **Management actions already initiated**: None known.

16. **Management actions required**:

16.1: Survey known and potential habitat within the species' known range.

16.2: Develop and promote guidelines and provide incentives for landowners to reduce the impact of current land use practices on the species outside reserves.

16.3: Establish appropriate reserves to secure the survival of the species.

16.4: Develop community awareness within the species' known range.

17. **Organisations responsible for**

conservation of species and individuals involved: Queensland Department of Environment and Heritage.

18. Other organisations and individuals involved: Patrick Couper, Glen Ingram and Jeanette Covacevich (Queensland Museum), Glenn Shea (University of Sydney).

19. Can recovery plan be carried out with existing resources?: No.

1:	Survey of geographic range and habitat preferences: 2 workers for 2 months each year for 2 years - $26,667 salary; $13,333 expenses.	**$40K**
2:	Research into basic biology and ecology, including assessment of threatening processes: 1 worker for 3 months each year for 2 years - $20,000 salary; $10,000 expenses.	**$30K**
3:	Preparation of management strategies: 1 worker for 3 months - $10,000 salary; $2,000 expenses.	**$12K**
4:	Purchase of land for the reserve system: uncosted.	
		Total $82K

20. Remarks: 10 specimens documented in Australian museum collections, all collected between 1929 and 1960.

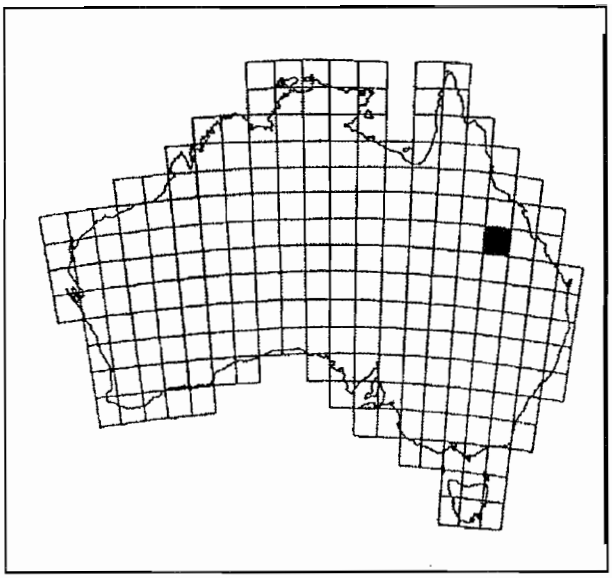
Queensland Museum staff have visited Retro three times in recent years but have been unable to locate any individuals of *Lerista allanae* (Jeanette Covacevich and Patrick Couper, *in litt.*). They are planning a saturation pitfall trapping program in the next few years.

References:

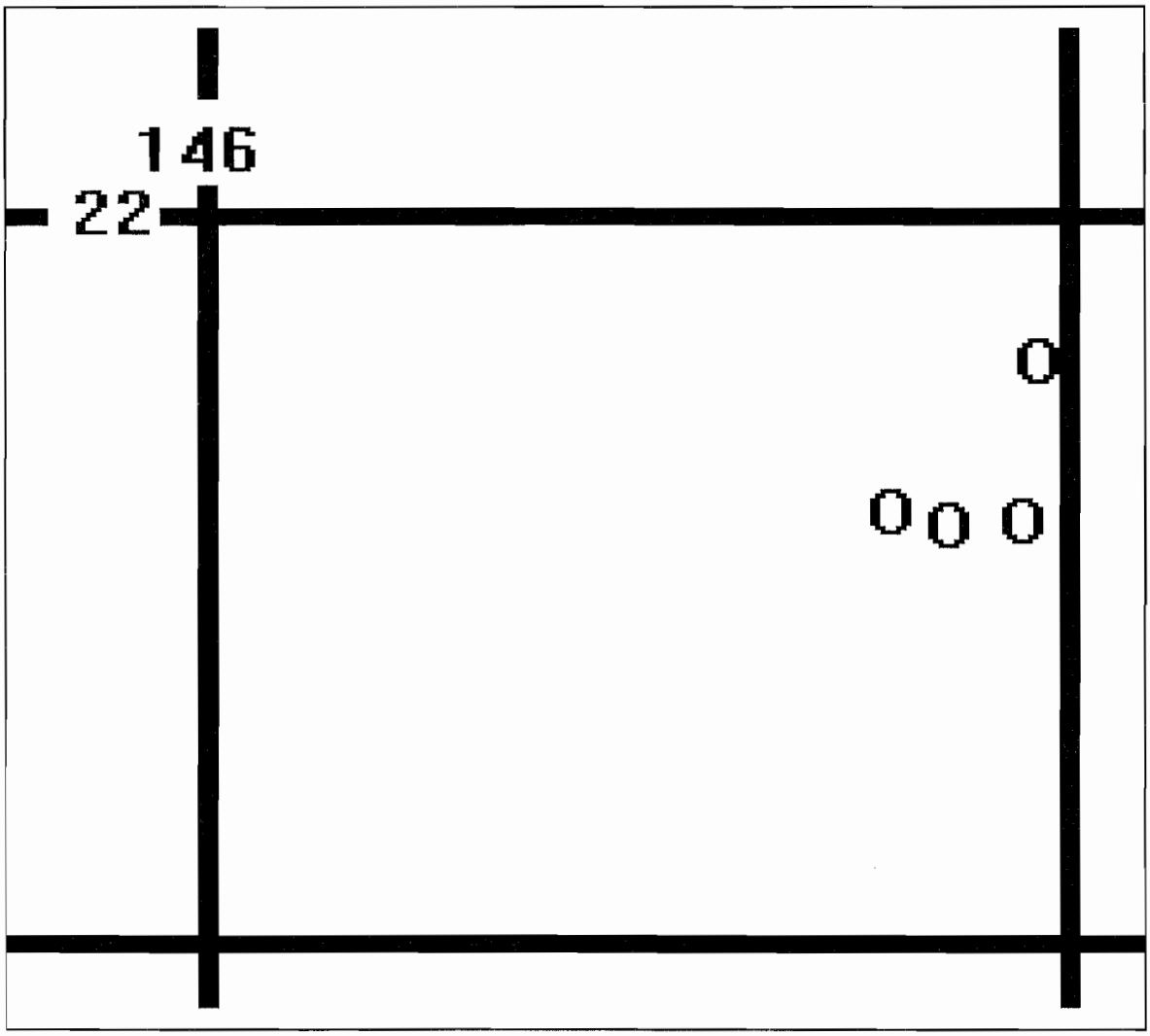
Couper, P.J. and Ingram, G.J. 1992. A new species of skink of *Lerista* from Queensland and a re-appraisal of *L. allanae* (Longman). Memoirs of the Queensland Museum 32(1): 55-59.

McDonald, K.R., Covacevich, J.A., Ingram, G.J. and Couper, P.J. 1991. The status of frogs and reptiles. pp. 338-345 in G.J. Ingram and R.J. Raven (eds) An Atlas of Queensland's Frogs, Reptiles, Birds and Mammals. Queensland Museum, Brisbane.

Shea, G. in press. New record of *Lerista allanae* (Squamata: Scincidae). Memoirs of the Queensland Museum 33(1).



Distribution of *Lerista allanae*



1. Family:	Scincidae
2. Scientific Name:	*Lerista vittata* Greer, McDonald and Lawrie, 1983
3. English Name:	Mount Cooper Striped Lerista

4. Infraspecific taxa: None

5. Species survival status: Vulnerable.

6. Former distribution: Area of suitable habitat originally occupied about 6,000 ha on Mount Cooper Station, but 4,000 ha was cleared in 1980 (Greer *et al.*, 1983).

7. Current distribution: Area of approximately 2,000 ha centred on Mount Cooper Station, Mount Cooper Tableland, 90 km south-east of Charters Towers, Queensland.

8. Habitat: Low closed forest, woodland.

Found burrowed in leaf litter and loose soil under logs in deciduous vine thicket growing on yellowish-red, deep sandy soils (Greer *et al.*, 1983). Also in "open patches of low vegetation, extending onto adjacent heavier soils supporting woodlands" (Wilson and Knowles, 1988), where it is found inside rotten logs (Glenn Shea, *in litt.*).

9. Reasons for decline: Clearance of habitat for grazing, and pasture improvement. Much of the vine thicket was cleared in July 1980 to establish a buffel grass pasture (Greer *et al.*, 1983).

10. Conservation reserves on which species occurs: None known.

10A. Other conservation reserves where species might be expected to occur: None known.

11. Other public land on which species occurs: None known.

12. Other land on which species occurs: Queensland: St Paul's Scrub, Mount Cooper Station.

13. Is knowledge about species adequate for objectives and actions to be defined accurately?: No.

13.1: Ground surveys need to be conducted to determine the full geographic range of the species and its habitat preferences.

13.2: Research is needed into the basic biology and ecology of the species in the field; it should include long term monitoring of changes in population size, habitat use and geographic range.

13.3: Research is needed to document the extent of the species' decline and to identify the major factors contributing to that decline.

14. Recovery Plan objectives:

14.1: To obtain sufficient information on the species' biology, ecology and distribution to determine its current conservation status and formulate appropriate management strategies.

14.2: To ensure that secure, viable populations of the species are maintained within a reserve system.

14.3: To implement land management practices which promote the maintenance of secure, viable populations of the species outside reserves.

15. Management actions already initiated: None known.

16. Management actions required:

16.1: Defer granting of licenses to clear vine scrub within the species' known range until the following actions have been carried out.

16.2: Survey known and potential habitat within the species' known range.

16.3: Establish appropriate reserves.

16.4: Develop and promote guidelines and provide incentives for landowners and users to reduce the impact of current land use practices on the species outside reserves.

16.5: Develop community awareness within

the species' known range.

17. Organisations responsible for conservation of species and individuals involved: Queensland Department of Environment and Heritage (Keith McDonald).

18. Other organisations and individuals involved: None known.

19. Can recovery plan be carried out with existing resources?: No.

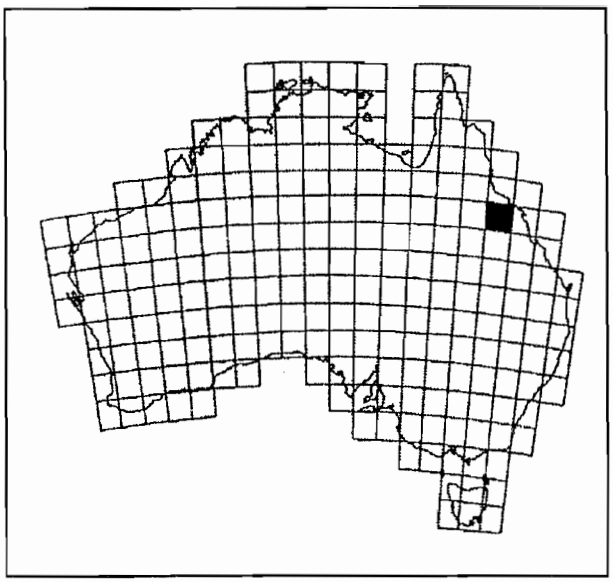
1:	Survey of geographic range and habitat preferences: 2 workers for 2 months each year for 2 years - $26,667 salary; $13,333 expenses.	**$40K**
2:	Research into basic biology and ecology, including assessment of threatening processes: 1 worker for 3 months each year for 2 years - $20,000 salary; $10,000 expenses.	**$30K**
3:	Preparation of management strategies: 1 worker for 3 months - $10,000 salary; $2,000 expenses.	**$12K**
4:	Purchase of land for the reserve system: uncosted.	
		Total $82K

20. Remarks: 91 specimens documented in Australian museum collections.

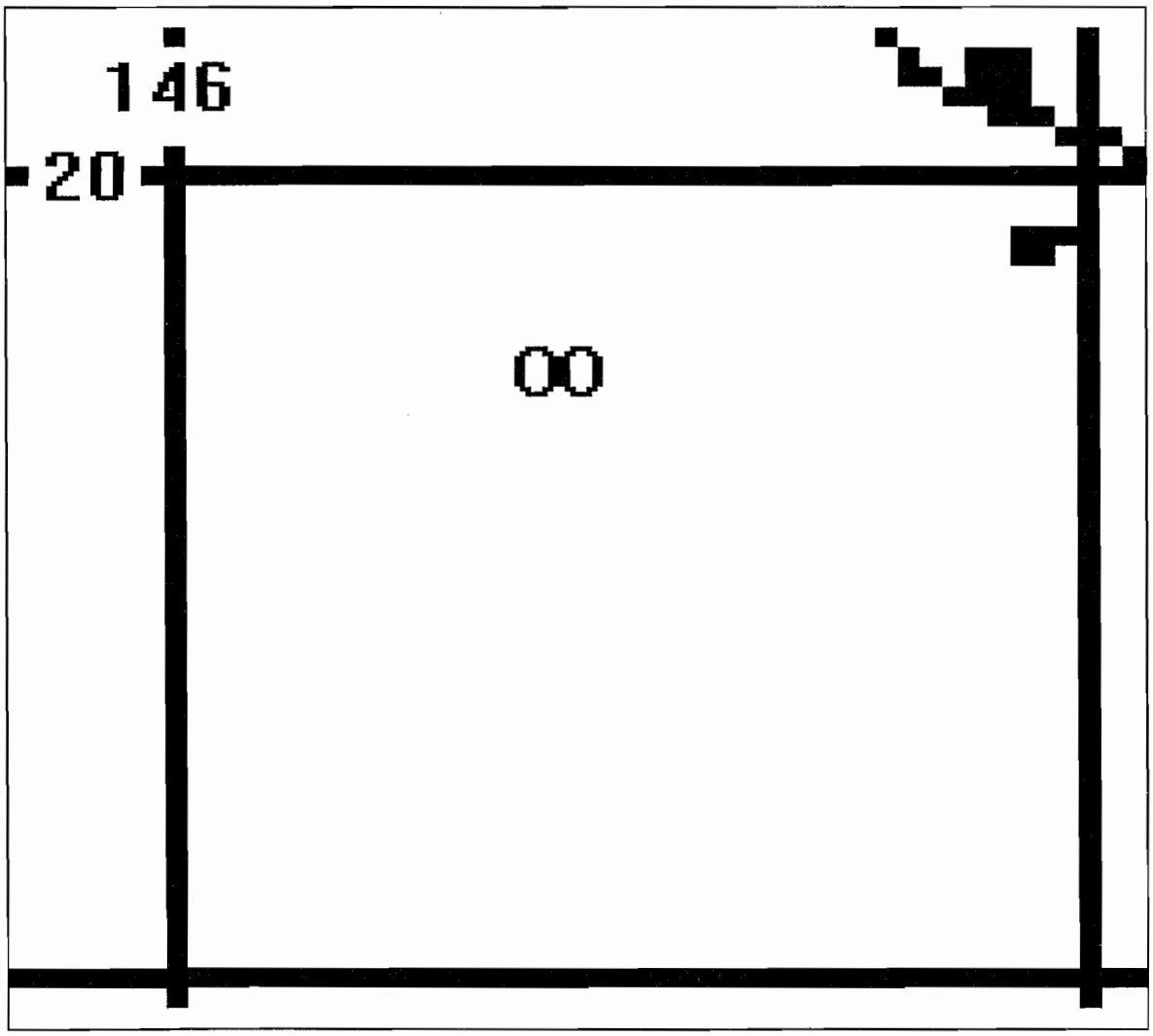
References:

Greer, A.E., McDonald, K.R. and Lawrie, B.C. 1983. Three new species of *Lerista* (Scincidae) from northern Queensland with a diagnosis of the *wilkinsi* species group. Journal of Herpetology 17(3): 247-255.

Wilson, S.K. and Knowles, D.G. 1988. Australia's Reptiles; a photographic reference to the terrestrial reptiles of Australia. Collins Publishers, Australia. 447 pp.



Distribution of *Lerista vittata*



1. Family:	Scincidae
2. Scientific Name:	*Niveoscincus palfreymani* (Rawlinson, 1974) [also appears in the literature as *Pseudemoia palfreymani*]
3. English Name:	Pedra Branca Skink

4. Infraspecific taxa: None

5. Species survival status: Vulnerable.

6. Former distribution: Not known to have differed from current distribution. The island is believed to have been separated from the mainland for at least 15,000 years (Rounsevell *et al.*, 1985).

7. Current distribution: Pedra Branca Island, 26 km off the south-east coast of Tasmania. Total area of the island is about 2.5 ha but only about 0.14 ha provides suitable habitat for the lizards.

8. Habitat: Rocky isolates.

The island is formed of layers of sandstone and there is practically no soil; guano has become cemented into crevices and between loose rocks. The lizards are confined to small areas of the island which provide suitable shelter in the form of burrows under boulders and in deep crevices, or extensive tunnels in weathered sandstone (Rounsevell *et al.*, 1985).

9. Reasons for decline: Not known to have declined, but its restriction to a single island makes it very vulnerable to new threatening processes, for example predation by rats which might be introduced by fishing boats, loss of its primary food source and possibly, climatic variation.

The lizards depend heavily on dead mackerel regurgitated by colonies of gannets and albatrosses which nest on the island, and might become extinct if the seabirds abandoned their rookeries. The seabirds are vulnerable to overfishing - either through the depletion of jack mackerel, or by drowning on the hooks of longlines which are increasingly being used in their feeding grounds. Climatic change could also threaten them: rising sea levels could critically reduce the area of the island, which is only 55 m high, and a drop in mean temperatures could approach the critical thermal minimum for a species already living in very unfavourable environmental conditions (Hutchinson and Schwaner, 1991).

10. Conservation reserves on which species occurs: Pedra Branca is included within the South-West Tasmania World Heritage Area and the Southwest Conservation Area.

10A. Other conservation reserves where species might be expected to occur: None.

11. Other public land on which species occurs: None.

12. Other land on which species occurs: None.

13. Is knowledge about species adequate for objectives and actions to be defined accurately?: No, but much preliminary work has been done.

13.1: Further ground surveys need to be conducted to more accurately determine the population size and habitat preferences of the species.

13.2: Research is needed into the basic biology and ecology of the species in the field; it should include long term monitoring of changes in population size, habitat use and distribution on the island.

13.3: Research is needed to determine if the species is declining and if so, to identify the major factors contributing to that decline.

14. Recovery Plan objectives:

14.1: To obtain sufficient information on the species' biology and ecology to determine its current conservation status and formulate appropriate management strategies.

14.2: To ensure that a secure, viable

population of the species is maintained on Pedra Branca Island.

15. Management actions already initiated:

15.1: Listed on Schedule 1 of the Commonwealth's *Endangered Species Protection Act 1992* and prescribed as "endangered wildlife" in Schedule 1A Part II of the Wildlife Regulations under the *Tasmanian National Parks and Wildlife Act 1971.*

15.2: Pedra Branca Island is included within the South-West Tasmania World Heritage Area and the Southwest Conservation Area.

15.3: Tasmanian Department of Environment and Land Management is undertaking a monitoring program, visiting the island regularly to mark individuals and collect field data.

16. Management actions required:

16.1: Continue regular visits to Pedra Branca Island to collect biological and ecological data, monitor the population, and detect introduced predators.

16.2: Collate and analyse data collected by Tas DELM on the species.

16.3: Develop and promote guidelines for potential visitors to the island to reduce the impact on the species.

16.4: Develop community awareness within the species' known range.

16.5: Implement eradication program should introduced predators become established on the island.

16.6: Monitor the viability of populations of seabirds (gannets and albatrosses) on the island because of their role in providing a source of food for the lizards.

17. Organisations responsible for conservation of species and individuals involved: Tasmanian Department of Environment and Land Management (David Rounsevell, Nigel Brothers).

18. Other organisations and individuals involved: None known.

19. Can recovery plan be carried out with existing resources?: No, although Tas DELM is already directing some of its existing resources to recovery activities.

1: Field observations to determine mortality and recruitment levels and other potential causes of change in population size, and to gather further data on basic biology and ecology: 2 workers for 1 month each year for 3 years - $20,000 salary; $30,000 expenses (3 x standard expenses for very remote region). **$50K**

2: Data analysis to refine estimation of population size from new and existing data: 1 worker for 3 months - $10,000 salary; $2,000 expenses. **$12K**

3: Preparation of management strategies: 1 worker for 3 months - $10,000 salary; $2,000 expenses. **$12K**

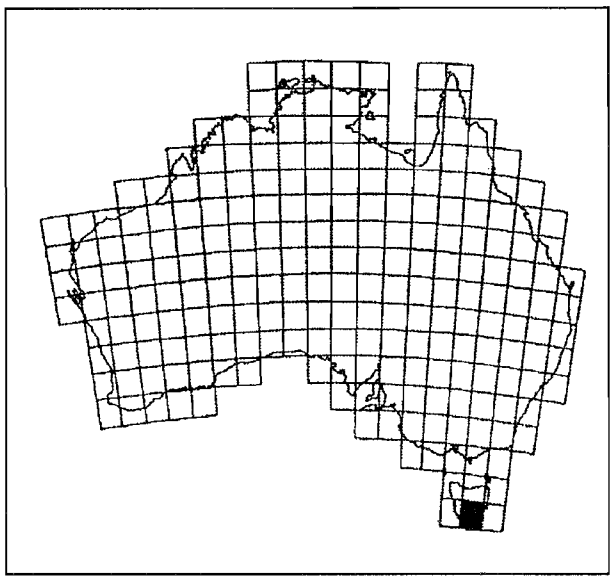
Total $74K

20. Remarks: 15 specimens documented in Australian museum collections. The total population of the island has been estimated at approximately 600 individuals (David Rounsevell, *in litt.*).

References:

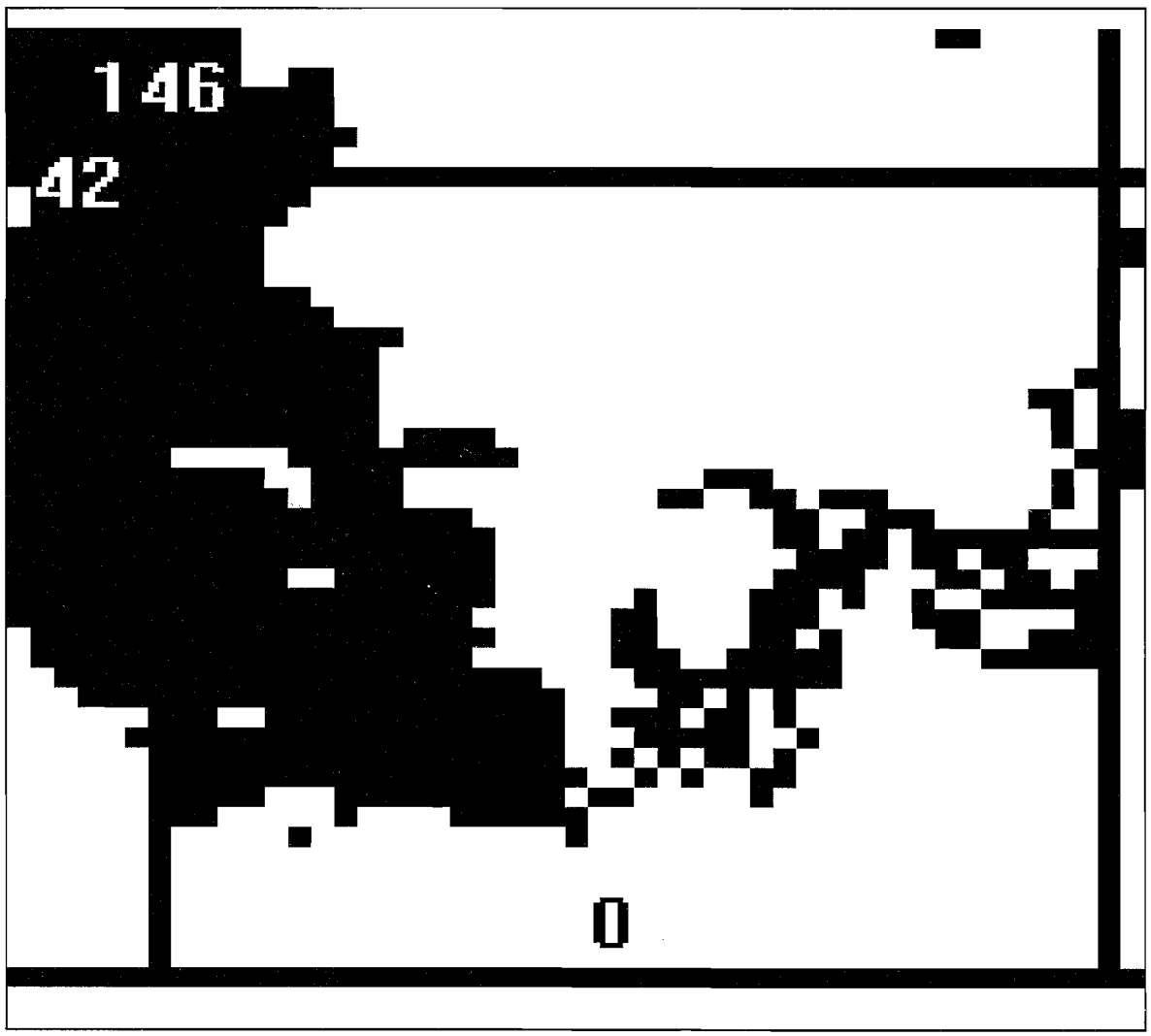
Hutchinson, M.N. and Schwaner, T.D. 1991. Genetic relationships among the Tasmanian scincid lizards of the genus *Niveoscincus*. Journal of Herpetology 25(1): 49-58.

Rounsevell, D., Brothers, N. and Holdsworth, M. 1985. The status and ecology of the Pedra Branca Skink *Pseudemoia palfreymani*. pp. 477-480 in G. Grigg, R. Shine and H. Ehmann (eds) The Biology of Australasian Frogs and Reptiles. Royal Zoological Society of New South Wales, Sydney.



Distribution of

Niveoscincus palfreymani



1. Family:	Scincidae
2. Scientific Name:	*Pseudemoia lichenigera* (O'Shaughnessy, 1874) [also appears in the literature as *Leiolopisma lichenigerum*]
3. English Name:	Lord Howe Island Skink

4. Infraspecific taxa: None at present but morphological differences between the Lord Howe and Norfolk populations are indicative of some degree of taxonomic distinctiveness.

5. Species survival status: Vulnerable. "Given that *L. lichenigerum* was found in virtually all habitats surveyed on Philip Island, albeit in small numbers, there seems no reason to doubt that the present population is substantial and that it is in no immediate danger of extinction" (Cogger *et al.*, 1983).

6. Former distribution: Lord Howe Island and Norfolk Island and their small off-shore islands, Pacific Ocean.

7. Current distribution: On Lord Howe Island Cogger (1971) found this species apparently restricted to a very small area around Malabar and Signal Point although Cameron Leary (*in litt.*) observed that its "range and extent of occurrence on Lord Howe Island ...would be far greater than...current information indicates". Also on Blackburn (Rabbit) Island in the lagoon, probably all of the Admiralty Islets (specific records are only from Roach Island), and on Ball's Pyramid. Appears to be extinct on Norfolk Island, but still occurs on Phillip Island, the largest of the offshore islands.

8. Habitat: Closed forest, low open woodland, tussock grassland, littoral complex, rocky isolates.

Lord Howe Island: on the islands in the lagoon found under and among loose basalt boulders. On the main island appears to be restricted to honeycombed beachrock boulders in dense *Howea* palm forest. Norfolk Island: on Phillip Island found in a wide range of habitats from bare eroded slopes to dense thickets of African Olive and amongst the roots of dense tussocks of graminoids such as *Cyperus haematodes*.

9. Reasons for decline: Probably a combination of factors, including grazing by rabbits, soil compaction and erosion, predation by rats, cats and pigs.

The virtual disappearance of this species from the main island of Lord Howe has been due almost certainly to the introduction of the Black Rat, *Rattus rattus*, through a shipwreck in 1918 (Cogger, 1971). Predation by cats and pigs on Lord Howe Island has also been documented.

It is probable that the disappearance of *P. lichenigera* from the mainland of Norfolk Island was due to the introduction of the Pacific Rat, *Rattus exulans* by Polynesians who are believed to have visited the island between 1100 and 250 years BP (Specht, 1979). The Black Rat, *Rattus rattus*, now occurs on Norfolk Island and is considered a greater threat to endemic birds. The population on Phillip Island is assumed to have declined dramatically with the massive habitat destruction caused by the introduction of rabbits, pigs and goats in the late 1700s; the pigs and goats died out quickly but rabbits were only eliminated in 1986.

10. Conservation reserves on which species occurs (including a list of other Action Plan species in each conservation reserve): Lord Howe Island: Lord Howe Island Permanent Park Reserve, which includes the Malabar region of Lord Howe Island, Blackburn (Rabbit) Island, the Admiralty Islands and Balls Pyramid; Norfolk Island: Phillip Island Forest Reserve.
Christinus guentheri (Vulnerable) also occurs on the reserves in the Lord Howe Island complex and on Phillip Island Forest Reserve.

10A. Other conservation reserves where species might be expected to occur: None.

11. Other public land on which species occurs: None known.

12. Other land on which species occurs: Lord Howe Island: Signal Point, Old Settlement, Ocean View Guest Lodge and the Palm Nursery.

13. Is knowledge about species adequate for objectives and actions to be defined accurately?: No.

13.1: Further ground surveys need to be conducted to determine habitat preferences, and the extent of the species' occurrence in existing reserves.

13.2: Research is needed into the basic biology and ecology of the species in the field; it should include long term monitoring of changes in population size, habitat use and geographic range.

13.3: Research is needed to document the extent of the species' decline and to identify the major factors contributing to that decline.

13.4: Genetic study needed to determine the extent of differentiation between the populations on the two island groups.

14. Recovery Plan objectives:

14.1: To obtain sufficient information on the species' biology, ecology and distribution to determine its current conservation status and formulate appropriate management strategies.

14.2: To ensure that secure, viable populations of the species are maintained within a reserve system.

14.3: To implement land management practices which promote the maintenance of secure, viable populations of the species outside reserves.

15. Management actions already initiated:

Lord Howe Island

15.1: Listed as "vulnerable and rare" on the 1992 Revised (Interim) Schedule 12 of the *NSW Endangered Fauna (Interim Protection) Act 1991.*

15.2: The entire area has World Heritage listing.

15.3: An intensive rat and mouse control program is in progress.

15.4: Prohibition placed on the importation of cats (only 12 domestic cats remaining in April 1993).

15.5: Pigs have been removed from the island.

Norfolk Island

15.6: Phillip Island is listed on the Register of the National Estate for its conservation values.

15.5: Survey of terrestrial reptiles of the Norfolk Island complex conducted for ANPWS in 1978 (Cogger *et al.*, 1979).

15.6: Rabbits eliminated from Phillip Island and revegetation program undertaken.

15.7: Current program to exclude rats from a large section of Norfolk Island National Park with associated possibility of re-introducing lizards.

15.8: Draft Management Plan for Phillip Island prepared by ANCA.

16. Management actions required:

16.1: Survey known and potential habitat in reserves.

16.2: Periodic monitoring of the satellite islands on which this species occurs in both the Norfolk Island and Lord Howe Island complexes; the small size, inhospitable environment and inaccessibility of these will mitigate against the need for direct management actions.

16.3: Maintain existing management strategies on Nepean and Blackburn (Rabbit) Islands.

16.4: Continue present program to rehabilitate vegetation on Phillip Island.

16.5: Implement or continue rat, cat and pig eradication programs on the main islands of Norfolk and Lord Howe.

16.6: Concentrate conservation management actions on those islands (Blackburn = Rabbit, Roach, Phillip) on which both this species and *Christinus guentheri* are known to occur.

16.7: Develop and promote guidelines for landowners and users to reduce the impact of current land use practices on the species outside reserves.

16.8: Develop community awareness.

17. Organisations responsible for conservation of species and individuals involved: Lord Howe Island: New South Wales National Parks and Wildlife Service (Cameron Leary, Senior Ranger), Lord Howe Island Board; Norfolk Island: Australian National Parks and Wildlife Service (Paul Stevenson, Conservator), Norfolk Island Administration.

18. Other organisations and individuals involved: Hal Cogger (Australian Museum).

19. Can recovery plan be carried out with existing resources?: No, although responsible agencies are currently directing some of their existing resources into recovery activities. For cost effectiveness, any study of *Pseudemoia lichenigera* should be run jointly with any study of *Christinus guentheri*, which would result in a combined budget of perhaps $180K.

1: Survey of habitat preferences and occurrence in reserves: 2 workers for 3 months each year for 3 years - $40,000 salary; $40,000 expenses (twice standard expenses for overseas travel). **$80K**

2: Research into basic biology, taxonomy and ecology, including assessment of threatening processes: 1 worker for 6 months each year for 2 - $40,000 salary; $40,000 expenses (twice standard expenses for overseas travel). **$80K**

3: Preparation of management strategies: 1 worker for 3 months - $10,000 salary; $2,000 expenses. **$12K**

Total $172K

20. Remarks: 89 specimens documented in Australian museum collections.

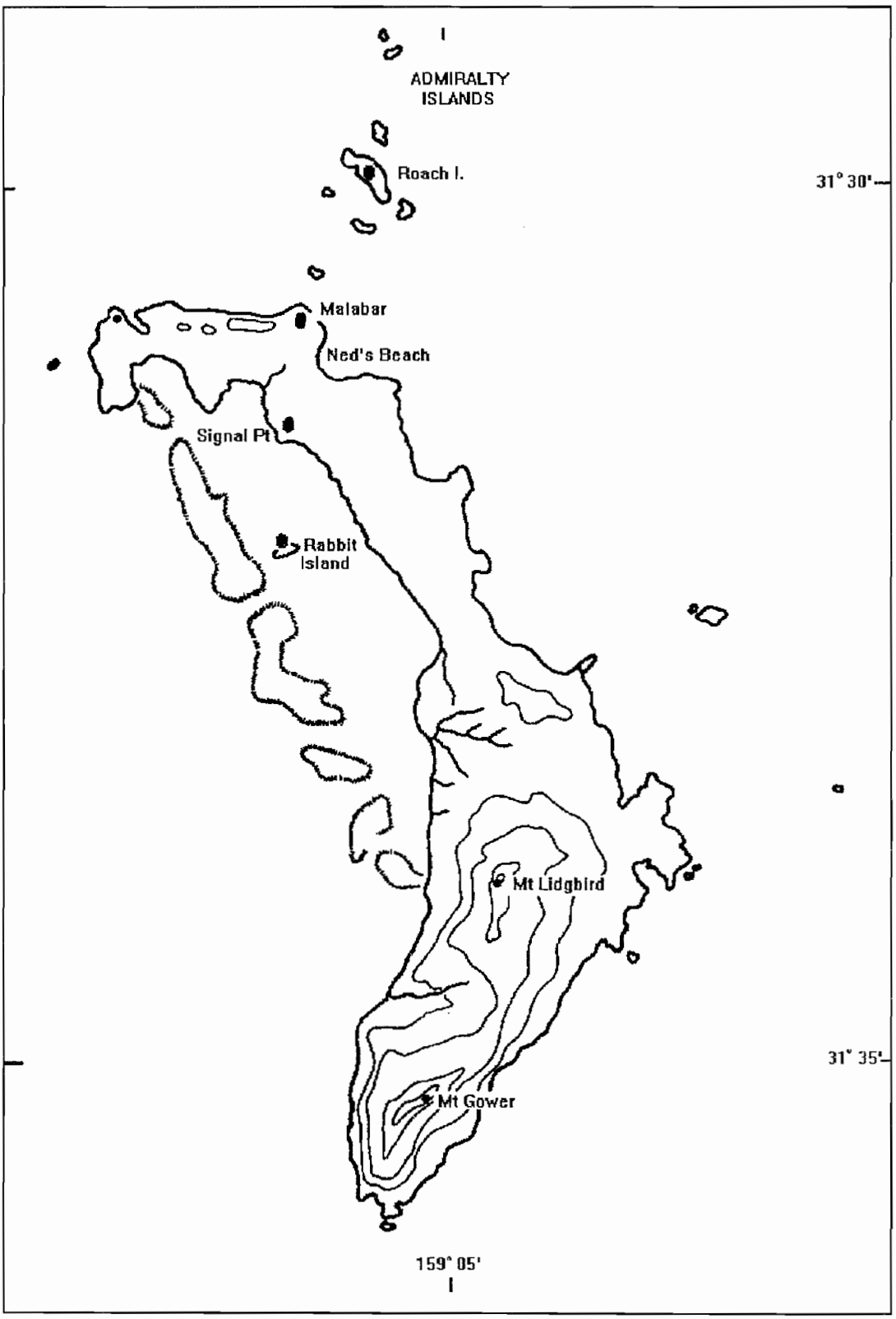
References:

Cogger, H.G. 1971. The reptiles of Lord Howe Island. Proceedings of the Linnean Society of New South Wales 96(1): 23-38.

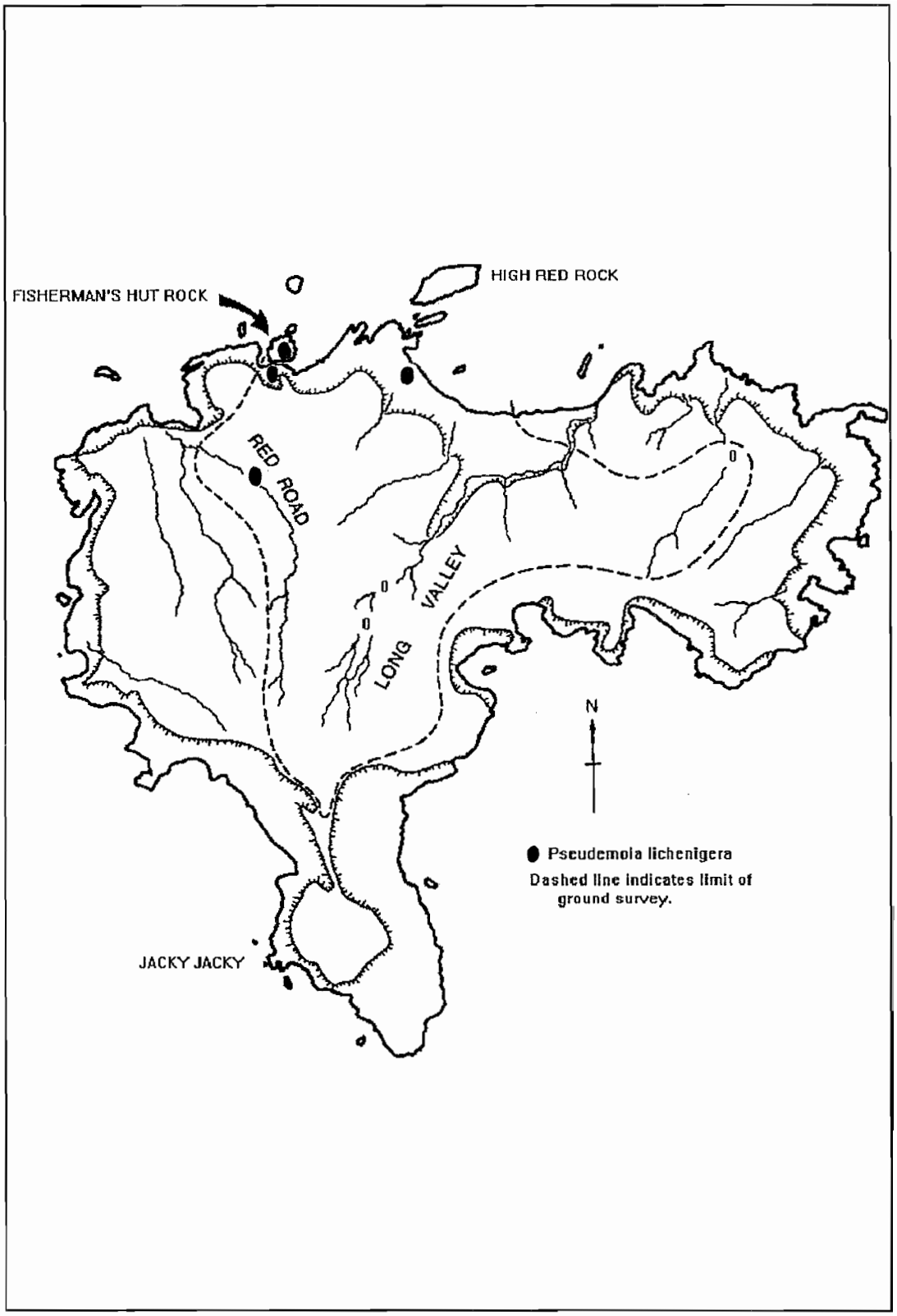
Cogger, H.G., Cameron, E.E. and Sadlier, R.A. 1979. The terrestrial reptiles of islands in the Norfolk Island complex. Australian Museum, Sydney. 122 pp. Limited circulation report for Australian National Parks & Wildlife Service.

Cogger, H.G., Sadlier, R.A. and Cameron, E.E. 1983. The terrestrial reptiles of Australia's island territories. Australian National Parks and Wildlife Service Special Publication 11: 1-80.

Specht, J. 1978. The early mystery of Norfolk Island. Australian Natural History 19(7): 218-223.



Distribution of *Pseudemoia lichenigera* on Lord Howe Island



Distribution of *Pseudemoia lichenigera* on Phillip Island

1. Family:	Scincidae
2. Scientific Name:	*Tiliqua adelaidensis* (Peters, 1863)
3. English Name:	Pygmy Bluetongue

4. Infraspecific taxa: None

5. Species survival status: Endangered,

6. Former distribution: Adelaide Plains from Marion in the south to the Burra district in the north-east, a distance of only 155 km. Very little is known of the species' original distribution but four recorded localities - Marion, Dry Creek, Copperhouse near Burra and Buchsfelde near Gawler - are probably reasonably accurate (Shea, 1992). Shea noted "the relative abundance of *T. adelaidensis* specimens in European collections (compared to the representation of other South Australian reptile species accessioned in that period) suggests that the species was formerly common".

7. Current distribution: Vicinity of Burra in the northern Mt Lofty Ranges 160 km north of Adelaide, South Australia (Armstrong and Reid, 1993). Three populations occur within 8 km of one another and a fourth population is 35 km further north.

8. Habitat: Tussock grassland, open woodland.

The four known extant populations inhabit pastures on clay loam soil supporting remnant native grassy and herbaceous vegetation (*Stipa, Danthonia* and *Lomandra* tussocks) mixed with introduced herbs and pasture grasses, on undulating terrain with gullies exposing underlying sandstone and shale bedrock. Woody vegetation has been almost entirely cleared with the exception of scattered *Casuarina* trees (Mark Hutchinson, *in litt.*). The lizards shelter in deserted spider burrows.

9. Reasons for decline: Probably a combination of factors, including habitat modification for agriculture - ploughing for wheat crops and pasture improvement; urban and industrial development in the southern part of its range.

Because the lizards occupy spider burrows in open grassland, they are particularly vulnerable to ploughing. A single ploughing of a paddock could eliminate a population (Mark Hutchinson, pers. comm.).

10. Conservation reserves on which species occurs: None.

10A. Other conservation reserves where species might be expected to occur: None known.

11. Other public land on which species occurs: None known.

12. Other land on which species occurs: Four freehold properties in the Burra district.

13. Is knowledge about species adequate for objectives and actions to be defined accurately?: No.

13.1: Further ground surveys need to be conducted to determine the full geographic range of the species and to further define its habitat preferences.

13.2: Further research is needed into the basic biology and ecology of the species in the field; it should include long term monitoring of changes in population size, habitat use and geographic range.

14. Recovery Plan objectives:

14.1: To obtain sufficient information on the species' biology, ecology and distribution to determine its current conservation status and formulate appropriate management strategies.

14.2: To ensure that secure, viable populations of the species are maintained within a reserve system.

14.3: To implement land management practices which promote the maintenance of secure, viable populations of the species outside reserves.

15. Management actions already initiated:

15.1: Listed on Schedule 1 of the Commonwealth's *Endangered Species Protection Act 1992* and listed as "endangered" on the 1991 Schedule of the *SA National Parks and Wildlife Act 1972*.

15.2: An 18-month field survey to assess the recently discovered populations has been funded by ANCA and is being supported and undertaken jointly by the South Australian Museum and the SA Department of Environment and Land Management.

15.3: Captive population has been established in the Adelaide Zoo and the feasibility of a captive breeding program is being examined jointly by the Zoo and the South Australian Museum.

16. Management actions required:

16.1: Continue survey of known and potential habitat throughout the species' known range.

16.2: Develop heritage agreements or land covenants and provide incentives for landowners to refrain from current land use practices such as ploughing, which would have a serious impact on the species outside reserves.

16.3: Develop community awareness within the species' known range.

16.4: Establish appropriate reserves.

16.5: If captive breeding program is successful, attempt re-introduction of the species into reserves created within its known range.

17. Organisations responsible for conservation of species and individuals involved: South Australian Department of Environment and Land Management.

18. Other organisations and individuals involved: Mark Hutchinson (South Australian Museum), Terry Morley (Adelaide Zoo), Glenn Shea (University of Sydney).

19. Can recovery plan be carried out with existing resources?: No, although ANCA has provided funds of $62,000 for research into basic biology and ecology over a period of 18 months.

1:	Survey of geographic range, habitat preferences and occurrence in reserves: 2 workers for 3 months each year for 2 years - $40,000 salary; $20,000 expenses.	**$60K**
2:	Research into basic biology and ecology, including assessment of threatening processes: 1 worker for 4 months each year for 3 years - $40,000 salary; $20,000 expenses.	**$60K**
3:	Preparation of management strategies: 1 worker for 3 months - $10,000 salary; $2,000 expenses.	**$12K**
4:	Establishment of captive breeding program: 1 worker for 2 months each year for 2 years - $13,333 salary; $2,667 expenses.	**$16K**
5:	Purchase of land for the reserve system: uncosted.	
		Total $148K

20. Remarks: Shea (1992) listed 20 extant museum specimens, most without accurate locality data. The species was only rediscovered in October 1992; it had not been recorded since 1959 (when two live specimens were caught at Marion) despite intensive searches in the intervening years (Ehmann, 1982). More than 50 individuals have been recorded in the four known extant populations.

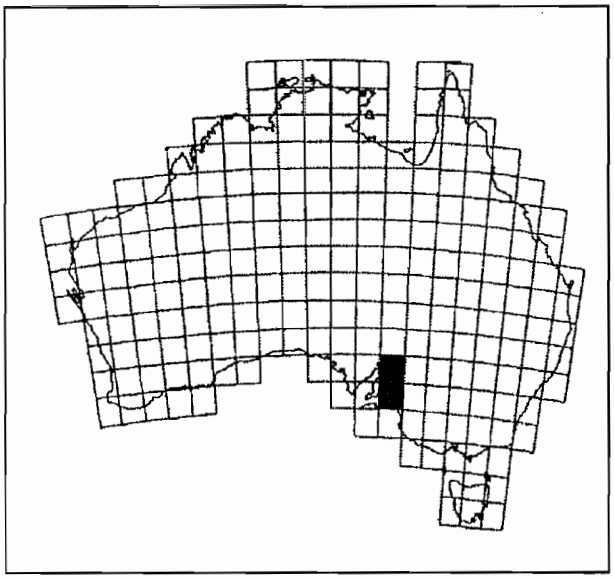
References:

Armstrong, G. and Reid, J. 1993. The rediscovery of the Adelaide Pygmy Bluetongue *Tiliqua adelaidensis*; (Peters, 1863). Herpetofauna 22(2): 3-6.

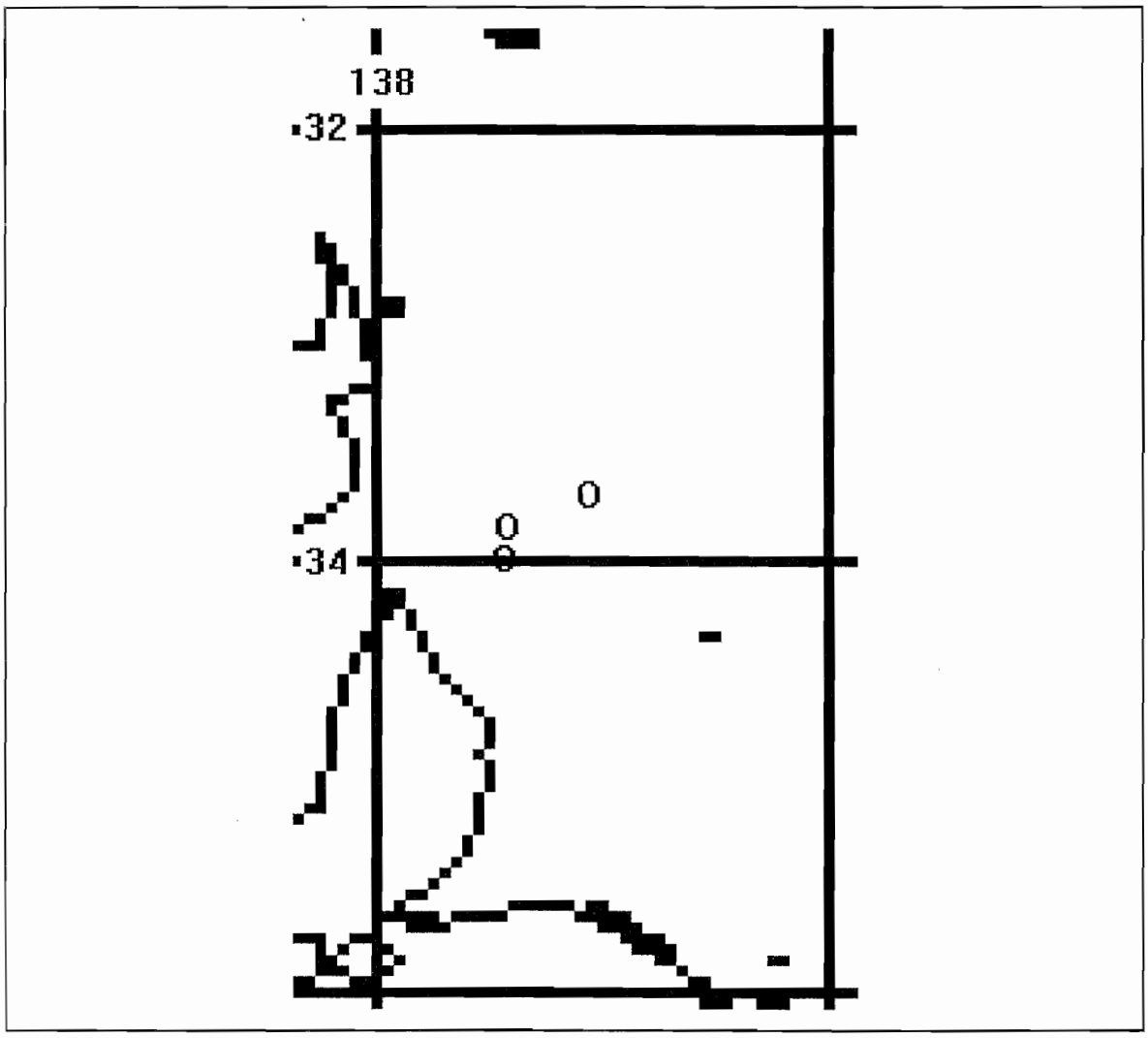
Ehmann, H.F.W. 1982. The natural history and conservation status of the Adelaide Pygmy Bluetongue Lizard *Tiliqua adelaidensis*. Herpetofauna 14(1):61-76.

Hutchinson, M.N. 1992. Mars Bars for brown snakes or the rediscovery of the Pygmy Bluetongue. 1992 Australian Society of Herpetologists AGM Abstracts: 6.

Shea, G.M. 1992. The systematics and reproduction of bluetongue lizards of the genus *Tiliqua* (Squamata: Scincidae). Unpublished doctoral dissertation. Department of Veterinary Anatomy, University of Sydney.



Distribution of *Tiliqua adelaidensis*



1. **Family:**	Typhlopidae
2. **Scientific Name:**	*Ramphotyphlops exocoeti* (Boulenger, 1887)
3. **English Name:**	Christmas Island Blind Snake

4. **Infraspecific taxa**: None

5. **Species survival status**: Vulnerable.

6. **Former distribution**: Not known to have differed from current distribution.

7. **Current distribution**: Christmas Island, Indian Ocean, (total area 13,470 ha).

8. **Habitat**: Closed forest.

The only habitat data available relate to a specimen collected in 1975. It was found during clearance of primary rainforest on the plateau; the site is now cleared of forest.

9. **Reasons for decline**: Probably a combination of factors, including habitat clearance, disturbance by mining, soil compaction and erosion.

In the process of mining phosphate, the closed forest was clear-felled and burnt and the topsoil removed to expose the phosphate ore body; removal of the phosphate exposed bare limestone pinnacles which are slowly revegetated by low herbs and shrubs, many of them exotics. This effectively destroys the microhabitat of the worm snake.

10. **Conservation reserves on which species occurs** (including a list of other Action Plan species in each conservation reserve): Christmas Island NP; *Lepidodactylus listeri* (Vulnerable) also occurs here.

10A. **Other conservation reserves where species might be expected to occur**: None.

11. **Other public land on which species occurs**: Potentially present in areas of closed forest outside the Christmas Island National Park.

12. **Other land on which species occurs**: None known.

13. **Is knowledge about species adequate for objectives and actions to be defined accurately?**: No.

13.1: Further ground surveys need to be conducted to determine the habitat preferences of the species and the extent of its occurrence in Christmas Island NP.

13.2: Research is needed into the basic biology and ecology of the species in the field; it should include long term monitoring of changes in population size, habitat use and distribution on the island.

13.3: Research is needed to document the extent of the species' decline and to identify the major factors contributing to that decline.

14. **Recovery Plan objectives**:

14.1: To obtain sufficient information on the species' biology, ecology and distribution to determine its current conservation status and formulate appropriate management strategies.

14.2: To ensure that a secure, viable population of the species is maintained within Christmas Island NP.

15. **Management actions already initiated**:

15.1: Survey of all terrestrial reptiles of Christmas Island funded by ANPWS and conducted in 1979 (Cogger and Sadlier, 1981).

15.2: Christmas Island National Park Plan of Management in preparation.

15.3: Establishment of a nursery to provide plants for the rehabilitation of the mine fields.

15.4: Study of the introduced Wolf Snake funded by ANPWS and conducted in 1991/92 (Rumpff, 1992).

16. **Management actions required**: Given the rarity of this species, we do not believe it would be biologically sensible or cost-effective to undertake independent surveys or studies of

Ramphotyphlops exocoeti. Rather, we propose that the surveying and studying of this species be made an integral part of the recovery plan for *Lepidodactylus listeri*, especially the component which monitors the status of Wolf Snakes (*Lycodon capucinus*).

16.1: Survey known and potential habitat in reserve.

16.2: Develop community awareness of the species.

16.3: Continue rehabilitation of mined areas by wide-scale planting of forest species on the plateau.

17. Organisations responsible for conservation of species and individuals involved: Australian Nature Conservation Agency.

18. Other organisations and individuals involved: Hal Cogger and Ross Sadlier (Australian Museum), Holger Rumpff, Christmas Island National Park Advisory Committee.

19. Can recovery plan be carried out with existing resources?: No, although mining royalties have contributed considerably towards the costs of maintaining the regeneration nursery. Costs additional to those proposed for the *Lepidodactylus listeri* recovery plan:

1: Enhancement of survey methods in the *L. listeri* program to optimise capture of *Ramphotyphlops exocoeti*: $10,000. **$10K**

Total $10K

20. Remarks: Five specimens documented in museum collections; the most recent specimen was collected in 1985.

In a feeding experiment, captive Wolf Snakes did not accept *Ramphotyphlops braminus* offered to them as prey although they fed readily on live and freshly dead geckos and skinks; this suggests that *R. exocoeti* would not be preyed upon by Wolf Snakes.

References:

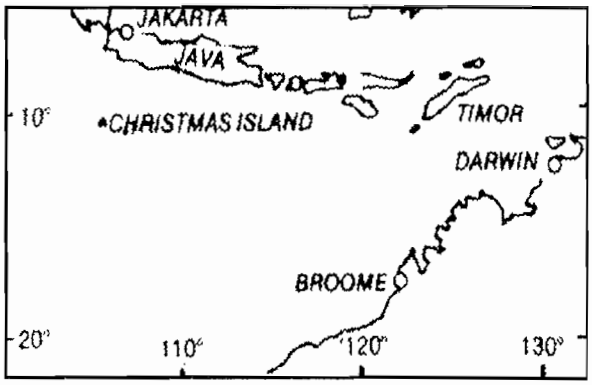
Australian National Parks and Wildlife Service. 1991. Annual Report 1990-91. Australian Government Publishing Service, Canberra.

Cogger, H.G. and Sadlier, R.A. 1981. The terrestrial reptiles of Christmas Island, Indian Ocean. Australian Museum, Sydney. 194 pp. Report to the Australian National Parks & Wildlife Service.

Cogger, H.G., Sadlier, R.A. and Cameron, E.E. 1983. The terrestrial reptiles of Australia's island territories. Australian National Parks and Wildlife Service Special Publication 11: 1-80.

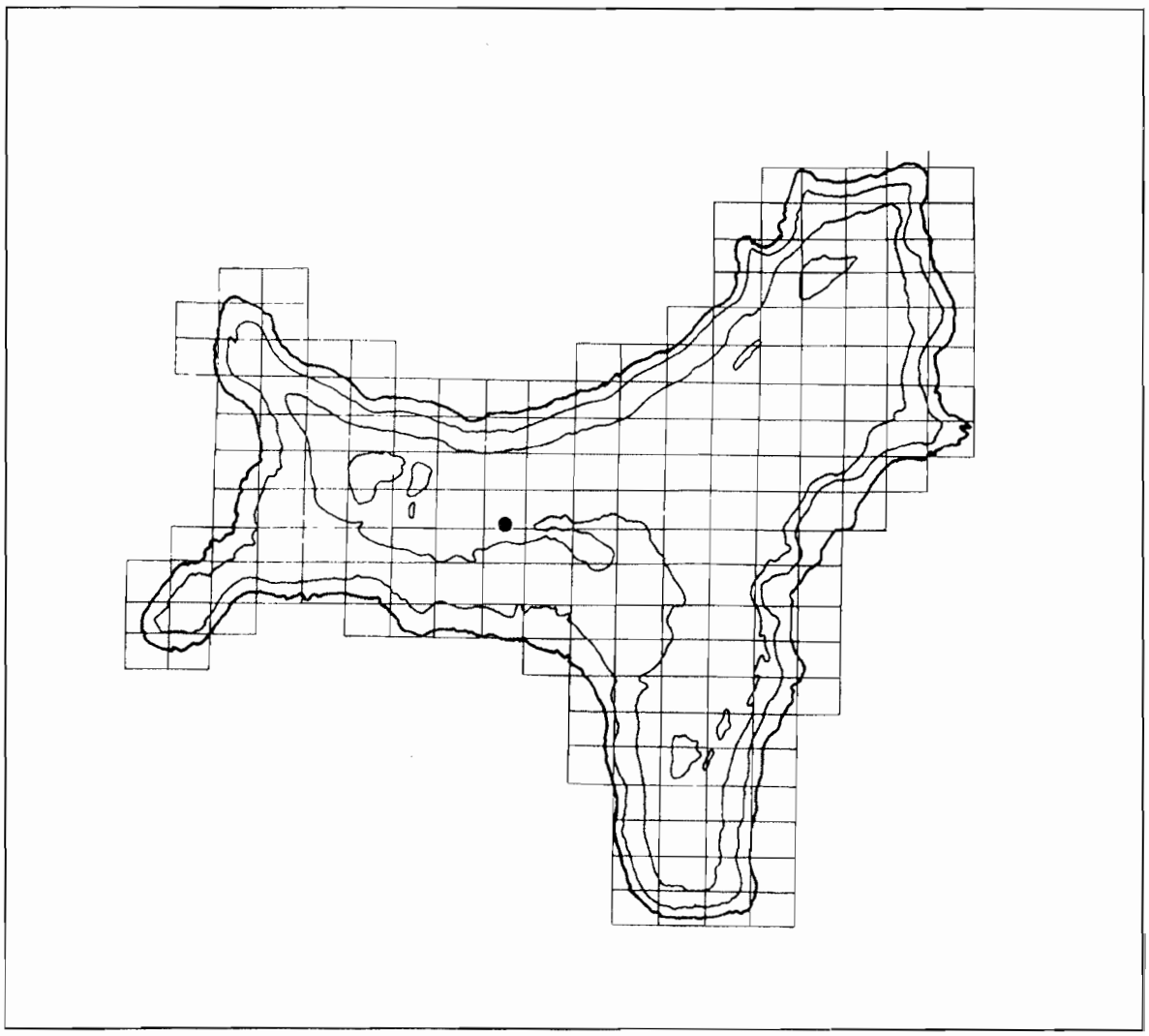
Fritts, T.H. 1993. The common wolf snake, *Lycodon aulicus capucinus*, a recent colonist of Christmas Island in the Indian Ocean. Wildlife Research 20: 261-266.

Rumpff, H. 1992. Distribution, population, structure and ecological behaviour of the introduced South-East Asian Wolf Snake *Lycodon aulicus capucinus* on Christmas Island, Indian Ocean. Report to the Australian National Parks and Wildlife Service, Canberra.



Distribution of

Ramphotyphlops exocoeti



1. **Family:**	Boidae
2. **Scientific Name:**	*Aspidites ramsayi* (Macleay, 1882) (population in south-western WA)
3. **English Name:**	Woma

4. **Infraspecific taxa**: Population under threat is apparently restricted to south-western Western Australia. "Until there are specimens from these intervening areas with heavy soils to prove the contrary the south-west population is best considered as being separated from the inland population" (Smith, 1981).

5. **Species survival status**: Endangered.

6. **Former distribution**: Prior to 1960 recorded from a broad strip of south-western Western Australia, extending south-east from Yuna (near Geraldton) to Boddington (south-east of Mandurah) and inland to Menzies in the north and the western edge of the Nullarbor Plain in the south. This region now largely coincides with the north-eastern wheatbelt of Western Australia.

7. **Current distribution**: Only eight specimens have been added to the Western Australian Museum's collections since 1960 (only one since 1975) and they have come from the north-western and south-eastern edges (Burracoppin and Narembeen) of the species' former range. Smith (1981) remarked "there seems little doubt that the south-western population is close to extinction".

8. **Habitat**: Open heath, tall shrubland.

Preferred habitat appears to be myrtaceous heath on sandplains (Laurie Smith, *in litt.*) which are bordered on the north and east by heavy soils dominated by mulga (*Acacia aneura*).

9. **Reasons for decline**: Probably a combination of factors, including clearance of habitat for agriculture and grazing, and crop production.

"... most [of the preferred habitat has] been cleared in the last 40 years" (Laurie Smith, *in litt.*). Wilson and Knowles (1988) also suggested that predation on young snakes by feral animals may have contributed to the decline.

10. **Conservation reserves on which species occurs**: None known.

10A. **Other conservation reserves where species might be expected to occur**: Badjaling NR, Bendering NR, Billyacatting Hill NR, Bindoo Hill NR, Buntine NR, Durokoppin NR, East Nugadong NR, East Yorkrakine NR, East Yuna NR, Kodj Kodj NR, Marchagee NR, North Bungulla NR, Nugadong NR, Nugadong Forest NR, South Badjaling NR, Wilroy NR, Yorkrakine NR, Yoting Water NR. These nature reserves within the known distribution range of *Aspidites ramsayi* were surveyed for vertebrates between 1971 and 1976 (Chapman and Dell, 1985) but the species was not found.

11. **Other public land on which species occurs**: None known.

12. **Other land on which species occurs**: Only specimen in Western Australian Museum registered since 1980, came from 12 km north of Marchagee, Western Australia. Known from private land near Watheroo and potentially present in areas of remnant native vegetation on private properties throughout the species' range in southern Western Australia.

13. **Is knowledge about species adequate for objectives and actions to be defined accurately?**: No.

13.1: Ground surveys need to be conducted to determine the full geographic range of this population, its habitat preferences, and the extent of its occurrence in existing reserves.

13.2: Research is needed into the basic biology and ecology of the population in the field; it should include long term monitoring of changes in population size, habitat use and geographic range.

13.3: Research is needed to document the extent of the population's decline and to identify the major factors

contributing to that decline.

14. Recovery Plan objectives:

14.1: To obtain sufficient information on the population's biology, ecology and distribution to determine its current conservation status and formulate appropriate management strategies.

14.2: To ensure that secure, viable populations are maintained within a reserve system.

14.3: To implement land management practices which promote the maintenance of secure, viable populations outside reserves.

15. Management actions already initiated:

15.1: Listed as requiring "special protection" on the 1990 Schedule of the *WA Wildlife Conservation Act 1950*. [The eastern population of this species is listed as "vulnerable and rare" on the 1992 Revised (Interim) Schedule 12 of the *NSW Endangered Fauna (Interim Protection) Act 1991*].

15.2: Twenty-four nature reserves in the WA wheatbelt were surveyed for vertebrates by the Western Australian Museum biological survey unit between 1971 and 1976 (Chapman and Dell, 1985).

16. Management actions required:

16.1: Survey known and potential habitat in reserves within the population's known range.

16.2: Survey known habitat outside reserves within the population's known range.

16.3: Develop and promote guidelines and provide incentives for landowners and users to reduce the impact of current land use practices on the population outside reserves.

16.4: Establish appropriate reserves.

16.5: Develop community awareness within the population's known range.

16.6: Implement control program for feral animals if these are demonstrated to have an adverse effect on the population.

16.7: In view of the success of many python captive breeding programs overseas, encourage captive breeding program for re-introduction of the species into reserves within its known range.

17. Organisations responsible for conservation of species and individuals involved: Western Australian Department of Conservation and Land Management (Andrew Burbidge).

18. Other organisations and individuals involved: Laurie Smith (Western Australian Museum).

19. Can recovery plan be carried out with existing resources?: No.

1: Survey of geographic range, habitat preferences and occurrence in reserves: 2 workers for 4 months each year for 2 years - $53,333 salary; $26,667 expenses. **$80K**

2: Research into basic biology and ecology, including assessment of threatening processes: 1 worker for 3 months each year for 3 years - $30,000 salary; $15,000 expenses. **$45K**

3: Preparation of management strategies: 1 worker for 3 months - $10,000 salary; $2,000 expenses. **$12K**

4: Develop captive breeding program: 1 worker for 2 months each year for 2 years: $13,333 salary; $2,667 expenses. **$16K**

Total $153K

20. Remarks: 52 specimens documented in Australian museum collections.

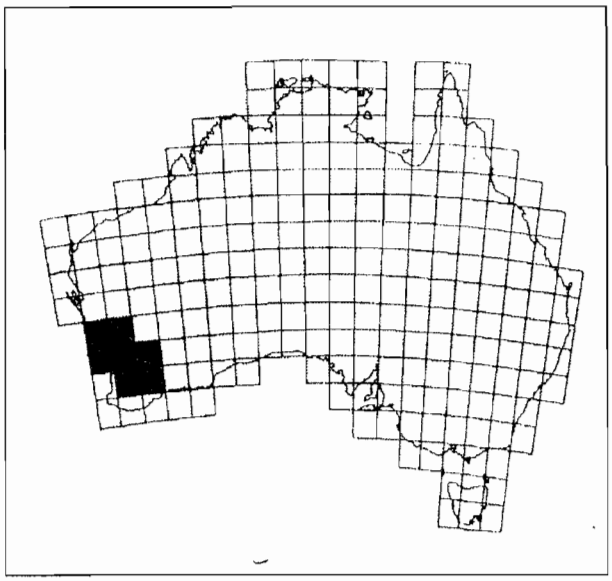
References:

Chapman, A. and Dell, J. 1985. Biology and zoogeography of the amphibians and reptiles of the Western Australian wheatbelt. Records of the Western Australian Museum 12(1): 1-46.

Smith, L.A. 1981. A revision of the python genera *Aspidites* and *Python* (Serpentes: Boidae) in Western Australia. Records of the Western Australian Museum 9: 211-226.

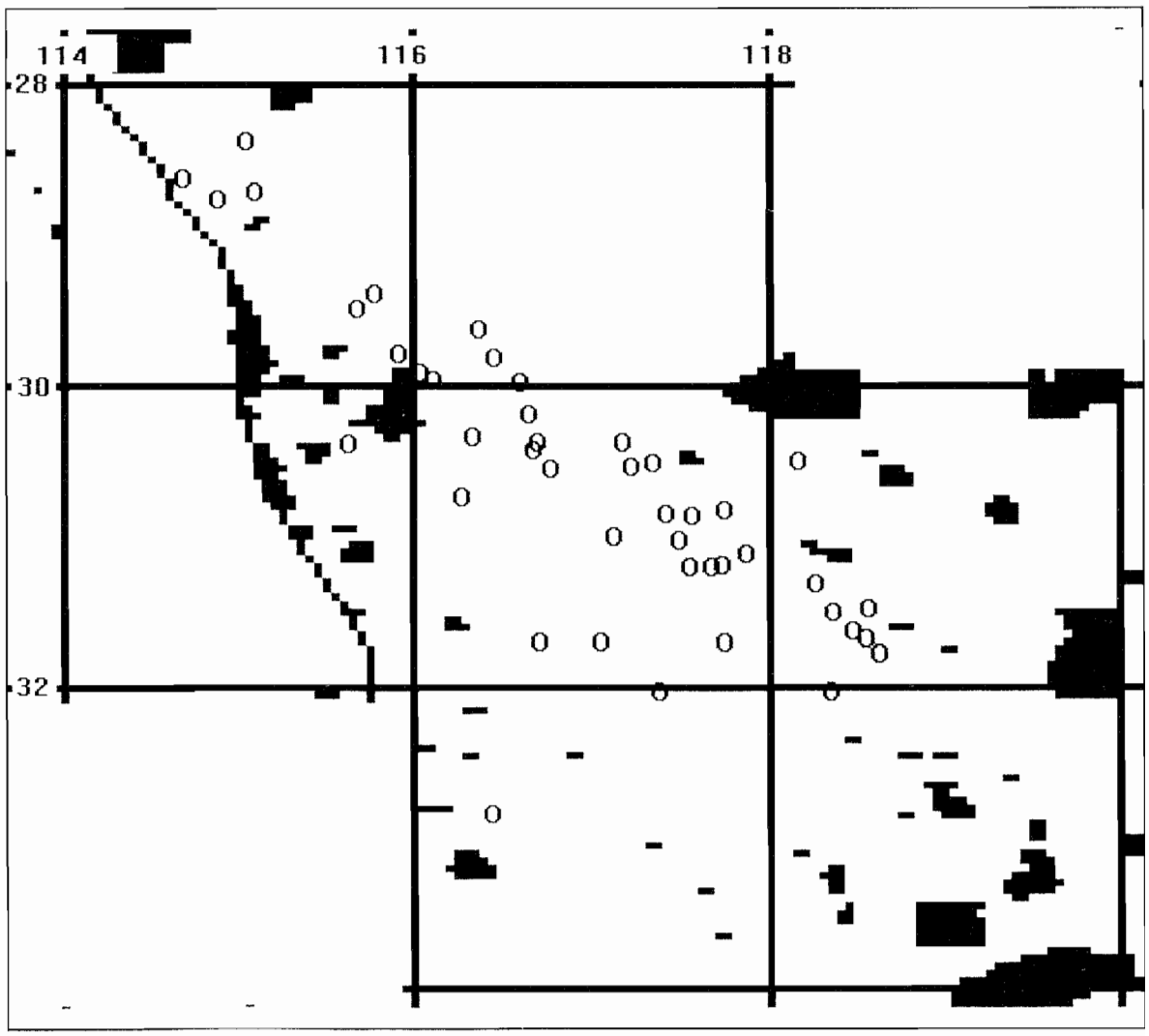
Storr, G.M., Smith, L.A. and Johnstone, R.E. 1986. Snakes of Western Australia. Western Australian Museum, Perth. 187 pp.

Wilson, S.K. and Knowles, D.G. 1988. Australia's Reptiles; a photographic reference to the terrestrial reptiles of Australia. Collins Publishers, Australia. 447 pp.



Distribution of *Aspidites ramsayi*

(south-western WA)



1. Family:	Boidae
2. Scientific Name:	*Morelia spilota imbricata* (Smith, 1981) [also appears in the literature as *Python spilotus imbricatus*]
3. English Name:	Western Australian Carpet Python

4. Infraspecific taxa: *M. spilota imbricata* (south-western Western Australia, and St Francis Island, South Australia *vide* Schwaner *et al.*, 1988), *M. spilota spilota* (coastal New South Wales), *M. spilota variegata* (remainder of continental Australia except for southern Victoria and arid central and western Australia). Laurie Smith (*in litt.*) reports that coastal and plateau populations of *M. spilota imbricata* can be differentiated on colour pattern and meristics.

5. Subspecies survival status: Vulnerable.

6. Former distribution: South-west of Western Australia, from Geraldton in the north to Kalgoorlie, Norseman and Mount Le Grand in the east.

7. Current distribution: "An analysis of *Python spilotus imbricatus* accessions [in the Western Australian Museum] suggests a decline in the numbers of this subspecies (at least on the mainland) similar to *Aspidites ramsayi* in south-western Western Australia" (Smith, 1981).

No longer present on North Wallabi Island although it is still found on a number of offshore islands including East and West Wallabi Islands in the Houtman Abrolhos, Garden Island off Kwinana, and North Twin Peak and Mondrain Islands in the Archipelago of the Recherche; also on St Francis Island off Ceduna, South Australia.

8. Habitat: Woodland, low woodland.

Observed in dry sclerophyll wandoo woodland (Nichols & Nichols, 1984), in "sandy heath ... with *Banksia attenuata* the predominant banksia", in a "grove of well established trees, predominantly *Banksia littoralis* and *Agonis flexuosa*" and in a "... predominantly *Banksia quercifolia* heath, with some *Banksia attenuata*" all in Torndirrup National Park (Smith, 1990).

9. Reasons for decline: Probably a combination of factors, including overgrazing by stock, clearance of habitat for agriculture and grazing, pasture improvement and crop production.

10. Conservation reserves on which subspecies occurs: Cape Naturaliste NP, Fitzgerald River NP, Peak Charles NP, Stirling Ranges NP, Stokes NP, Torndirrup NP, West Bendering NR.

10A. Other conservation reserves where subspecies might be expected to occur: Badjaling NR, Bendering NR, South Badjaling NR, West Bendering NR, Yoting Water NR, Yornaning NR. These wheatbelt nature reserves within the range of *Morelia spilota imbricata* were surveyed for vertebrates between 1971 and 1976 (Chapman and Dell, 1985) but the subspecies was not found.

11. Other public land on which subspecies occurs: Bold Park (Perth), Mount Saddleback SF and Dryandra SF; probably present in all the major State Forests in the south west of the state (Andrew Burbidge, *in litt.*).

12. Other land on which subspecies occurs: Potentially present in areas of remnant native vegetation on private properties throughout the subspecies' range in southern Western Australia.

13. Is knowledge about subspecies adequate for objectives and actions to be defined accurately?: No.

13.1: Ground surveys need to be conducted to determine the full geographic range of the subspecies, its habitat preferences, and the extent of its occurrence in existing reserves.

13.2: Research is needed into the basic biology and ecology of the subspecies in the field; it should include long term monitoring of changes in population

size, habitat use and geographic range.

13.3: Research is needed to document the extent of the subspecies' decline and to identify the major factors contributing to that decline.

13.4: Genetic study needed to determine the taxonomic status of this subspecies.

14. Recovery Plan objectives:

14.1: To obtain sufficient information on the subspecies' biology, ecology and distribution to determine its current conservation status and formulate appropriate management strategies.

14.2: To ensure that secure, viable populations of the subspecies are maintained within a reserve system.

14.3: To implement land management practices which promote the maintenance of secure, viable populations of the subspecies outside reserves.

15. Management actions already initiated:

15.1: Listed as requiring "special protection" on the 1990 Schedule of the *WA Wildlife Conservation Act 1950.*

15.2: Twenty-four nature reserves in the WA wheatbelt were surveyed for vertebrates by the Western Australian Museum biological survey unit between 1971 and 1976 (Chapman and Dell, 1985).

15.3: Fox control program has been operational in Dryandra SF for the past eight years.

16. Management actions required:

16.1: Survey known and potential habitat in reserves within the subspecies' known range.

16.2: Survey known habitat outside reserves within the subspecies' known range.

16.3: Develop and promote guidelines and provide incentives for landowners and users to reduce the impact of current land use practices on the subspecies outside reserves.

16.4: Establish appropriate reserves if the existing reserve system is found to be inadequate to secure the survival of the subspecies.

16.5: Develop community awareness within the subspecies' known range.

16.6: In view of the success of many python captive breeding programs overseas, encourage captive breeding program for re-introduction of the species into reserves within its known range.

17. Organisations responsible for conservation of subspecies and individuals involved: Western Australian Department of Conservation and Land Management (Andrew Burbidge).

18. Other organisations and individuals involved: Laurie Smith (Western Australian Museum).

19. Can recovery plan be carried out with existing resources?: No.

1:	Survey of geographic range, habitat preferences and occurrence in reserves: 2 workers for 3 months each year for 2 years - $40,000 salary; $20,000 expenses.	**$60K**
2:	Research into basic biology, taxonomy and ecology, including assessment of threatening processes: 1 worker for 4 months each year for 3 years: $40,000 salary; $20,000 expenses.	**$60K**
3:	Preparation of management strategies: 1 worker for 3 months - $10,000 salary; $2,000 expenses.	**$12K**
4:	Establishment of captive breeding program: 1 worker for 2 months each year for 2 years - $13,333 salary; $2,667 expenses.	**$16K**
		Total $148K

20. Remarks: 139 specimens documented in Australian museum collections. Although this species probably occurs in more conservation reserves than do most species included in the Reptile Action Plan, its decline is unequivocal.

References:

Bush, B. 1985. Some reptiles and frogs recorded in Stokes National Park. Western Australian Naturalist 16(2/3): 52.

Chapman, A. and Dell, J. 1977. Reptiles and frogs of Bendering and West Bendering Nature Reserves. Records of the Western Australian Museum Supplement 5: 47-55.

Chapman, A. and Dell, J. 1985. Biology and zoogeography of the amphibians and reptiles of the Western Australian wheatbelt. Records of the Western Australian Museum 12(1): 1-46.

How, R.A and Dell, J. 1990. Vertebrate fauna of Bold Park, Perth. Western Australian Naturalist 18(4/5): 122-131.

How, R.A., Dell, J. and Muir, B.G. 1988. The biological survey of the Eastern Goldfields of Western Australia. Park 4. Lake Johnston-Hyden Study Area. IV. Vertebrate fauna. Records of the Western Australian Museum Supplement 30: 44-83.

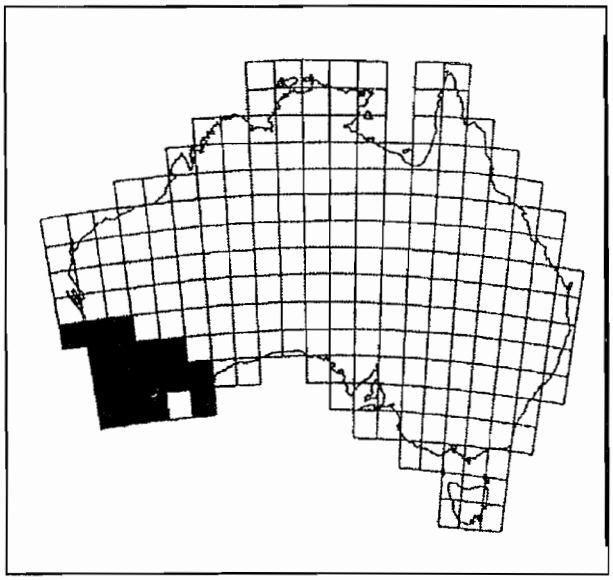
Nichols, O.G. and Nichols, F.M. 1984. The reptilian, avian and mammalian fauna of the Mount Saddleback State Forest, Western Australia. Western Australian Naturalist 15(8): 179-189.

Schwaner, T., Francis, M. and Harvey, C. 1988. Identification and conservation of carpet pythons (*Morelia spilota imbricata*) on St. Francis Island, South Australia. Herpetofauna 18(2): 13-20.

Smith, L.A. 1981. A revision of the python genera *Aspidites* and *Python* (Serpentes: Boidae) in Western Australia. Records of the Western Australian Museum 9: 211-226.

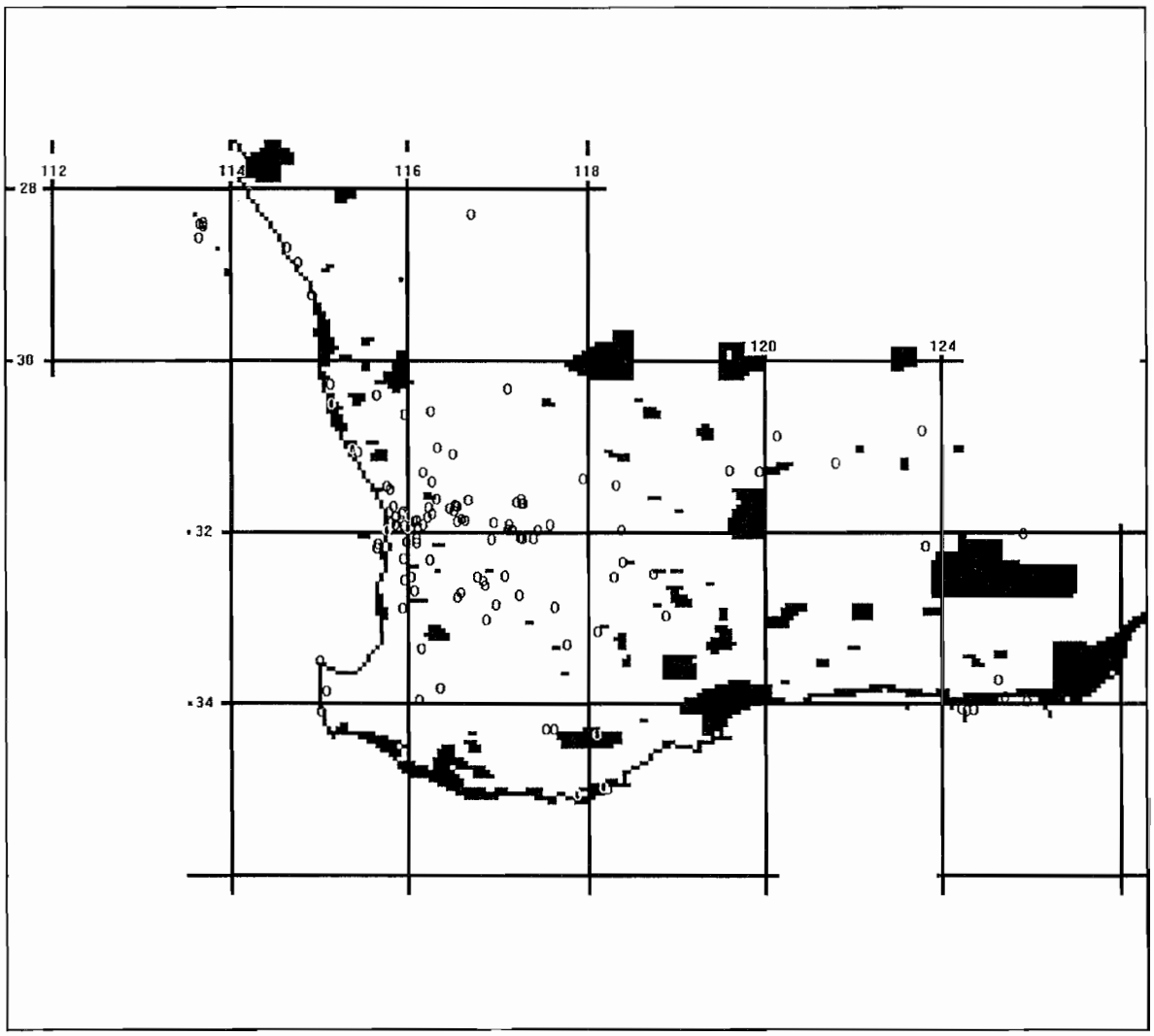
Smith, V.W. 1990. The terrestrial vertebrate fauna of the Torndirrup National Park. Western Australian Naturalist 18(3): 82-92.

Storr, G.M., Smith, L.A. and Johnstone, R.E. 1986. Snakes of Western Australia. Western Australian Museum, Perth. 187 pp.



Distribution of

Morelia spilota imbricata



1. Family:	Elapidae
2. Scientific Name:	*Austrelaps labialis* (Jan, 1859) (population around Adelaide, SA)
3. English Name:	Pygmy Copperhead

4. Infraspecific taxa: Only the Adelaide population is considered under threat; the geographically-isolated Kangaroo Island population is probably secure (Hutchinson, 1992).

5. Species survival status: Vulnerable.

6. Former distribution: Not known to have differed from current distribution.

7. Current distribution: Occurs on Kangaroo Island and in the Mount Lofty Ranges, South Australia, but only the latter population, concentrated in an area of about 150 km^2 in the Adelaide Hills, is of immediate conservation concern.

8. Habitat: Open forest, woodland.

In the Mount Lofty Ranges, largely restricted to high altitude stringybark forest with dominant species *Eucalyptus obliqua* and *E. baxteri* and an understorey of *Lomandra* species, *Hakea rostrata*, mixed species heath or introduced species. Two sites were in Bluegum (*Eucalyptus leucoxylon*) and Pinkgum (*E. fasciculosa*) woodland. These areas have a high average annual rainfall between 800 and 1000 mm. Most localities that could be accurately determined were near the tops of hills and were characterised by a near closed canopy and dense heath or bracken understorey. Resting copperheads were usually found under rocks or iron (Read and Bedford, 1991).

9. Reasons for decline: Probably a combination of factors, including clearance of habitat for agriculture and grazing, crop production, urban development and predation by cats and brown snakes.

Has been recorded as prey of domestic cats in the Adelaide Hills and this threat may be quite significant as the domestic and feral cat population in the Mount Lofty Ranges appears to be quite large. Predation by brown snakes which have encroached on the copperheads' range due to land clearance may also be a problem. Clearance of sclerophyll scrub in the Mount Lofty Ranges for agriculture and housing appears to result in the displacement of copperheads (Read and Bedford, 1991). The species has become less common in the Adelaide Hills as a result of urbanisation of the Stirling-Heathfield-Aldgate area (John Read and Mark Hutchinson, *in litt.*).

10. Conservation reserves on which species occurs: In the Mount Lofty Ranges: Cox's Scrub CP (prior to 1983 at least), Cleland CP.

On Kangaroo Island present in Dudley CP, Pelican Lagoon CP and Flinders Chase NP.

10A. Other conservation reserves where species might be expected to occur on the mainland: Probably none; between January 1988 and March 1989, Read and Bedford (1991) searched many National, Conservation and Recreation Parks in the Mount Lofty Ranges, including Deep Creek, Newland Head, Scott, Horsnell Gully, Belair and low reaches of Cleland, without finding *Austrelaps labialis*.

11. Other public land on which species occurs: None known.

12. Other land on which species occurs: Potentially present in suitable habitat on private properties throughout the population's range.

13. Is knowledge about species adequate for objectives and actions to be defined accurately?: No.

13.1: Further ground surveys need to be conducted to determine the full geographic range of the population, its habitat preferences, and the extent of its occurrence in existing reserves.

13.2: Research is needed into the basic biology and ecology of this population in the field; it should include long term monitoring of changes in population size, habitat use and geographic range.

13.3: Research is needed to document the extent of the population's decline and to identify the major factors contributing to that decline.

14. Recovery Plan objectives:

14.1: To obtain sufficient information on the biology, ecology and distribution of the geographically-isolated Mount Lofty population to determine its current conservation status and formulate appropriate management strategies.

14.2: To ensure that secure, viable populations are maintained within a reserve system.

14.3: To implement land management practices which promote the maintenance of secure, viable populations outside reserves.

15. Management actions already initiated: None known.

16. Management actions required:

16.1: Survey known and potential habitat in reserves within the population's known range.

16.2: Survey known habitat outside reserves within the population's known range.

16.3: Establish appropriate reserves if the existing reserve system is found to be inadequate to secure the survival of the population.

16.4: Develop and promote guidelines and provide incentives for landowners and users to reduce the impact of current land use practices on the population outside reserves.

16.5: Develop community awareness within the population's known range.

16.6: Implement control program for feral cats if they are demonstrated to have an adverse effect on the population.

17. Organisations responsible for conservation of species and individuals involved: South Australian Department of Environment and Land Management.

18. Other organisations and individuals involved: John Read (Olympic Dam Operations).

19. Can recovery plan be carried out with existing resources?: No.

1:	Survey of geographic range, habitat preferences and occurrence in reserves: 2 workers for 2 months each year for 2 years - $26,667 salary; $13,333 expenses.	**$40K**
2:	Research into basic biology and ecology, including assessment of threatening processes: 1 worker for 3 months each year for 2 years - $20,000 salary; $10,000 expenses.	**$30K**
3:	Preparation of management strategies: 1 worker for 3 months - $10,000 salary; $2,000 expenses.	**$12K**
		Total $82K

20. Remarks: 53 specimens from the Adelaide Hills documented in Australian museum collections.

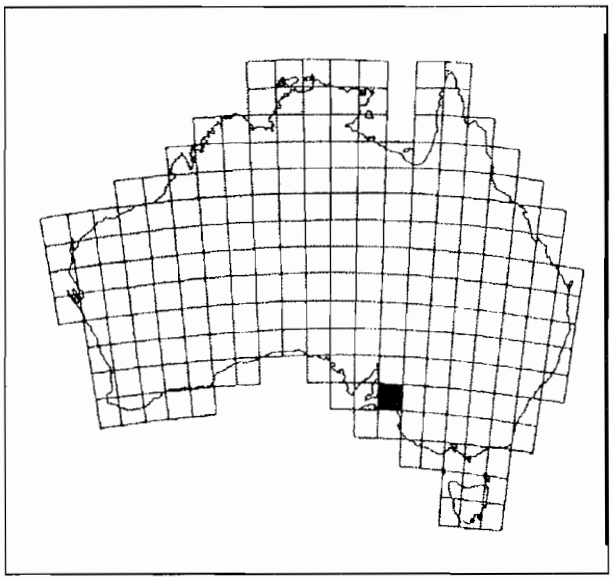
References:

Hutchinson, M.N. 1992. Threatened reptiles in South Australia. Section 7 *in* S.P. Tay (ed.) Threatened species and habitats in South Australia: a catalyst for community action. South Australian Advisory Committee on Threatened Species, Adelaide.

Rawlinson, P.A. 1991. Taxonomy and distribution of the Australian tiger snakes (*Notechis*) and copperheads (*Austrelaps*) (Serpentes, Elapidae). Proceedings of the Royal Society of Victoria 103(2): 125-135.

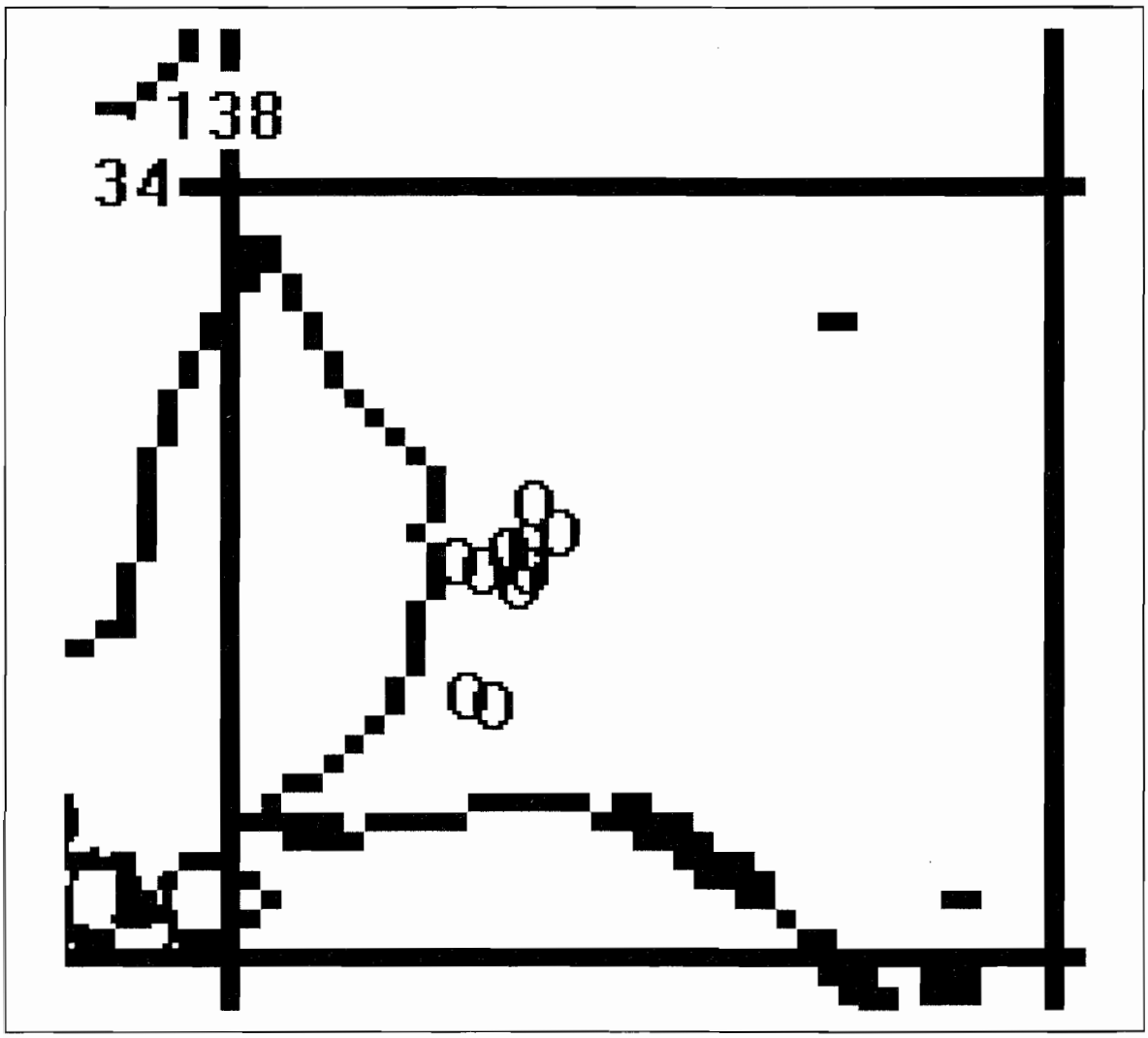
Read, J.L. and Bedford, G. 1991. The distribution and ecology of the Pygmy Copperhead Snake (*Austrelaps labialis*). Herpetofauna 21(2): 1-6.

Shine, R. 1987. Ecological ramifications of prey size: food habits and reproductive biology of Australian copperhead snakes (*Austrelaps*, Elapidae). Journal of Herpetology 21: 71-74.



Distribution of *Austrelaps labialis*

(Adelaide population)



1. Family:	Elapidae
2. Scientific Name:	*Denisonia maculata* (Steindachner, 1867)
3. English Name:	Ornamental Snake

4. Infraspecific taxa: None

5. Species survival status: Vulnerable.

6. Former distribution: Not known to have differed from current distribution.

7. Current distribution: Confined to the Brigalow (*Acacia harpophylla*) Belt within the drainage system of the Fitzroy River, mid-eastern Queensland.

8. Habitat: Open forest, woodland, riparian habitats.

As well as occurring in Brigalow forest growing on clay and sandy soils, it is found in riverside woodland and open forest growing on natural levees (Ehmann, 1992).

9. Reasons for decline: Not known to have declined, but "considering the poor level of habitat protection in the area, and...that at least eight species of mammals have become extinct ...it seems likely, even certain, that frog and reptile species...are also at risk" (McDonald *et al.*, 1991). Threatened probably by a combination of factors including overgrazing by stock, clearance of habitat for agriculture and grazing, pasture improvement, crop production, urban development and possibly poisoning by ingestion of cane toads.

"...beef cattle have tramped, eaten and defecated over most of the Brigalow Belt not used for agriculture or urban development" (McDonald *et al.*, 1991); these authors noted the area had been intensively studied with the goal of improving techniques of clearing, pasture improvement and agriculture.

The diet of *Denisonia maculata* is almost exclusively frogs (Shine, 1983) and it could be poisoned by ingesting cane toads (*Bufo marinus*) which are abundant within its range (Glen Ingram, *in litt.*).

10. Conservation reserves on which species occurs: Dipperu NP.

10A. Other conservation reserves where species might be expected to occur: Blackdown Tableland NP, Byfield NP, Castle Tower NP, Isla Gorge NP, Mount Archer EP, Palmgrove NP, Precipice NP, Expedition Range NP, Taunton FR.

11. Other public land on which species occurs: May occur in the Shoalwater Bay area (Steve Wilson, *in litt.*).

12. Other land on which species occurs: Private property in the Moura district; potentially present on private properties throughout the species' range.

13. Is knowledge about species adequate for objectives and actions to be defined accurately?: No.

13.1: Ground surveys need to be conducted to determine the full geographic range of the species, its habitat preferences, and the extent of its occurrence in existing reserves.

13.2: Research is needed into the basic biology and ecology of the species in the field; it should include long term monitoring of changes in population size, habitat use and geographic range.

13.3: Research is needed to determine if the species is declining and if so, to identify the major factors contributing to that decline.

14. Recovery Plan objectives:

14.1: To obtain sufficient information on the species' biology, ecology and distribution to determine its current conservation status and formulate appropriate management strategies.

14.2: To ensure that secure, viable populations of the species are maintained within a reserve system.

14.3: To implement land management

practices which promote the maintenance of secure, viable populations of the species outside reserves.

15. Management actions already initiated:

15.1: "Surveys are currently underway [by QDEH] to determine remaining locations of various Brigalow and other vegetation communities in the Brigalow Belt so as to maximise representations within the National Park estate and to determine other conservation strategies" (Sattler *in* McDonald *et al.*, 1991).

16. Management actions required:

16.1: Survey known and potential habitat in reserves within the species' known range.

16.2: Survey known habitat outside reserves within the species' known range.

16.3: Establish appropriate reserves if the existing reserve system is found to be inadequate to secure the survival of the species.

16.4: Develop and promote guidelines and provide incentives for landowners and users to reduce the impact of current land use practices on the species outside reserves.

16.5: Develop community awareness within the species' known range.

17. Organisations responsible for conservation of species and individuals involved: Queensland Department of Environment and Heritage.

18. Other organisations and individuals involved: Herpetological staff of the Queensland Museum.

19. Can recovery plan be carried out with existing resources?: No.

1:	Survey of geographic range, habitat preferences and occurrence in reserves: 2 workers for 2 months each year for 2 years - $26,667 salary; $13,333 expenses.	**$40K**
2:	Research into basic biology and ecology, including assessment of threatening processes: 1 worker for 3 months each year for 2 years - $20,000 salary; $10,000 expenses.	**$30K**
3:	Preparation of management strategies: 1 worker for 3 months - $10,000 salary; $2,000 expenses.	**$12K**
		Total $82K

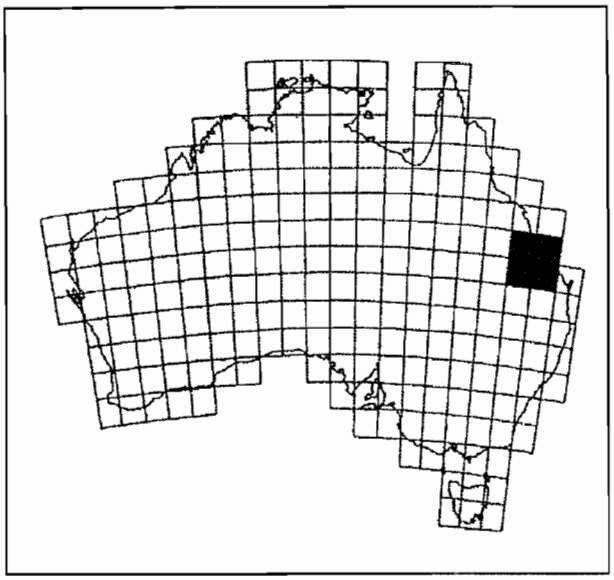
20. Remarks: 66 specimens documented in Australian museum collections.

References:

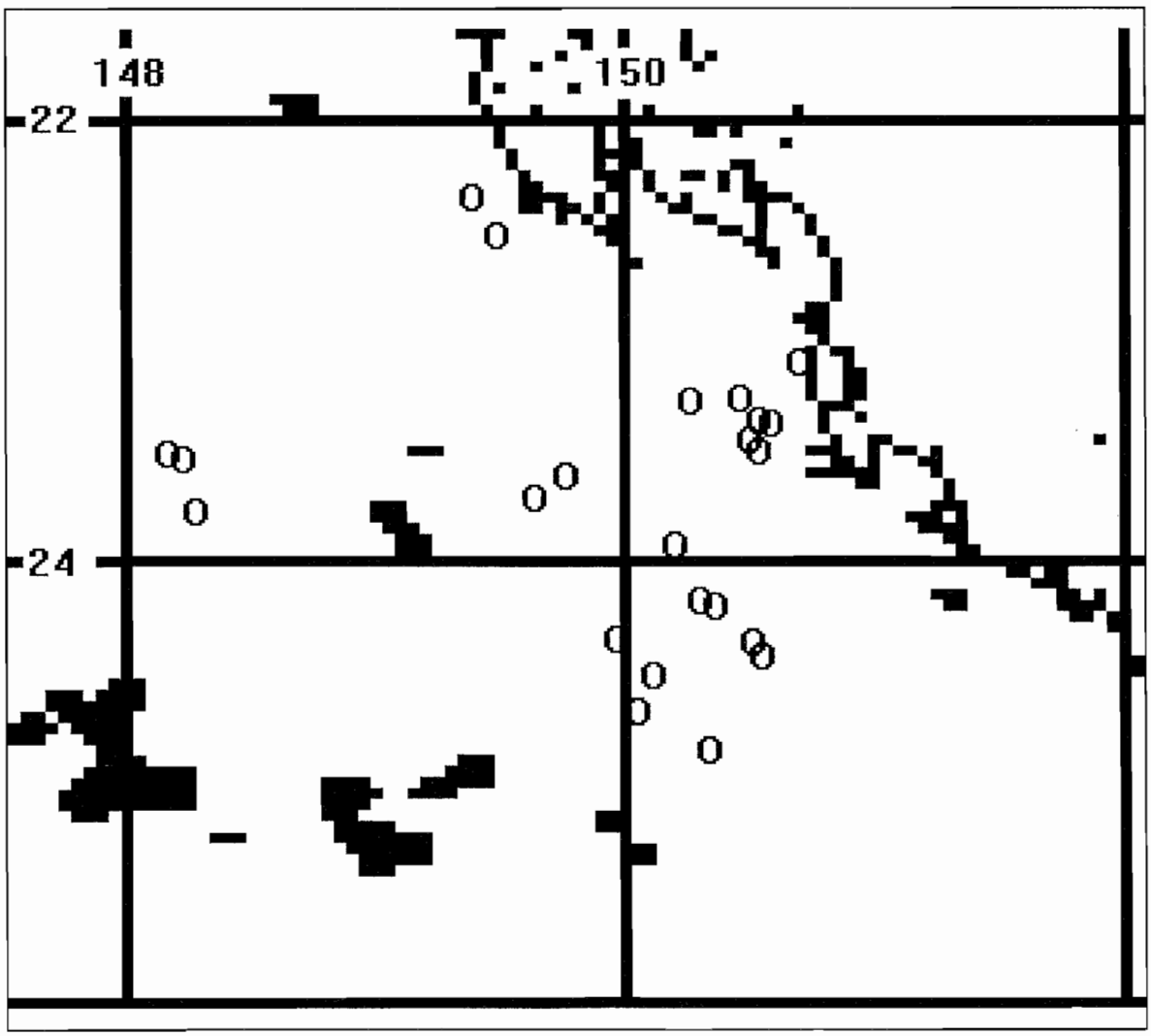
Ehmann, H.F.W. 1992. Encyclopedia of Australian Animals: Reptiles. Australian Museum with Angus and Robertson, Sydney. xv + 495 pp.

McDonald, K.R., Covacevich, J.A., Ingram, G.J. and Couper, P.J. 1991. The status of frogs and reptiles. pp. 338-345 in G.J. Ingram and R.J. Raven (eds) An Atlas of Queensland's Frogs, Reptiles, Birds and Mammals. Queensland Museum, Brisbane.

Shine, R. 1983. Food habits and reproductive biology of Australian elapid snakes of the genus *Denisonia*. Journal of Herpetology 17(2): 171-175.



Distribution of *Denisonia maculata*



1. Family:	Elapidae
2. Scientific Name:	*Echiopsis atriceps* (Storr, 1980) [also appears in the literature as *Brachyaspis atriceps* and *Denisonia atriceps*]
3. English Name:	Lake Cronin Snake

4. Infraspecific taxa: None

5. Species survival status: Vulnerable.

6. Former distribution: Not known to have differed from current distribution.

7. Current distribution: Vicinity of Lake Cronin in the semi-arid interior of southern Western Australia; this is on the eastern margin of the Western Australian wheatbelt.

8. Habitat: Open woodland, tall shrubland.

Holotype collected in open *Eucalyptus salmonophloia* woodland on sandy loam close to an ephemeral freshwater lake (How *et al.*, 1988). Melaleuca thickets (Wilson and Knowles, 1988) and an understorey of low shrubs (Ehmann, 1992) may be present in association with the eucalypts.

9. Reasons for decline: Not known to have declined, but the species is vulnerable as it has a very restricted range surrounded by unsuitable habitat. Probably a combination of factors threaten it, including clearance of habitat for agriculture and grazing, crop production and disturbance by mining activities.

There is a possibility of strip mining for gold in the future, and core holes resulting from mineral surveys in the shrubland surrounding the Lake Cronin Nature Reserve, already present a hazard to *E. atriceps* (Harald Ehmann, *in litt.*). The deep uncapped holes form an extensive grid of permanently open "pitfall traps" with the potential to cause the death of all small animals which fall into them. There is also the possibility of clearance for wheat growing if the wheatbelt expands.

10. Conservation reserves on which species occurs: None known.

10A. Other conservation reserves where species might be expected to occur: Lake Cronin Nature Reserve.

12. Other land on which species occurs: Recorded from vicinity of Lake Cronin and 7 km east-south-east of Mount Holland; potentially present in suitable habitat on private properties throughout the species' range.

13. Is knowledge about species adequate for objectives and actions to be defined accurately?: No.

13.1: Ground surveys need to be conducted to determine the full geographic range of the species, its habitat preferences, and the extent of its occurrence in existing reserves.

13.2: Research is needed into the basic biology and ecology of the species in the field; it should include long term monitoring of changes in population size, habitat use and geographic range.

13.3: Research is needed to determine if the species is declining and if so, to identify the major factors contributing to that decline.

14. Recovery Plan objectives:

14.1: To obtain sufficient information on the species' biology, ecology and distribution to determine its current conservation status and formulate appropriate management strategies.

14.2: To ensure that secure, viable populations of the species are maintained within a reserve system.

14.3: To implement land management practices which promote the maintenance of secure, viable populations of the species outside reserves.

15. Management actions already initiated: None known.

16. Management actions required:

16.1: Survey known and potential habitat in reserves within the species' known range.

16.2: Survey known habitat outside reserves within the species' known range.

16.3: Extend Lake Cronin Reserve to include known range of the species and establish further reserves if the existing reserve system is found to be inadequate to secure the survival of the species.

16.4: Develop and promote guidelines and provide incentives for landowners and users to reduce the impact of current land use practices on the species outside reserves.

16.5: Develop community awareness within the species' known range.

17. Organisations responsible for conservation of species and individuals involved: Western Australian Department of Conservation and Land Management (Andrew Burbidge).

18. Other organisations and individuals involved: Harald Ehmann (Sydney Institute of Technology).

19. Can recovery plan be carried out with existing resources?: No.

1: Survey of geographic range, habitat preferences and occurrence in reserves: 2 workers for 1 month each year for 2 years - $13,333 salary; $6,667 expenses. **$20K**

2: Research into basic biology and ecology, including assessment of threatening processes: 1 worker for 3 months each year for 2 years - $20,000 salary; $10,000 expenses. **$30K**

3: Preparation of management strategies: 1 worker for 3 months - $10,000 salary; $2,000 expenses. **$12K**

4: Purchase of land for the reserve system: uncosted.

Total $62K

20. Remarks: Three specimens documented in Australian museum collections. An unidentified elapid (MCZ 142435 from Lake Grace, Western Australia) which was listed by McDowell (ms) from the Museum of Comparative Zoology, Harvard, may be this species (Glenn Shea, *in litt.*).

References:

Anonymous 1981. New venomous snake found. SWANS 11(1): 23.

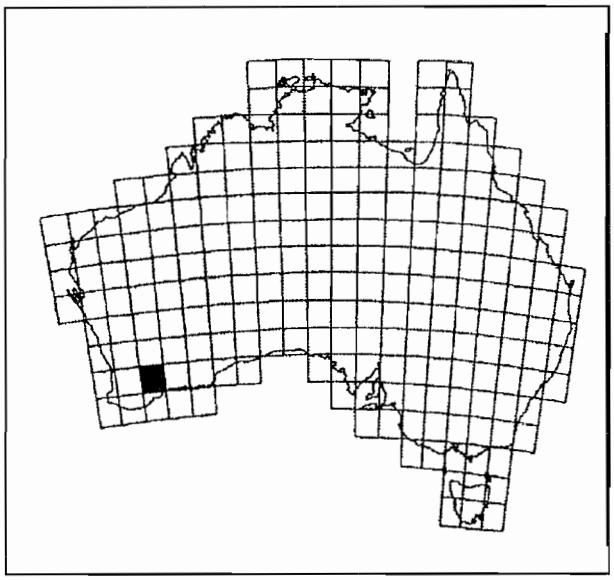
Ehmann, H.F.W. 1992. Encyclopedia of Australian Animals: Reptiles. Australian Museum with Angus and Robertson, Sydney. xv + 495 pp.

How, R.A., Dell, J. and Muir, B.G. 1988. The biological survey of the Eastern Goldfields of Western Australia. Park 4. Lake Johnston-Hyden Study Area. IV. Vertebrate fauna. Records of the Western Australian Museum Supplement 30: 44-83.

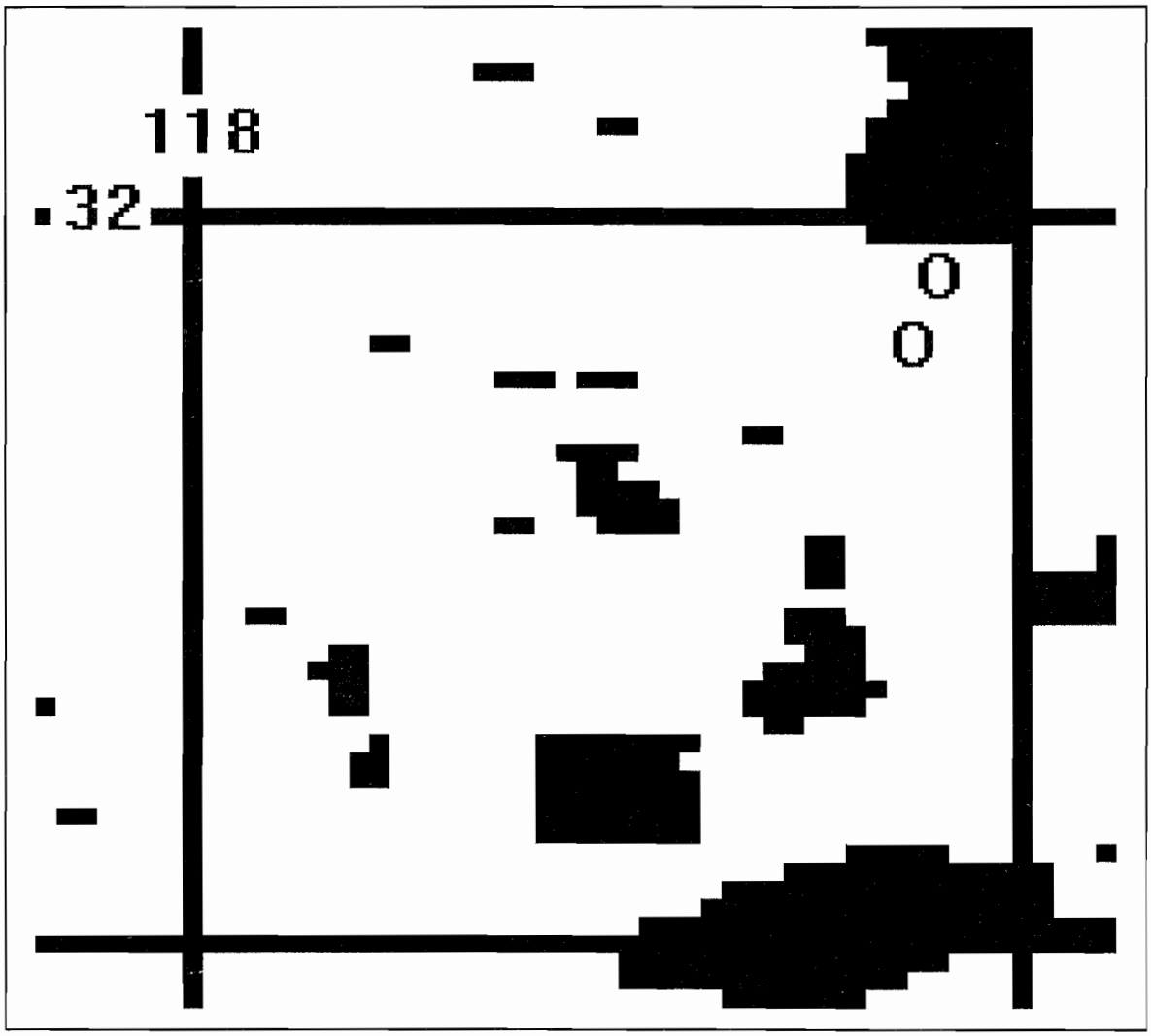
McDowell, S.B. The zoogeography of the New Guinea region snakes. ms.

Storr, G.M. 1980. A new *Brachyaspis* (Serpentes: Elapidae) from Western Australia. Records of the Western Australian Museum 8(3): 397-399.

Wilson, S.K. and Knowles, D.G. 1988. Australia's Reptiles; a photographic reference to the terrestrial reptiles of Australia. Collins Publishers, Australia. 447 pp.



Distribution of *Echiopsis atriceps*



1. Family:	Elapidae
2. Scientific Name:	*Echiopsis curta* (Schlegel, 1837) [also appears in the literature as *Notechis curtus*] (population east of Adelaide)
3. English Name:	Bardick

4. Infraspecific taxa: Only the population east of Adelaide is considered under threat. Storr (1982) referred to this as population "D" in his revision of the species and listed some morphological characters in which it differed from the other, more western, populations.

5. Species survival status: Vulnerable.

6. Former distribution: Not known to have differed from current distribution, but there are few recent records from New South Wales and South Australia.

7. Current distribution: Mallee areas of south-eastern South Australia, western Victoria, and south-western New South Wales around Balranald. Robertson *et al.* (1989) listed it as having a moderate distribution in the mallee of north-western Victoria (the Big Desert and Sunset Country regions).

8. Habitat: Tall shrubland.

The eastern population appears to be dependent on mallee, generally with an understorey of hummock grasses (*Triodia* spp.) and growing on sandy to loamy soils. In Victoria it is found in mallee heath and broombush mallee (Robertson *et al.*, 1989).

9. Reasons for decline: Probably a combination of factors, including overgrazing by stock, clearance of habitat for grazing and agriculture, crop production and possibly, inappropriate fire regime.

In the mallee of north-western Victoria, clearing for agriculture has greatly reduced the available habitat and vegetation has also been changed by grazing, altered burning regimes and timber cutting (Robertson *et al.*, 1989).

10. Conservation reserves on which species occurs: South Australia: Danggali CP.

10A. Other conservation reserves where species might be expected to occur: New South Wales: Nearie Lake NR, Willandra Lakes WHA;
South Australia: Bakara CP, Billiatt CP, Brookfield CP, Carcuma CP, Coorong GR, Coorong NP, Gum Lagoon CP, Karte CP, Lowan NR, Messent CP, Mount Boothby CP, Mount Rescue CP, Ngarkat CP, Peebinga CP, Pike River CP, Pooginook CP, Scorpion Springs CP, Swan Reach CP;
Victoria: Big Desert W, Bronzewing WR, Canunda NP, Dergholm SP, Hattah-Kulkyne NP, Katarapko GR, Kemendok NR, Lake Albacutya SP, Little Desert NP, Little Desert West RA, Lock Luna GR, Mallee Cliffs NP, Moorook GR, Murray-Kulkyne P, Pink Lakes SP, Red Bluff WR, Roseneath RA, Tooloy-Lake Mundi WR, Wandoun FFR, Wandown WR, Wilken FFR, Wyperfeld NP, Yanga NR.

11. Other public land on which species occurs: None known.

12. Other land on which species occurs: Kynock Station near Keith, South Australia (1968 specimen); potentially present on private properties throughout the species' range in south-eastern Australia.

13. Is knowledge about species adequate for objectives and actions to be defined accurately?: No.

13.1: Ground surveys need to be conducted to determine the full geographic range of the population, its habitat preferences, and the extent of its occurrence in existing reserves.

13.2: Research is needed into the basic biology and ecology of the population in the field; it should include long term monitoring of changes in population size, habitat use and geographic range.

13.3: Research is needed to document the extent of the population's decline and to identify the major factors

contributing to that decline.

14. Recovery Plan objectives:

14.1: To obtain sufficient information on the biology, ecology and distribution of the population to determine its current conservation status and formulate appropriate management strategies.

14.2: To ensure that secure, viable populations are maintained within a reserve system.

14.3: To implement land management practices which promote the maintenance of secure, viable populations outside reserves.

15. Management actions already initiated:

15.1: Listed as "vulnerable and rare" on the 1992 Revised (Interim) Schedule 12 of the *NSW Endangered Fauna (Interim Protection) Act 1991.*

16. Management actions required:

16.1: Survey known and potential habitat in reserves within the population's known range.

16.2: Survey known habitat outside reserves within the population's known range.

16.3: Establish appropriate reserves if the existing reserve system is found to be inadequate to secure the survival of the population.

16.4: Develop and promote guidelines and provide incentives for landowners and users to reduce the impact of current land use practices on the population outside reserves.

16.5: Develop community awareness within the population's known range.

17. Organisations responsible for conservation of species and individuals involved: South Australian Department of Environment and Land Management, Victorian Department of Conservation and Natural Resources (Peter Robertson), New South Wales National Parks and Wildlife Service.

18. Other organisations and individuals involved: None known.

19. Can recovery plan be carried out with existing resources?: No.

1: Survey of geographic range, habitat preferences and occurrence in reserves: 2 workers for 3 months each year for 2 years - $40,000 salary; $20,000 expenses. **$60K**

2: Research into basic biology and ecology, including assessment of threatening processes: 1 worker for 3 months each year for 3 years - $30,000 salary; $15,000 expenses. **$45K**

3: Preparation of management strategies: 1 worker for 3 months - $10,000 salary; $2,000 expenses. **$12K**

Total $117K

20. Remarks: 29 specimens documented in Australian museum collections. Wilson and Knowles (1988) illustrate a recent individual from Bidura, NSW. Robertson *et al.* (1989) recorded the species as "rare" in their mallee study area of north-western Victoria.

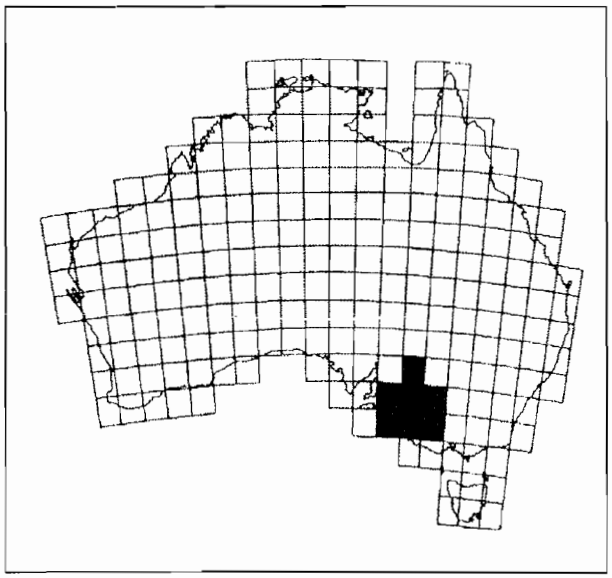
References:

Robertson, P., Bennett, A.F., Lumsden, L.F., Silveira, C.E., Johnson, P.G., Yen, A.L., Milledge, G.A., Lillywhite, P.K. and Pribble, H.J. 1989. Fauna of the mallee study area north-western Victoria. Arthur Rylah Institute Technical Report No. 87: 1-91.

Shine, R. 1982. Ecology of the Australian elapid snake *Echiopsis curta*. Journal of Herpetology 16(4): 388-393.

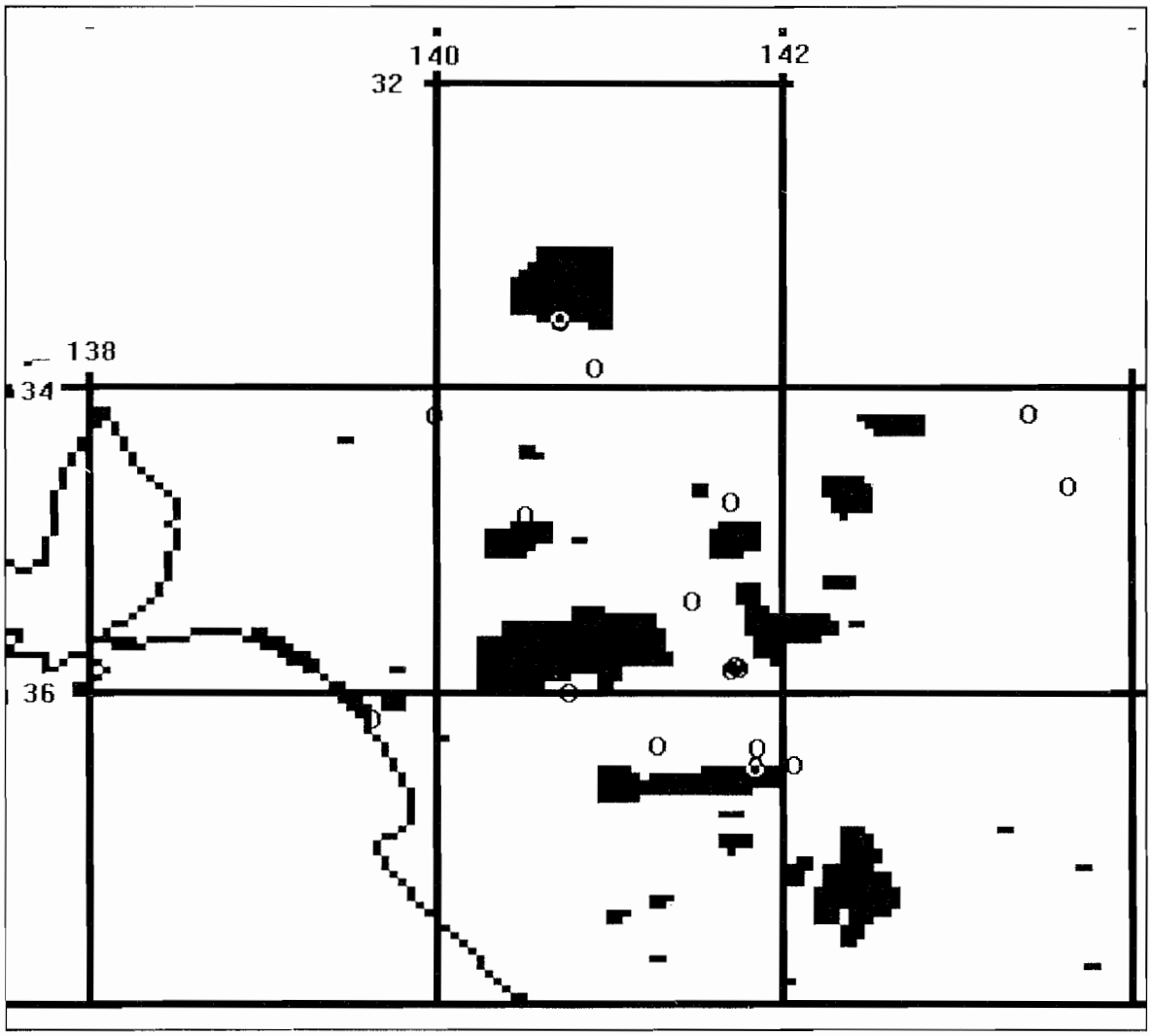
Storr, G.M. 1982. The genus *Notechis* (Serpentes: Elapidae) in Western Australia. Records of the Western Australian Museum 9(4): 325-340.

Wilson, S.K. and Knowles, D.G. 1988. Australia's Reptiles; a photographic reference to the terrestrial reptiles of Australia. Collins Publishers, Australia. 447 pp.



Distribution of *Echiopsis curta*

(population east of Adelaide)



1. Family:	Elapidae
2. Scientific Name:	*Elapognathus minor* (Günther, 1863)
3. English Name:	Short-nosed Snake

4. Infraspecific taxa: None

5. Species survival status: Vulnerable.

6. Former distribution: Not known to have differed from current distribution.

7. Current distribution: Humid coastal plains of south-western Western Australia, from Busselton in the north to Two Peoples Bay east of Albany.

8. Habitat: Open heath, tall open forest, woodland.

Found in swampy areas amongst dunes, in heathland or the dense tussock understorey of coastal woodland and occasionally, of wet sclerophyll forest growing on sandy soils.

9. Reasons for decline: Not known to have declined but the species has a very restricted distribution and there are few recent records in museums. Probably threatened by a combination of factors, including clearance of habitat for agriculture, native forest logging, drainage of habitat, and urban development along the coastal fringe of the south-west.
May suffer competition from the more abundant Crowned Snake (*Drysdalia coronata*) (Wilson and Knowles, 1988).

10. Conservation reserves on which species occurs: Two Peoples Bay NR.

10A. Other conservation reserves where species might be expected to occur: Cowaramup NP, D'Entrecasteaux NP, Gingilup Swamps NR, Hamelin Bay NP, Leeuwin-Naturaliste NP, Scott NP, Two Peoples Bay NR, Walpole-Nornalup NP, Warren NP, West Cape Howe NP, William Bay NP, Yallingup NP.

11. Other public land on which species occurs: State Forest near the south coast (A. Burbidge, *in litt.*).

12. Other land on which species occurs: Potentially present in suitable habitat on private properties throughout the species' range.

13. Is knowledge about species adequate for objectives and actions to be defined accurately?: No.

13.1: Ground surveys need to be conducted to determine the full geographic range of the species, its habitat preferences, and the extent of its occurrence in existing reserves.

13.2: Research is needed into the basic biology and ecology of the species in the field; it should include long term monitoring of changes in population size, habitat use and geographic range.

13.3: Research is needed to determine if the species is declining and if so, to identify the major factors contributing to that decline.

14. Recovery Plan objectives:

14.1: To obtain sufficient information on the species' biology, ecology and distribution to determine its current conservation status and formulate appropriate management strategies.

14.2: To ensure that secure, viable populations of the species are maintained within a reserve system.

14.3: To implement land management practices which promote the maintenance of secure, viable populations of the species outside reserves.

15. Management actions already initiated: None known.

16. Management actions required:

16.1: Survey known and potential habitat in reserves within the species' known range.

16.2: Survey known habitat outside reserves within the species' known range.

16.3: Establish appropriate reserves if the

existing reserve system is found to be inadequate to secure the survival of the species.

16.4: Develop and promote guidelines and provide incentives for landowners and users to reduce the impact of current land use practices on the species outside reserves.

16.5: Develop community awareness within the species' known range.

17. Organisations responsible for conservation of species and individuals involved: Western Australian Department of Conservation and Land Management (Andrew Burbidge).

18. Other organisations and individuals involved: None known.

19. Can recovery plan be carried out with existing resources?: No.

1: Survey of geographic range, habitat preferences and occurrence in reserves: 2 workers for 2 months each year for 2 years - $26,667 salary; $13,333 expenses. **$40K**

2: Research into basic biology and ecology, including assessment of threatening processes: 1 worker for 3 months each year for 2 years - $20,000 salary; $10,000 expenses. **$30K**

3: Preparation of management strategies: 1 worker for 3 months - $10,000 salary; $2,000 expenses. **$12K**

Total $82K

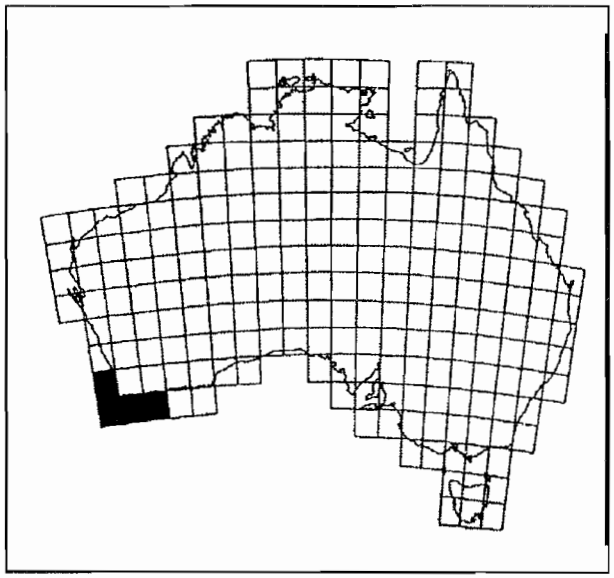
20. Remarks: 24 specimens documented in Australian museum collections.

References:

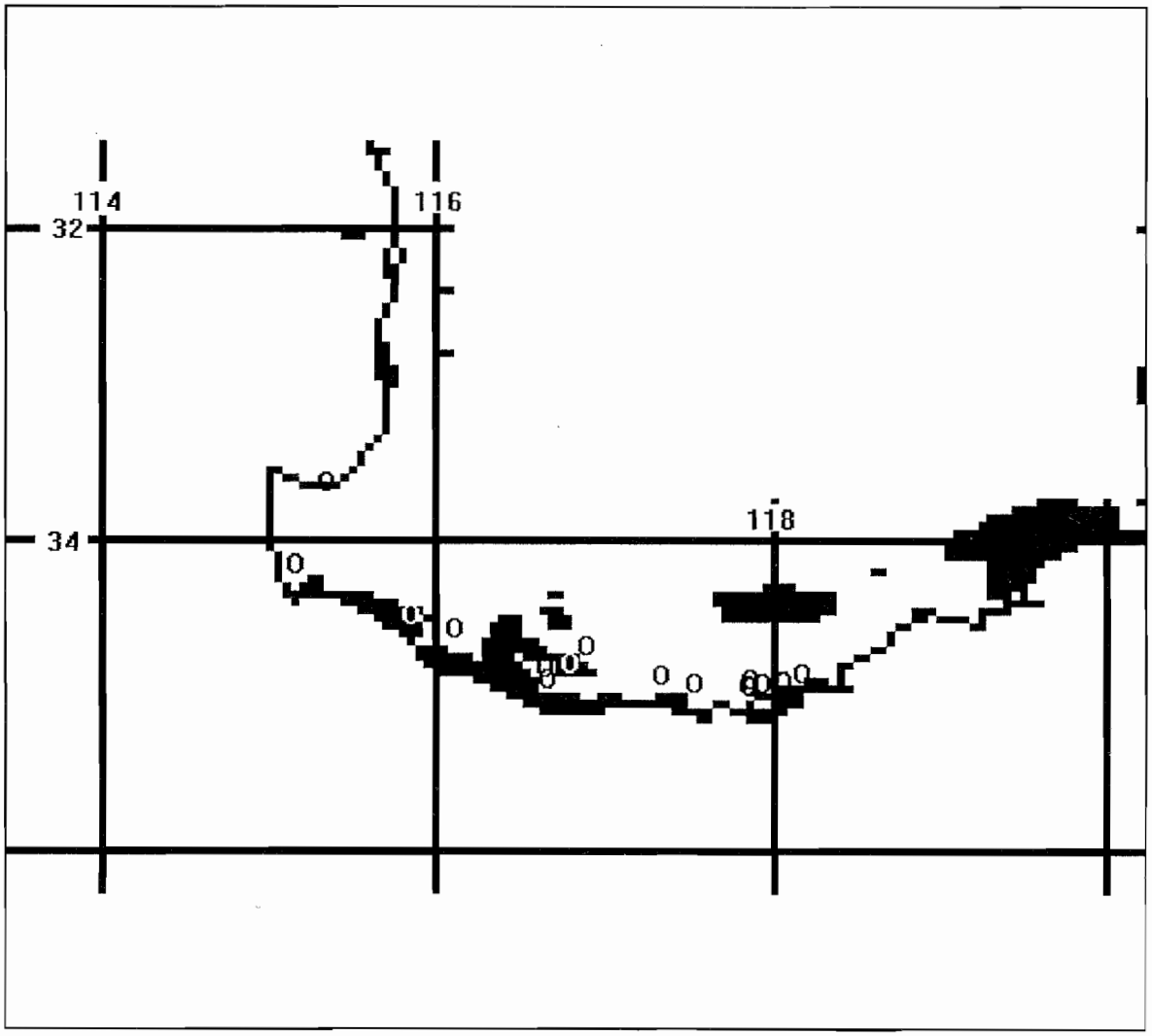
Shine, R. 1986. Natural history of two monotypic snake genera of south-western Australia, *Elapognathus* and *Rhinoplocephalus* (Elapidae). Journal of Herpetology 20(3): 436-439.

Storr, G.M., Smith, L.A. and Johnstone, R.E. 1986. Snakes of Western Australia. Western Australian Museum, Perth. 187 pp.

Wilson, S.K. and Knowles, D.G. 1988. Australia's Reptiles; a photographic reference to the terrestrial reptiles of Australia. Collins Publishers, Australia. 447 pp.



Distribution of *Elapognathus minor*



1. Family:	Elapidae
2. Scientific Name:	*Furina dunmalli* (Worrell, 1955) [also appears in the literature as *Glyphodon dunmalli*]
3. English Name:	Dunmall's Snake

4. Infraspecific taxa: None

5. Species survival status: Vulnerable.

6. Former distribution: Not known to have differed from current distribution.

7. Current distribution: South-eastern interior of Queensland, including the Darling Downs. The range extends from Yeppoon and the Expedition Range in the north, to Oakey, Glenmorgan and Inglewood in the south; most locality records are between 200 and 500 m in altitude.

8. Habitat: Open forest, woodland.

Preferred habitat, especially on the Darling Downs, appears to be Brigalow (*Acacia harpophylla*) forest and woodland growing on cracking black clay and clay loam soils.

9. Reasons for decline: Not known to have declined, but this species is either rare or very secretive and not many have been recorded. Its association with Brigalow makes it vulnerable to the same threats faced by two other Brigalow reptiles - see entries for *Paradelma orientalis* and *Denisonia maculata*. These threats include extensive habitat changes caused by overgrazing by stock, clearance of habitat for agriculture and grazing, pasture improvement, crop production and urban development.

The Darling Downs have been described as "the most modified, intensely farmed and grazed areas in Queensland" (Covacevich *et al.*, 1988). Drainage of swamps may be another threat (Harald Ehmann, *in litt.*).

10. Conservation reserves on which species occurs: Expedition Range NP (including the former Robinson's Gorge NP), Lake Broadwater EP.

10A. Other conservation reserves where species might be expected to occur: Byfield NP, Cania Gorge NP, Carnarvon NP, Castle Tower NP, Deepwater NP, Eurimbula NP, Hurdle Gully Scrub SA, Isla Gorge NP, Lonesome NP, Mount Archer EP, Precipice NP, Southwood NP, Wondul Range NP.

11. Other public land on which species occurs: May occur in Dunmore and Barakula State Forests (Steve Wilson, *in litt.*); roadside reserves between Inglewood and Texas, and along the Mitchell Road, Rosedale north-west of Bundaberg (Bob and Steve Irwin, pers. comm.).

12. Other land on which species occurs: Potentially present in suitable habitat on private properties throughout the species' range.

13. Is knowledge about species adequate for objectives and actions to be defined accurately?: No.

13.1: Ground surveys need to be conducted to determine the full geographic range of the species, its habitat preferences, and the extent of its occurrence in existing reserves.

13.2: Research is needed into the basic biology and ecology of the species in the field; it should include long term monitoring of changes in population size, habitat use and geographic range.

13.3: Research is needed to determine if the species is declining and if so, to identify the major factors contributing to that decline.

14. Recovery Plan objectives:

14.1: To obtain sufficient information on the species' biology, ecology and distribution to determine its current conservation status and formulate appropriate management strategies.

14.2: To ensure that secure, viable populations of the species are maintained within a reserve system.

14.3: To implement land management practices which promote the maintenance of secure, viable populations of the species outside reserves.

15. Management actions already initiated: None known.

16. Management actions required:

16.1: Survey known and potential habitat in reserves within the species' known range.

16.2: Survey known habitat outside reserves within the species' known range.

16.3: Establish appropriate reserves if the existing reserve system is found to be inadequate to secure the survival of the species.

16.4: Develop and promote guidelines and provide incentives for landowners and users to reduce the impact of current land use practices on the species outside reserves.

16.5: Develop community awareness within the species' known range.

17. Organisations responsible for conservation of species and individuals involved: Queensland Department of Environment and Heritage.

18. Other organisations and individuals involved: Jeanette Covacevich (Queensland Museum).

19. Can recovery plan be carried out with existing resources?: No.

1: Survey of geographic range, habitat preferences and occurrence in reserves: 2 workers for 2 months each year for 2 years - $26,667 salary; $13,333 expenses. **$40K**

2: Research into basic biology and ecology, including assessment of threatening processes: 1 worker for 3 months each year for 2 years - $20,000 salary; $10,000 expenses. **$30K**

3: Preparation of management strategies: 1 worker for 3 months - $10,000 salary; $2,000 expenses. **$12K**

Total $82K

20. Remarks: Ten specimens documented in Australian museum collections (Longmore, 1986). Two sight records near Rosedale (north-west of Bundaberg) in early 1993, and two on the road between Inglewood and Texas in the early 1980s (the Brigalow in this area has since been cleared) (Bob and Steve Irwin, pers. comm.); all four individuals were captured, identified in the hand and released the same night.

References:

Covacevich, J., Dunmall, W. and Sorley, J.A. 1988. Reptiles. pp. 265-273 in G. Scott (ed.) Lake Broadwater: the natural history of an inland lake and its environs. Lake Darling Downs Institute Press and Lake Broadwater Natural History Association, Toowoomba. 344 pp.

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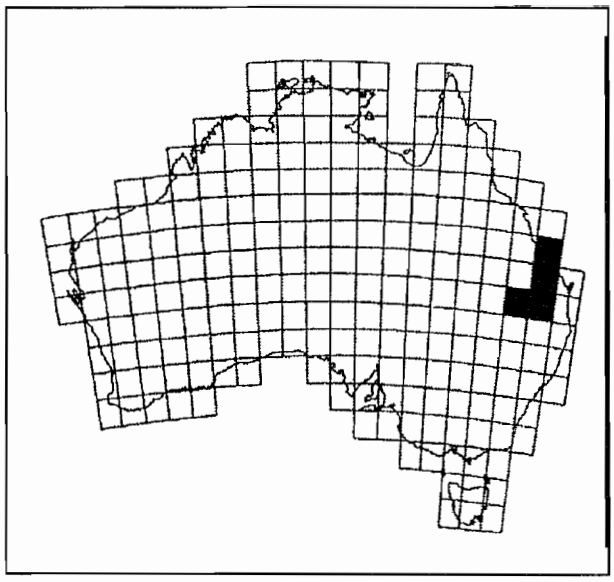
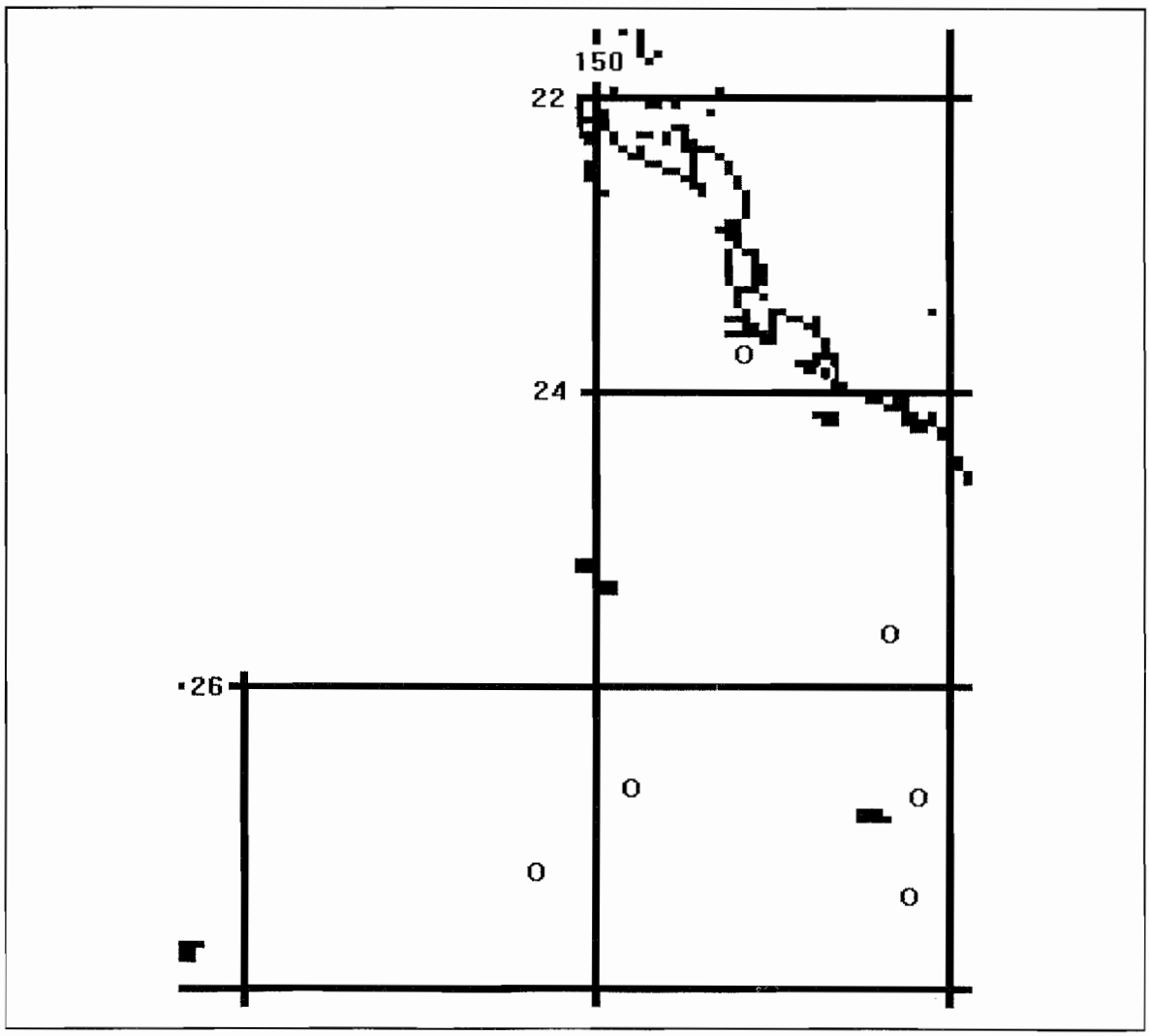


Distribution of *Furina dunmalli*



1. Family:	Elapidae
2. Scientific Name:	*Hoplocephalus bungaroides* (Schlegel, 1837)
3. English Name:	Broad-headed Snake

4. Infraspecific taxa: None

5. Species survival status: Vulnerable.

6. Former distribution: In the 1860s the species was common along the rocky coastline around Sydney, from the entrance to Port Jackson south to Botany Bay, and around Middle Harbour, Lane Cove and Parramatta, although its numbers were already declining (Krefft, 1869). No specimens have been recorded from the Sydney metropolitan area since the 1970s.

7. Current distribution: Sandstone ranges of the southern central New South Wales coast, extending from Colo north of Sydney to Nowra in the south, and as far inland as Bathurst. The entire range falls within a 200 km radius of Sydney. On the outskirts of Sydney, still considered to occur on the Hornsby and Woronora Plateaus and the lower Blue Mountains (Wells and Wellington, 1989).

8. Habitat: Open forest, rocky isolates.

Winter refuges are generally crevices between and under flat rocks created by exfoliating sandstone outcrops which typically occur along ridge tops in dry sclerophyll forest (Hersey, 1980). However in summer the species is often found away from rocks, in hollow limbs of large eucalypts some distance above the ground (Rick Shine and Jon Webb, *in litt.*). On the western edge of its range, near Bathurst, *H. bungaroides* is found in forest growing on shale or conglomerate slopes and bluffs (Glenn Shea, *in litt.*). The distribution of suitable habitat is patchy throughout the species' range.

9. Reasons for decline: Probably a combination of factors, including habitat clearance, urban development, rock removal and possibly, trapping for captivity, and disturbance by frequent visitation.

Habitat clearance has led not only to an overall loss of habitat, but also to fragmentation of remaining habitat, so the population has been broken up into small isolated units. The species' range coincides with the highest density of human population in Australia and with wide-scale habitat degradation. The type of sandstone boulders preferred by the snakes are also those preferred by collectors of "bushrock" for landscape gardening; Schlesinger and Shine (in press) found that bushrock removal is likely to have a very significant effect on the sandstone herpetofauna. Although there are many national parks within the species' range, they are subject to high visitation and illegal habitat destruction has occurred even within these areas (Shine & Fitzgerald, 1989). Illegal collecting has been suggested as a reason for decline (Burbidge and Jenkins, 1984) but the magnitude of this threat is unknown; in 1980 the NSW NPWS was aware of seven people holding this species in captivity (Hersey, 1980).

10. Conservation reserves on which species occurs: Blue Mountains NP, Heathcote NP, Morton National Park, Royal National Park, Wollemi NP.

10A. Other conservation reserves where species might be expected to occur: Budderoo NP, Conimbla NP, Dharug NP, Jervis Bay NR, Kanangra-Boyd NP, Macquarie Pass NP, Pantoneys Crown NR, Parr SRA, Yengo NP.

11. Other public land on which species occurs: Colymea SF, Yalwal SF and Yerriyong SF (all in the Nowra region), Woronora Dam Catchment Area, Mount Keira.

12. Other land on which species occurs: Potentially present in suitable habitat on private properties throughout the species' range.

13. Is knowledge about species adequate for objectives and actions to be defined accurately?: No.

13.1: Ground surveys need to be conducted to determine the full geographic range

of the species, its habitat preferences, and the extent of its occurrence in existing reserves.

13.2: Further research is needed into the basic biology and ecology of the species in the field; it should include long term monitoring of changes in population size, habitat use and geographic range.

13.3: Research is needed to document the extent of the species' decline and to identify the major factors contributing to that decline.

14. Recovery Plan objectives:

14.1: To obtain sufficient information on the species' biology, ecology and distribution to determine its current conservation status and formulate appropriate management strategies.

14.2: To ensure that secure, viable populations of the species are maintained within a reserve system.

14.3: To implement land management practices which promote the maintenance of secure, viable populations of the species outside reserves.

15. Management actions already initiated:

15.1: Listed on Schedule 1 of the Commonwealth's *Endangered Species Protection Act 1992* and listed as "threatened" on the 1992 Revised (Interim) Schedule 12 of the *NSW Endangered Fauna (Interim Protection) Act 1991*.

16. Management actions required:

16.1: Survey known and potential habitat in reserves within the species' known range.

16.2: Survey known habitat outside reserves within the species' known range.

16.3: Establish appropriate reserves if the existing reserve system is found to be inadequate to secure the survival of the species.

16.4: Develop and promote guidelines for landowners and users to reduce the impact of current land use practices on the species outside reserves.

16.5: Develop community awareness within the species' known range.

16.6: Police bushrock removal and sales.

17. Organisations responsible for conservation of species and individuals involved: New South Wales National Parks and Wildlife Service; Forestry Commission of New South Wales.

18. Other organisations and individuals involved: Rick Shine and Jon Webb (University of Sydney).

19. Can recovery plan be carried out with existing resources?: No.

1:	Survey of geographic range, habitat preferences and occurrence in reserves: 2 workers for 3 months each year for 2 years - $40,000 salary; $20,000 expenses.	**$60K**
2:	Research into basic biology and ecology, including assessment of threatening processes: 1 worker for 4 months each year for 3 years - $40,000 salary; $20,000 expenses.	**$60K**
3:	Preparation of management strategies: 1 worker for 3 months - $10,000 salary; $2,000 expenses.	**$12K**
		Total $132K

20. Remarks: 78 specimens documented in Australian museum collections. Krefft (1869) referred to "many hundreds" of specimens distributed to kindred institutions in addition to the collection held at that time in the Australian Museum.

Jonathon Webb (University of Sydney) is enrolled in a PhD on "The Ecology of the Broad-headed Snake".

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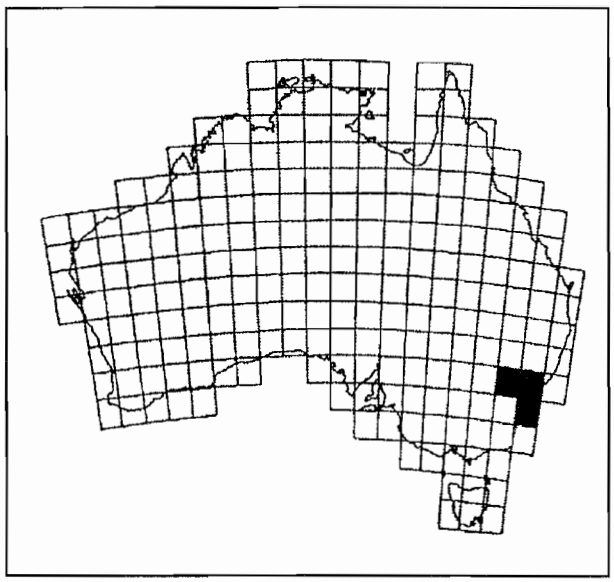
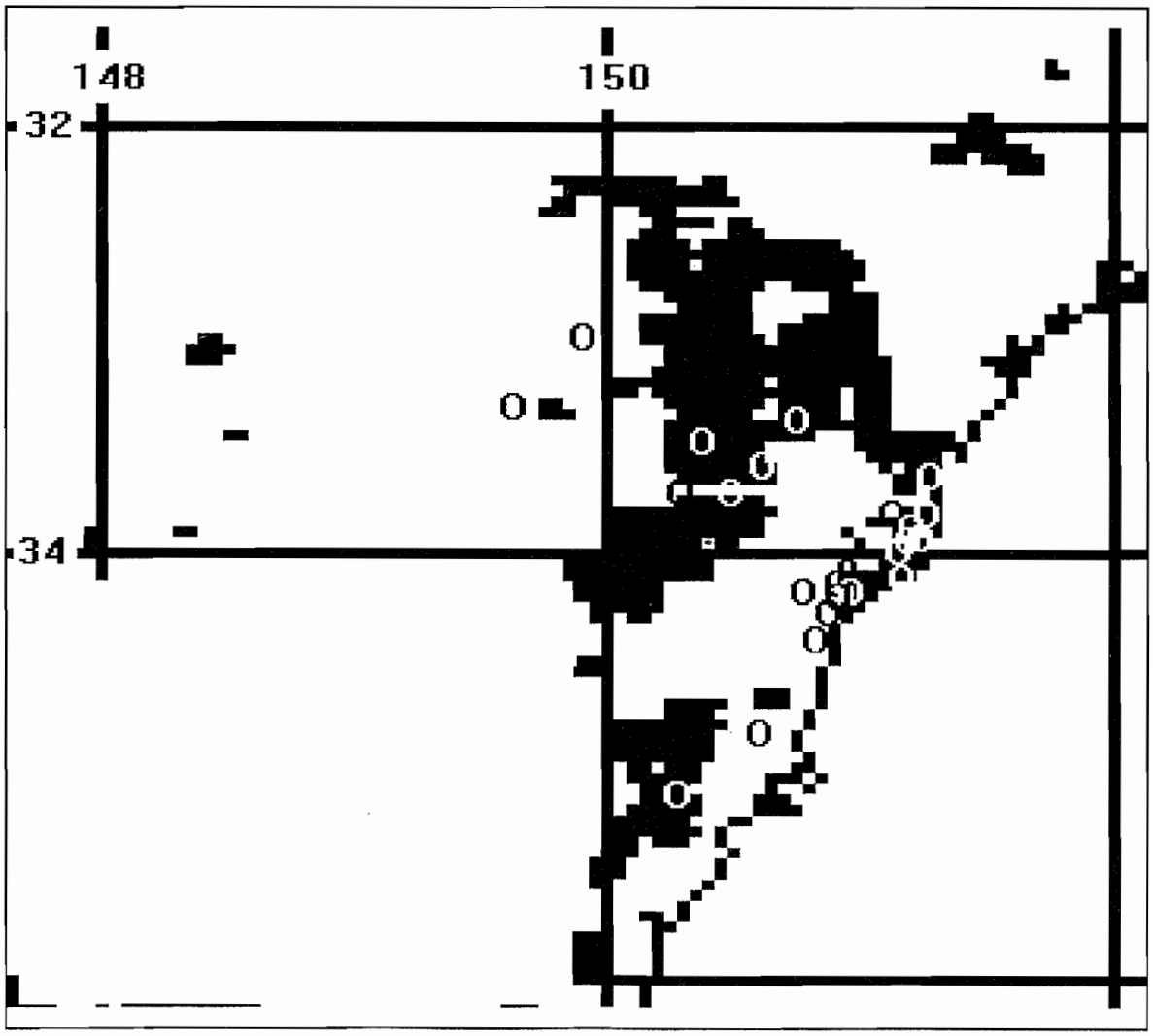


Distribution of

Hoplocephalus bungaroides



1. Family:	Elapidae
2. Scientific Name:	*Notechis ater ater* (Krefft, 1866) (population in the Flinders Ranges, SA)
3. English Name:	Krefft's Tiger Snake

4. Infraspecific taxa: Relationships of the various species, subspecies and populations of *Notechis* are obscure and Schwaner (1990) has referred all populations to "the *Notechis scutatus-ater* complex". Only the population restricted to the Flinders Ranges (the type locality for *Notechis ater*), is of immediate conservation concern.

5. Species survival status: Vulnerable.

6. Former distribution: The present patchy distribution suggests a relictual population which was once more widespread (Hutchinson, 1992); Mirtschin and Bailey (1990) cite anecdotal evidence for tiger snakes being more widespread in the Flinders Ranges earlier this century.

7. Current distribution: Confined to several stream systems in the southern Flinders Ranges, South Australia. The range extends approximately from Wilmington in the north to Crystal Brook in the south, westwards towards the mouth of the Broughton River and possibly as far east as Burra Creek. The average annual rainfall in this area is 600 mm or above.

8. Habitat: Open woodland, riparian habitats, rocky isolates.

Found only along the margins of watercourses which may diminish in the dry summer climate to isolated pools. The creeks are typically lined by woodland of River Red Gums (*Eucalyptus camaldulensis*) and Sugar Gums *E. cladocalyx*, with Long-leafed Box (*E. goniocalyx*) growing on the sloping valley sides. The snakes shelter in flood debris in creek beds, rocky screes on the slopes, and shrubby undergrowth on the plains country (Mirtschin and Bailey, 1990).

9. Reasons for decline: Probably a combination of factors, including overgrazing by stock, clearance of habitat, soil erosion, water pollution, inappropriate fire regimes and possibly loss of food source (frogs) to an introduced competitor (trout).

Diversion and eutrophication of streams (resulting from the aerial spreading of fertilisers) and clearing of undergrowth have probably been the main factors contributing to the decline of the species (Hutchinson, 1992). Timber was cleared on the slopes for charcoal production early this century (Mirtschin and Bailey, 1990). Bushfires in Mount Remarkable National Park may also pose a threat: a fire in 1988 burnt much natural vegetation and a subsequent decline in the number of snakes was recorded. Mirtschin and Bailey (1990) noted that the accessibility of this population of tiger snakes had resulted in individuals being taken for taxidermy. The introduction of trout into several streams within the species' range (Waterfall Creek, Burra Creek), resulting in the disappearance of frogs from those streams, may be another cause of decline in some populations of *N. ater* (Peter Mirtschin, *in litt.*).

10. Conservation reserves on which species occurs (including a list of other Action Plan species in each conservation reserve): South Australia: Mount Remarkable National Park; *Aprasia pseudopulchella* (Vulnerable) also occurs here.

10A. Other conservation reserves where species might be expected to occur: Telowie Gorge CP.

11. Other public land on which species occurs: Doughby Reserve south-east of Melrose.

12. Other land on which species occurs: Spring Creek and Cannons Swamp, north of Melrose; mouth of the Broughton River south of Port Pirie. Most populations occur on private land (Hutchinson, 1992).

13. Is knowledge about species adequate for objectives and actions to be defined accurately?: No.

13.1: Ground surveys need to be conducted

to determine the full geographic range of the species, its habitat preferences, and the extent of its occurrence in existing reserves.

13.2: Research is needed into the basic biology and ecology of the species in the field; it should include long term monitoring of changes in population size, habitat use and geographic range.

13.3: Research is needed to document the extent of the species' decline and to identify the major factors contributing to that decline.

13.4: Genetic study needed to determine the taxonomic status of this population.

14. Recovery Plan objectives:

14.1: To obtain sufficient information on the species' biology, ecology and distribution to determine its current conservation status and formulate appropriate management strategies.

14.2: To ensure that secure, viable populations of the species are maintained within a reserve system.

14.3: To implement land management practices which promote the maintenance of secure, viable populations of the species outside reserves.

15. Management actions already initiated:

15.1: Krefft's Tiger Snake Action Committee convened by the South Australian co-ordinator of the of the National Threatened Species Network.

15.2: The Network has selected a water-course near Doughby Reserve as suitable for fencing to exclude stock and promote rehabilitation of habitat for *N. ater*.

16. Management actions required:

16.1: Survey known and potential habitat in reserves within the species' known range.

16.2: Survey known habitat outside reserves within the species' known range.

16.3: Develop and promote guidelines (such as heritage agreements, fencing of watercourses to reduce soil erosion and encourage regeneration, and the provision of alternative stock watering points) and provide incentives for landowners and users to reduce the impact of current land use practices on the species outside reserves.

16.4: Establish appropriate reserves if the existing reserve system is found to be inadequate to secure the survival of the species.

16.5: Develop community awareness within the species' known range.

17. Organisations responsible for conservation of species and individuals involved: South Australian Department of Environment and Land Management.

18. Other organisations and individuals involved: Peter Mirtschin (Venom Supplies, Tanunda), Mark Hutchinson (South Australian Museum), National Threatened Species Network (SA) Krefft's Tiger Snake Action Committee.

19. Can recovery plan be carried out with existing resources?: No.

1: Survey of geographic range, habitat preferences and occurrence in reserves: 2 workers for 3 months each year for 2 years - $40,000 salary; $20,000 expenses. **$60K**

2: Research into basic biology, taxonomy and ecology, including assessment of threatening processes: 1 worker for 4 months for 2 years - $26,667 salary; $13,333 expenses. **$40K**

3: Preparation of management strategies: 1 worker for 3 months - $10,000 salary; $2,000 expenses. **$12K**

Total $112K

20. Remarks: 19 specimens documented in Australian museum collections. Mirtschin and Bailey (1990) captured and measured 47 individuals during a four-year study of the population on one private property.

References:

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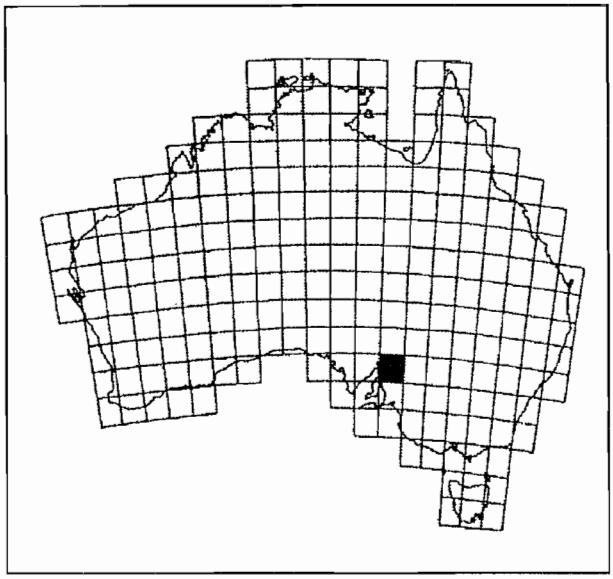
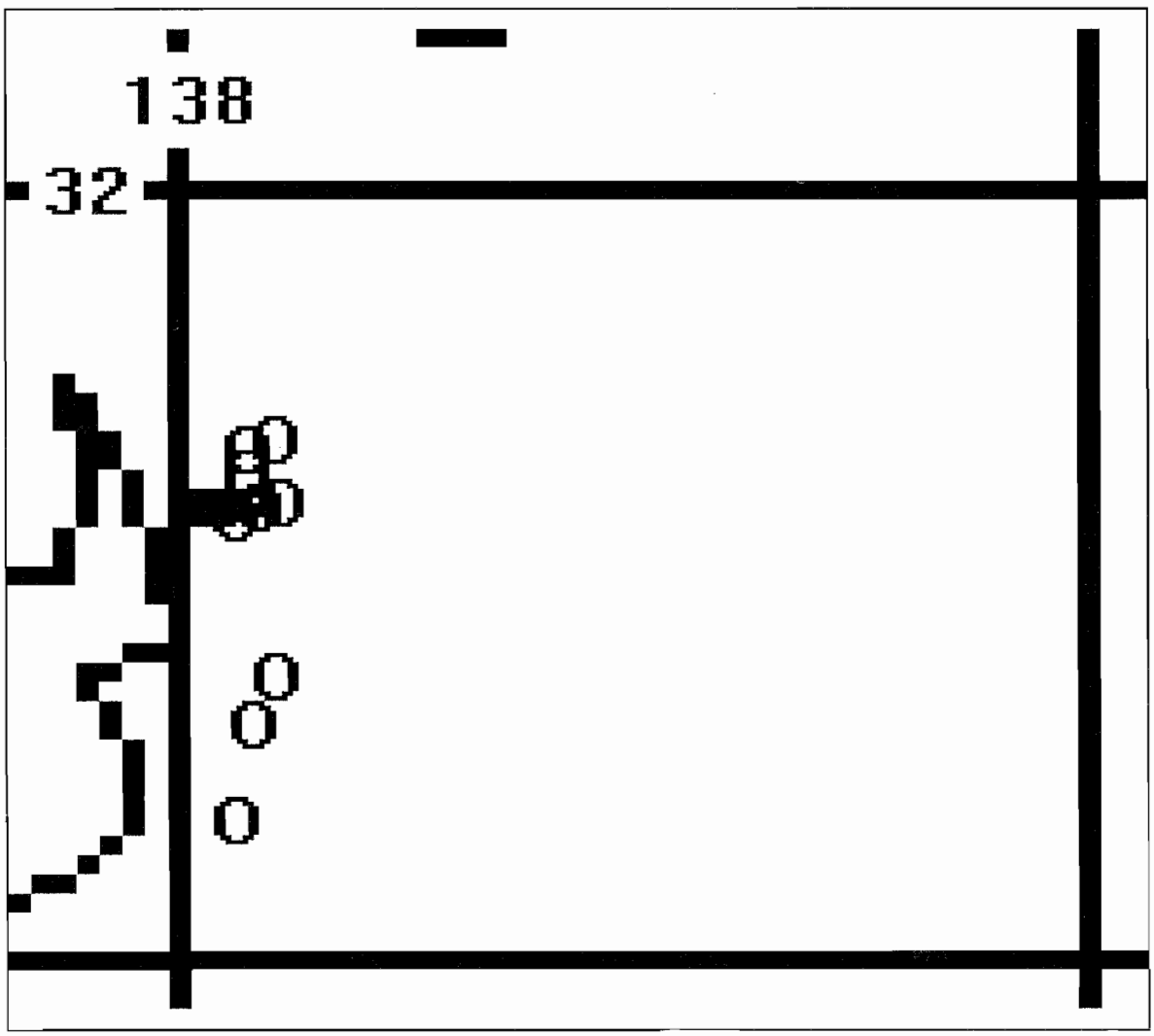


Distribution of

Notechis ater ater



1. Family:	Elapidae
2. Scientific Name:	*Simoselaps calonotus* (Duméril, Bibron and Duméril, 1854) [also appears in the literature as *Neelaps calonotus* and *Vermicella calonotos*]
3. English Name:	Black-striped Snake

4. Infraspecific taxa: None

5. Species survival status: Endangered.

6. Former distribution: Two specimens registered in the Western Australian Museum prior to 1940 are purported to have come from Bickley and York - towns approximately 100 km inland from Perth and well east of any other records for the species. These locality data are probably erroneous (Laurie Smith and John Dell, *in litt.*).

7. Current distribution: Confined to a narrow strip of sand dunes on the lower west coast of Western Australia, extending from Lancelin and Cooljarloo in the north to Mandurah in the south, a total distance of only 220 km. Within this range, the species has a patchy distribution dependent on suitable habitat (Laurie Smith and John Dell, *in litt.*). An individual was photographed by Michael Morcombe in the Darling Range east of Perth within the past few years (Andrew Burbidge, *in litt.*).

8. Habitat: Woodland, low woodland, open heath.

Preferred habitat appears to be deep, white coastal sand that supports *Banksia* woodland with a heathy understorey. On the coastal dunes of Bold Park, 11 km west of Perth, the species was recorded in coastal heath, *Dryandra sessilis* thicket, *Banksia* woodland and Tuart (*Eucalyptus gomphocephala*) woodland (How and Dell, 1990).

9. Reasons for decline: Probably a combination of factors, including clearance of habitat for urban development and small-scale agricultural crops, weed invasion, frequent fires and habitat fragmentation.

The Black-striped Snake's range coincides with the region of greatest population density in Western Australia. Habitat clearance has led to an overall loss of habitat and also to fragmentation of remaining habitat, so the population has been broken up into small isolated units. How and Dell (1990) mentioned weed invasion and increasingly frequent fires as threats to the remaining urban bushland in Bold Park, where the Black-striped Snake has been recorded on a number of recent occasions.

10. Conservation reserves on which species occurs: Boonanarring NR.

10A. Other conservation reserves where species might be expected to occur: Alexander Morrison NP, Drovers Cave NP, Moore River NP, Nambung NP, Yanchep NP.

11. Other public land on which species occurs: Bold Park (Perth), Melaleuca Park, Trigg Scrub, Scarborough Beach.

12. Other land on which species occurs: Pearce Aerodrome at Bullsbrook, Quarantine Station at Woodman Point.

13. Is knowledge about species adequate for objectives and actions to be defined accurately?: No.

13.1: Further ground surveys need to be conducted to determine the full geographic range of the species, its habitat preferences, and the extent of its occurrence in existing reserves.

13.2: Research is needed into the basic biology and ecology of the species in the field; it should include long term monitoring of changes in population size, habitat use and geographic range.

13.3: Research is needed to document the extent of the species' decline and to identify the major factors contributing to that decline.

14. Recovery Plan objectives:

14.1: To obtain sufficient information on the species' biology, ecology and distribution to determine its current conservation status and formulate appropriate management strategies.

14.2: To ensure that secure, viable populations of the species are maintained within a reserve system.

14.3: To implement land management practices which promote the maintenance of secure, viable populations of the species outside reserves.

15. Management actions already initiated:

15.1: In 1985 the species was listed as "rare" under Western Australian legislation and was recognised as "endangered fauna" by the Australian Conservation Council of Nature Conservation Ministers (the forerunner of ANZECC) (Jenkins, 1985) but by 1990 it had been removed from both lists.

15.2: Urban bushland in Perth has been surveyed for vertebrates by the Western Australian Museum biological survey unit (How and Dell, 1990, Laurie Smith, *in litt.*).

16. Management actions required:

16.1: Survey known and potential habitat in reserves within the species' known range.

16.2: Survey known habitat outside reserves within the species' known range.

16.3: Establish appropriate reserves if the existing reserve system is found to be inadequate to secure the survival of the species.

16.4: Develop and promote guidelines and provide incentives for landowners and users to reduce the impact of current land use practices on the species outside reserves; these should include careful control of fire regimes on public lands.

16.5: Develop community awareness within the species' known range.

16.6: Review policies for further development of the coastal dunes and sandplains which might have deleterious effects on the preferred habitat of this species.

17. Organisations responsible for conservation of species and individuals involved: Western Australian Department of Conservation and Land Management (Andrew Burbidge).

18. Other organisations and individuals involved: Laurie Smith and John Dell (Western Australian Museum).

19. Can recovery plan be carried out with existing resources?: No.

1:	Survey of geographic range, habitat preferences and occurrence in reserves: 2 workers for 2 months each year for 2 years - $26,667 salary; $13,333 expenses.	**$40K**
2:	Research into basic biology and ecology, including assessment of threatening processes: 1 worker for 2 months each year for 2 years - $13,333 salary; $6,667 expenses.	**$20K**
3:	Preparation of management strategies: 1 worker for 3 months - $10,000 salary; $2,000 expenses.	**$12K**
		Total $72K

20. Remarks: 107 specimens documented in Australian museum collections. Trapped in four different study sites within a 300 ha urban bushland park between 1986 and 1989 (How and Dell, 1990).

References:

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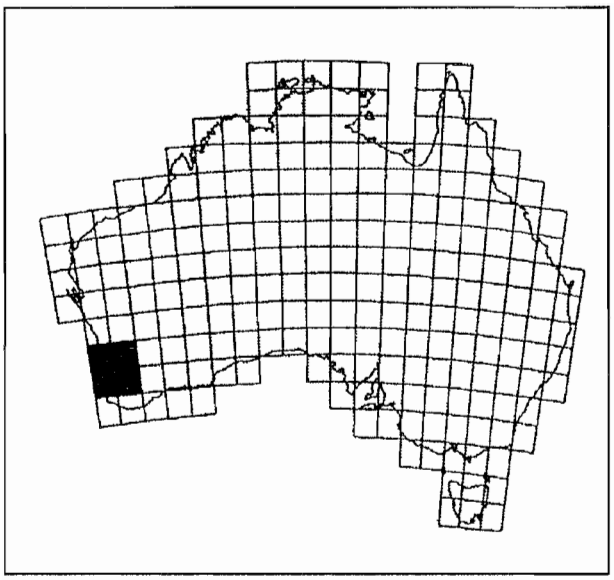
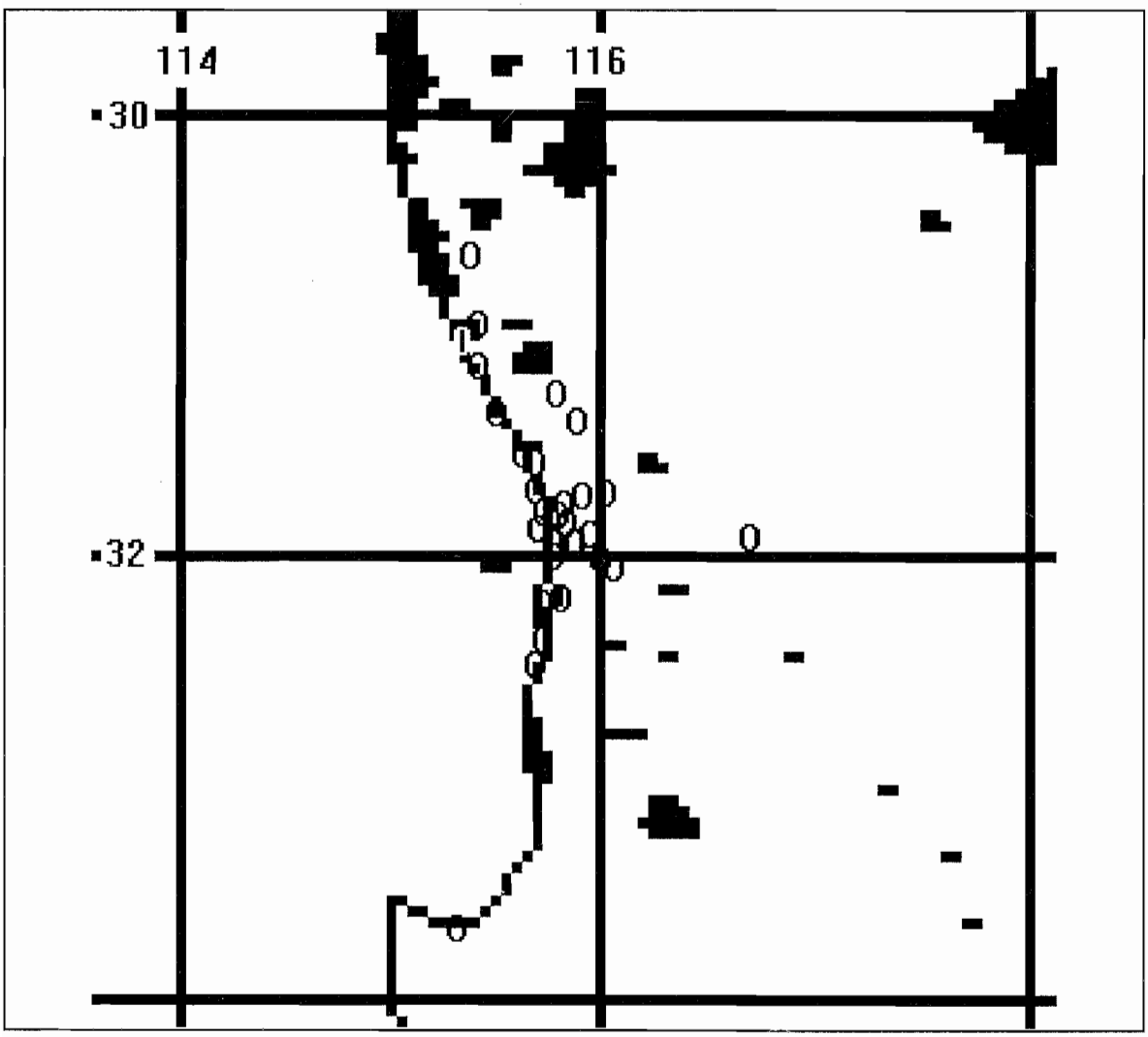


Distribution of *Simoselaps calonotus*



APPENDIX 1.1 TAXONOMIC LIST OF AUSTRALIA'S THREATENED REPTILES

Family CROCODYLIDAE	
Crocodylus johnstoni	RARE OR INSUFFICIENTLY KNOWN
Crocodylus porosus	RARE OR INSUFFICIENTLY KNOWN
Family CHELONIIDAE	
Caretta caretta	VULNERABLE
Loggerhead Turtle	
Chelonia mydas	VULNERABLE
Green Turtle	
Eretmochelys imbricata	VULNERABLE
Hawksbill Turtle	
Lepidochelys olivacea	VULNERABLE
Olive Ridley	
Natator depressus	RARE OR INSUFFICIENTLY KNOWN
Family DERMOCHELYIDAE	
Dermochelys coriacea	VULNERABLE
Leatherback Turtle	
Family CARETTOCHELYIDAE	
Carettochelys insculpta	RARE OR INSUFFICIENTLY KNOWN
Family CHELIDAE	
Chelodina expansa	RARE OR INSUFFICIENTLY KNOWN
Elseya sp. nov. (Bellinger River, NSW)	RARE OR INSUFFICIENTLY KNOWN
Elseya sp. nov. (Manning River, NSW)	RARE OR INSUFFICIENTLY KNOWN
Elseya sp. nov. (Namoi River, NSW)	VULNERABLE
Namoi River Elseya	
Emydura macquarii	RARE OR INSUFFICIENTLY KNOWN
Emydura subglobosa	RARE OR INSUFFICIENTLY KNOWN
Emydura signata (Bellinger River, NSW)	VULNERABLE
Bellinger River Emydura	
Pseudemydura umbrina	ENDANGERED (CRITICAL)
Western Swamp Tortoise	
Rheodytes leukops	VULNERABLE
Fitzroy Tortoise	
Gen. nov. sp. nov. (Mary River, QLD)	ENDANGERED
Mary River Tortoise	
Family GEKKONIDAE	
Christinus guentheri	VULNERABLE
Lord Howe Island Gecko	
Diplodactylus fulleri	RARE OR INSUFFICIENTLY KNOWN
Diplodactylus kenneallyi	RARE OR INSUFFICIENTLY KNOWN
Diplodactylus occultus	RARE OR INSUFFICIENTLY KNOWN
Diplodactylus taenicauda	RARE OR INSUFFICIENTLY KNOWN
Lepidodactylus listeri	VULNERABLE
Christmas Island Gecko	
Lepidodactylus pumilus	RARE OR INSUFFICIENTLY KNOWN
Nactus galgajuga	RARE OR INSUFFICIENTLY KNOWN
Nephrurus deleani	VULNERABLE
Pernatty Knob-tail	
Oedura reticulata	RARE OR INSUFFICIENTLY KNOWN

Phyllurus caudiannulatus	RARE OR INSUFFICIENTLY KNOWN
Underwoodisaurus sphyrurus	VULNERABLE
Border Thick-tailed Gecko	
Family PYGOPODIDAE	
Aclys concinna major	RARE OR INSUFFICIENTLY KNOWN
Aprasia aurita	ENDANGERED
Mallee Worm-lizard	
Aprasia haroldi	RARE OR INSUFFICIENTLY KNOWN
Aprasia parapulchella	RARE OR INSUFFICIENTLY KNOWN
Aprasia pseudopulchella	VULNERABLE
Flinders Ranges Worm-lizard	
Aprasia rostrata rostrata	VULNERABLE
Hermite Island Worm-lizard	
Delma impar	VULNERABLE
Striped Legless Lizard	
Delma labialis	VULNERABLE
Striped-tailed Delma	
Delma mitella	RARE OR INSUFFICIENTLY KNOWN
Delma torquata	VULNERABLE
Collared Delma	
Ophidiocephalus taeniatus	VULNERABLE
Bronzeback Snake-lizard	
Paradelma orientalis	VULNERABLE
Brigalow Scaly-foot	
Pletholax gracilis edelensis	RARE OR INSUFFICIENTLY KNOWN
Family AGAMIDAE	
Cryptagama aurita	RARE OR INSUFFICIENTLY KNOWN
Ctenophorus mckenziei	RARE OR INSUFFICIENTLY KNOWN
Ctenophorus yinnietharra	VULNERABLE
Yinnietharra Rock Dragon	
Diporiphora convergens	RARE OR INSUFFICIENTLY KNOWN
Hypsilurus spinipes	RARE OR INSUFFICIENTLY KNOWN
Tympanocryptis lineata pinguicolla	VULNERABLE
South-eastern Lined Earless Dragon	
Tympanocryptis uniformis	RARE OR INSUFFICIENTLY KNOWN
Family VARANIDAE	
Varanus glauerti (Kakadu)	RARE OR INSUFFICIENTLY KNOWN
Varanus primordius	RARE OR INSUFFICIENTLY KNOWN
Varanus rosenbergi (SE Australia popn)	RARE OR INSUFFICIENTLY KNOWN
Varanus semiremex	RARE OR INSUFFICIENTLY KNOWN
Varanus teriae	RARE OR INSUFFICIENTLY KNOWN
Family SCINCIDAE	
Anomalopus gowi	RARE OR INSUFFICIENTLY KNOWN
Anomalopus mackayi	VULNERABLE
Long-legged Worm-skink	
Anomalopus pluto	RARE OR INSUFFICIENTLY KNOWN
Bartleia jigurru	RARE OR INSUFFICIENTLY KNOWN
Calyptotis temporalis	RARE OR INSUFFICIENTLY KNOWN
Calyptotis thorntonensis	RARE OR INSUFFICIENTLY KNOWN
Carlia coensis	RARE OR INSUFFICIENTLY KNOWN
Carlia rimula	RARE OR INSUFFICIENTLY KNOWN

Carlia scirtetis	RARE OR INSUFFICIENTLY KNOWN
Coeranoscincus reticulatus	VULNERABLE
Three-toed Snake-tooth Skink	
Cryptoblepharus fuhni	RARE OR INSUFFICIENTLY KNOWN
Ctenotus alleni	RARE OR INSUFFICIENTLY KNOWN
Ctenotus angusticeps	RARE OR INSUFFICIENTLY KNOWN
Ctenotus aphrodite	RARE OR INSUFFICIENTLY KNOWN
Ctenotus arnhemensis	RARE OR INSUFFICIENTLY KNOWN
Ctenotus astarte	RARE OR INSUFFICIENTLY KNOWN
Ctenotus capricorni	RARE OR INSUFFICIENTLY KNOWN
Ctenotus delli	RARE OR INSUFFICIENTLY KNOWN
Ctenotus ehmanni	RARE OR INSUFFICIENTLY KNOWN
Ctenotus eurydice	RARE OR INSUFFICIENTLY KNOWN
Ctenotus hypatia	RARE OR INSUFFICIENTLY KNOWN
Ctenotus lancelini	ENDANGERED
Lancelin Island Skink	
Ctenotus monticola	RARE OR INSUFFICIENTLY KNOWN
Ctenotus nigrilineatus	RARE OR INSUFFICIENTLY KNOWN
Ctenotus nullum	RARE OR INSUFFICIENTLY KNOWN
Ctenotus quinkan	RARE OR INSUFFICIENTLY KNOWN
Ctenotus rawlinsoni	RARE OR INSUFFICIENTLY KNOWN
Ctenotus schevilli	RARE OR INSUFFICIENTLY KNOWN
Ctenotus septenarius	RARE OR INSUFFICIENTLY KNOWN
Ctenotus serotinus	RARE OR INSUFFICIENTLY KNOWN
Ctenotus tanamiensis	RARE OR INSUFFICIENTLY KNOWN
Ctenotus terrareginae	RARE OR INSUFFICIENTLY KNOWN
Ctenotus xenopleura	RARE OR INSUFFICIENTLY KNOWN
Ctenotus yampiensis	RARE OR INSUFFICIENTLY KNOWN
Ctenotus zastictus	VULNERABLE
Hamelin Ctenotus	
Ctenotus zebrilla	RARE OR INSUFFICIENTLY KNOWN
Cyclodomorphus sp. (samphire, SA)	RARE OR INSUFFICIENTLY KNOWN
Egernia arnhemensis	RARE OR INSUFFICIENTLY KNOWN
Egernia coventryi	RARE OR INSUFFICIENTLY KNOWN
Egernia douglasi	RARE OR INSUFFICIENTLY KNOWN
Egernia kintorei	VULNERABLE
Great Desert Skink	
Egernia pulchra longicauda	VULNERABLE
Jurien Bay Rock-skink	
Egernia rugosa	RARE OR INSUFFICIENTLY KNOWN
Egernia saxatilis saxatilis	RARE OR INSUFFICIENTLY KNOWN
Egernia sp. aff. saxatilis (Kaputar Ranges, NSW)	RARE OR INSUFFICIENTLY KNOWN
Egernia slateri	RARE OR INSUFFICIENTLY KNOWN
Egernia stokesii aethiops	VULNERABLE
Baudin Island Spiny-tailed Skink	
Egernia stokesii badia	ENDANGERED
Western Spiny-tailed Skink	
Egernia stokesii stokesii	VULNERABLE
Houtman Abrolhos Spiny-tailed Skink	
Emoia atrocostata australis	RARE OR INSUFFICIENTLY KNOWN
Eroticoscincus graciloides	RARE OR INSUFFICIENTLY KNOWN
Eulamprus amplus	RARE OR INSUFFICIENTLY KNOWN
Eulamprus kosciuskoi	RARE OR INSUFFICIENTLY KNOWN
Eulamprus leuraensis	ENDANGERED
Blue Mountains Water Skink	

Eulamprus luteilateralis	RARE OR INSUFFICIENTLY KNOWN
Eulamprus murrayi	RARE OR INSUFFICIENTLY KNOWN
Eulamprus tigrinus	RARE OR INSUFFICIENTLY KNOWN
Eulamprus tympanum ssp. nov.	ENDANGERED
Dreeite Water Skink	
Glaphyromorphus fuscicaudis	RARE OR INSUFFICIENTLY KNOWN
Glaphyromorphus mjobergi	RARE OR INSUFFICIENTLY KNOWN
Lampropholis caligula	RARE OR INSUFFICIENTLY KNOWN
Lampropholis sp. aff. challengeri	RARE OR INSUFFICIENTLY KNOWN
Lampropholis colossus	RARE OR INSUFFICIENTLY KNOWN
Lampropholis mirabilis	RARE OR INSUFFICIENTLY KNOWN
Lampropholis robertsi	RARE OR INSUFFICIENTLY KNOWN
Lerista allanae	ENDANGERED
Allan's Lerista	
Lerista allochira	RARE OR INSUFFICIENTLY KNOWN
Lerista ameles	RARE OR INSUFFICIENTLY KNOWN
Lerista apoda	RARE OR INSUFFICIENTLY KNOWN
Lerista axillaris	RARE OR INSUFFICIENTLY KNOWN
Lerista carpentariae	RARE OR INSUFFICIENTLY KNOWN
Lerista christinae	RARE OR INSUFFICIENTLY KNOWN
Lerista cinerea	RARE OR INSUFFICIENTLY KNOWN
Lerista haroldi	RARE OR INSUFFICIENTLY KNOWN
Lerista humphriesi	RARE OR INSUFFICIENTLY KNOWN
Lerista ingrami	RARE OR INSUFFICIENTLY KNOWN
Lerista kalumburu	RARE OR INSUFFICIENTLY KNOWN
Lerista lineata	RARE OR INSUFFICIENTLY KNOWN
Lerista macropisthopus galea	RARE OR INSUFFICIENTLY KNOWN
Lerista maculosa	RARE OR INSUFFICIENTLY KNOWN
Lerista puncticauda	RARE OR INSUFFICIENTLY KNOWN
Lerista quadrivincula	RARE OR INSUFFICIENTLY KNOWN
Lerista robusta	RARE OR INSUFFICIENTLY KNOWN
Lerista separanda	RARE OR INSUFFICIENTLY KNOWN
Lerista speciosa	RARE OR INSUFFICIENTLY KNOWN
Lerista stictopleura	RARE OR INSUFFICIENTLY KNOWN
Lerista storri	RARE OR INSUFFICIENTLY KNOWN
Lerista stylis	RARE OR INSUFFICIENTLY KNOWN
Lerista viduata	RARE OR INSUFFICIENTLY KNOWN
Lerista vittata	VULNERABLE
Mount Cooper Striped Lerista	
Lerista walkeri	RARE OR INSUFFICIENTLY KNOWN
Lerista wilkinsi	RARE OR INSUFFICIENTLY KNOWN
Lerista yuna	RARE OR INSUFFICIENTLY KNOWN
Lygisaurus rococo	RARE OR INSUFFICIENTLY KNOWN
Lygisaurus tanneri	RARE OR INSUFFICIENTLY KNOWN
Menetia concinna	RARE OR INSUFFICIENTLY KNOWN
Menetia koshlandae	RARE OR INSUFFICIENTLY KNOWN
Menetia sadlieri	RARE OR INSUFFICIENTLY KNOWN
Nannoscincus maccoyi	RARE OR INSUFFICIENTLY KNOWN
Niveoscincus palfreymani	VULNERABLE
Pedra Branca Skink	
Notoscincus butleri	RARE OR INSUFFICIENTLY KNOWN
Ophioscincus cooloolensis	RARE OR INSUFFICIENTLY KNOWN
Ophioscincus truncatus	RARE OR INSUFFICIENTLY KNOWN
Pseudemoia baudini	RARE OR INSUFFICIENTLY KNOWN

Pseudemoia lichenigera	VULNERABLE
Lord Howe Island Skink	
Pseudemoia rawlinsoni	RARE OR INSUFFICIENTLY KNOWN
Tiliqua adelaidensis	ENDANGERED
Pygmy Bluetongue	
Family TYPHLOPIDAE	
Ramphotyphlops broomi	RARE OR INSUFFICIENTLY KNOWN
Ramphotyphlops exocoeti	VULNERABLE
Christmas Island Blind Snake	
Ramphotyphlops howi	RARE OR INSUFFICIENTLY KNOWN
Ramphotyphlops margaretae	RARE OR INSUFFICIENTLY KNOWN
Ramphotyphlops micromma	RARE OR INSUFFICIENTLY KNOWN
Ramphotyphlops tovelli	RARE OR INSUFFICIENTLY KNOWN
Ramphotyphlops troglodytes	RARE OR INSUFFICIENTLY KNOWN
Ramphotyphlops yampiensis	RARE OR INSUFFICIENTLY KNOWN
Ramphotyphlops yirrikalae	RARE OR INSUFFICIENTLY KNOWN
Family BOIDAE	
Aspidites ramsayi (south-western WA)	ENDANGERED
Woma	
Chondropython viridis	RARE OR INSUFFICIENTLY KNOWN
Liasis albertisii	RARE OR INSUFFICIENTLY KNOWN
Liasis olivaceus barroni	RARE OR INSUFFICIENTLY KNOWN
Morelia carinata	RARE OR INSUFFICIENTLY KNOWN
Morelia oenpelliensis	RARE OR INSUFFICIENTLY KNOWN
Morelia spilota imbricata	VULNERABLE
Western Australian Carpet Python	
Morelia spilota spilota	RARE OR INSUFFICIENTLY KNOWN
Family COLUBRIDAE	
Cerberus rynchops	RARE OR INSUFFICIENTLY KNOWN
Myron richardsonii	RARE OR INSUFFICIENTLY KNOWN
Stegonotus parvus	RARE OR INSUFFICIENTLY KNOWN
Family ELAPIDAE	
Acanthophis antarcticus	RARE OR INSUFFICIENTLY KNOWN
Austrelaps labialis (Adelaide, SA)	VULNERABLE
Pygmy Copperhead	
Denisonia maculata	VULNERABLE
Ornamental Snake	
Echiopsis atriceps	VULNERABLE
Lake Cronin Snake	
Echiopsis curta (population east of Adelaide)	VULNERABLE
Bardick	
Elapognathus minor	VULNERABLE
Short-nosed Snake	
Furina barnardi	RARE OR INSUFFICIENTLY KNOWN
Furina dunmalli	VULNERABLE
Dunmall's Snake	
Hoplocephalus bungaroides	VULNERABLE
Broad-headed Snake	
Hoplocephalus stephensii	RARE OR INSUFFICIENTLY KNOWN
Notechis ater ater (Flinders Ranges, SA)	VULNERABLE
Krefft's Tiger Snake	

Pseudonaja affinis exilis RARE OR INSUFFICIENTLY KNOWN
Pseudonaja affinis tanneri RARE OR INSUFFICIENTLY KNOWN
Rhinoplocephalus sp. (Eyre Peninsula, SA; taxonomic status uncertain) RARE OR INSUFFICIENTLY KNOWN
Simoselaps calonotus ENDANGERED
Black-striped Snake
Simoselaps minimus RARE OR INSUFFICIENTLY KNOWN
Simoselaps warro RARE OR INSUFFICIENTLY KNOWN
Vermicella annulata RARE OR INSUFFICIENTLY KNOWN

Family HYDROPHIIDAE
Aipysurus pooleorum RARE OR INSUFFICIENTLY KNOWN
Hydrelaps darwiniensis RARE OR INSUFFICIENTLY KNOWN
Parahydrophis mertoni RARE OR INSUFFICIENTLY KNOWN

TABLE 1 TAXONOMIC BREAKDOWN OF AUSTRALIA'S THREATENED REPTILES

FAMILY	E	V	R or I	Total threatened	Total species	% E + V	% threatened
Crocodylidae	0	0	2	2	2	0	100
Cheloniidae	0	4	1	5	5	80	100
Dermochelyidae	0	1	0	1	1	100	100
Carettochelyidae	0	0	1	1	1	0	100
Chelidae	2	3	5	10	19	26	53
Gekkonidae	0	4	8	12	97	4	12
Pygopodidae	1	7	5	13	34	24	38
Agamidae	0	2	5	7	63	3	11
Varanidae	0	0	5	5	25	0	20
Scincidae	6	10	91	107	347	5	31
Typhlopidae	0	1	8	9	31	3	29
Boidae	1	1	6	8	16	13	50
Acrochordidae	0	0	0	0	2	0	0
Colubridae	0	0	3	3	10	0	30
Elapidae	1	8	9	18	80	11	23
Hydrophiidae	0	0	3	3	31	0	10
Laticaudidae	0	0	0	0	2	0	0
Total herpetofauna	11	41	152	204	765	7%	27%

APPENDIX 2. THE STATUS OF AUSTRALIA'S THREATENED REPTILES, RANKED ACCORDING TO SCORES BASED ON THE METHODOLOGY OF MILLSAP ET AL., 1990[1]

Taxa with the same score are listed in taxonomic order of family, then in alphabetical order of genus and species. Common names are provided only for ENDANGERED (CRITICAL), ENDANGERED and VULNERABLE species.

ENDANGERED (CRITICAL)

Pseudemydura umbrina Family CHELIDAE
Western Swamp Tortoise

ENDANGERED

Tiliqua adelaidensis Family SCINCIDAE
Pygmy Bluetongue
Gen. nov. sp. nov. (Mary River, QLD) Family CHELIDAE
Mary River Tortoise
Ctenotus lancelini Family SCINCIDAE
Lancelin Island Skink
Aprasia aurita Family PYGOPODIDAE
Mallee Worm-lizard
Eulamprus leuraensis Family SCINCIDAE
Blue Mountains Water Skink
Eulamprus tympanum ssp. nov. (basalt plains, VIC) Family SCINCIDAE
Dreeite Water Skink
Lerista allanae Family SCINCIDAE
Allan's Lerista
Aspidites ramsayi (south-western WA) Family BOIDAE
Woma
Egernia stokesii badia Family SCINCIDAE
Western Spiny-tailed Skink
Simoselaps calonotus Family ELAPIDAE
Black-striped Snake

VULNERABLE

Aprasia rostrata rostrata Family PYGOPODIDAE
Hermite Island Worm-lizard
Ramphotyphlops exocoeti Family TYPHLOPIDAE
Christmas Island Blind Snake
Pseudemoia lichenigera Family SCINCIDAE
Lord Howe Island Skink
Lepidodactylus listeri Family GEKKONIDAE
Christmas Island Gecko
Anomalopus mackayi Family SCINCIDAE
Long-legged Worm-skink
Notechis ater ater (Flinders Ranges, SA) Family ELAPIDAE
Krefft's Tiger Snake
Hoplocephalus bungaroides Family ELAPIDAE
Broad-headed Snake
Elseya sp. nov. (Namoi River, NSW) Family CHELIDAE
Namoi River Elseya
Emydura signata (Bellinger River, NSW) Family CHELIDAE
Bellinger River Emydura

Austrelaps labialis (Adelaide, SA) Family ELAPIDAE
Pygmy Copperhead
Delma impar Family PYGOPODIDAE
Striped Legless Lizard
Delma torquata Family PYGOPODIDAE
Collared Delma
Lerista vittata Family SCINCIDAE
Mount Cooper Striped Lerista
Coeranoscincus reticulatus Family SCINCIDAE
Three-toed Snake-tooth Skink
Denisonia maculata Family ELAPIDAE
Ornamental Snake
Furina dunmalli Family ELAPIDAE
Dunmall's Snake
Christinus guentheri Family GEKKONIDAE
Lord Howe Island Gecko
Ctenophorus yinnietharra Family AGAMIDAE
Yinnietharra Rock Dragon
Niveoscincus palfreymani Family SCINCIDAE
Pedra Branca Skink
Delma labialis Family PYGOPODIDAE
Striped-tailed Delma
Aprasia pseudopulchella Family PYGOPODIDAE
Flinders Ranges Worm-lizard
Morelia spilota imbricata Family BOIDAE
Western Australian Carpet Python
Echiopsis atriceps Family ELAPIDAE
Lake Cronin Snake
Echiopsis curta (population east of Adelaide) Family ELAPIDAE
Bardick
Rheodytes leukops Family CHELIDAE
Fitzroy Tortoise
Nephrurus deleani Family GEKKONIDAE
Pernatty Knob-tail
Underwoodisaurus sphyrurus Family GEKKONIDAE
Border Thick-tailed Gecko
Tympanocryptis lineata pinguicolla Family AGAMIDAE
South-eastern Lined Earless Dragon
Elapognathus minor Family ELAPIDAE
Short-nosed Snake
Ctenotus zastictus Family SCINCIDAE
Hamelin Ctenotus
Egernia kintorei Family SCINCIDAE
Great Desert Skink
Egernia pulchra longicauda Family SCINCIDAE
Jurien Bay Rock-skink
Egernia stokesii aethiops Family SCINCIDAE
Baudin Island Spiny-tailed Skink
Egernia stokesii stokesii Family SCINCIDAE
Houtman Abrolhos Spiny-tailed Skink
Ophidiocephalus taeniatus Family PYGOPODIDAE
Bronzeback Snake-lizard
Paradelma orientalis Family PYGOPODIDAE
Brigalow Scaly-foot

VULNERABLE - MARINE TURTLES

Caretta caretta Family CHELONIIDAE
Loggerhead Turtle
Chelonia mydas Family CHELONIIDAE
Green Turtle
Eretmochelys imbricata Family CHELONIIDAE
Hawksbill Turtle
Lepidochelys olivacea Family CHELONIIDAE
Olive Ridley
Dermochelys coriacea Family DERMOCHELYIDAE
Leatherback Turtle

RARE OR INSUFFICIENTLY KNOWN

Aprasia parapulchella Family PYGOPODIDAE
Ramphotyphlops howi Family TYPHLOPIDAE
Ramphotyphlops margaretae Family TYPHLOPIDAE
Ramphotyphlops micromma Family TYPHLOPIDAE
Ramphotyphlops troglodytes Family TYPHLOPIDAE
Ramphotyphlops yampiensis Family TYPHLOPIDAE
Elseya sp. nov. (Bellinger River, NSW) Family CHELIDAE
Elseya sp. nov. (Manning River, NSW) Family CHELIDAE
Eroticoscincus graciloides Family SCINCIDAE
Delma mitella Family PYGOPODIDAE
Varanus semiremex Family VARANIDAE
Ctenotus nigrilineatus Family SCINCIDAE
Ctenotus schevilli Family SCINCIDAE
Egernia slateri Family SCINCIDAE
Eulamprus luteilateralis Family SCINCIDAE
Lerista cinerea Family SCINCIDAE
Lerista speciosa Family SCINCIDAE
Lerista wilkinsi Family SCINCIDAE
Menetia koshlandae Family SCINCIDAE
Hoplocephalus stephensii Family ELAPIDAE
Ramphotyphlops broomi Family TYPHLOPIDAE
Anomalopus gowi Family SCINCIDAE
Calyptotis thorntonensis Family SCINCIDAE
Rhinoplocephalus sp. (Eyre Peninsula, SA, taxonomic status uncertain) Family ELAPIDAE
Bartleia jigurru Family SCINCIDAE
Egernia sp. aff. saxatilis (Kaputar Range, NSW) Family SCINCIDAE
Eulamprus murrayi Family SCINCIDAE
Lerista storri Family SCINCIDAE
Lygisaurus tanneri Family SCINCIDAE
Pletholax gracilis edelensis Family PYGOPODIDAE
Varanus teriae Family VARANIDAE
Lerista humphriesi Family SCINCIDAE
Ctenotus alleni Family SCINCIDAE
Lampropholis sp. aff. challengeri Family SCINCIDAE
Diplodactylus taenicauda Family GEKKONIDAE
Oedura reticulata Family GEKKONIDAE
Cryptagama aurita Family AGAMIDAE
Hypsilurus spinipes Family AGAMIDAE
Ctenotus quinkan Family SCINCIDAE
Emoia atrocostata australis Family SCINCIDAE

Eulamprus tigrinus Family SCINCIDAE
Glaphyromorphus fuscicaudis Family SCINCIDAE
Glaphyromorphus mjobergi Family SCINCIDAE
Lerista ameles Family SCINCIDAE
Lerista maculosa Family SCINCIDAE
Lerista puncticauda Family SCINCIDAE
Lerista quadrivincula Family SCINCIDAE
Lerista robusta Family SCINCIDAE
Lerista stictopleura Family SCINCIDAE
Lerista viduata Family SCINCIDAE
Lerista yuna Family SCINCIDAE
Ophioscincus truncatus Family SCINCIDAE
Chondropython viridis Family BOIDAE
Liasis olivaceus barroni Family BOIDAE
Stegonotus parvus Family COLUBRIDAE
Simoselaps minimus Family ELAPIDAE
Anomalopus pluto Family SCINCIDAE
Carettochelys insculpta Family CARETTOCHELYIDAE
Diplodactylus occultus Family GEKKONIDAE
Diporiphora convergens Family AGAMIDAE
Ctenotus ehmanni Family SCINCIDAE
Ctenotus hypatia Family SCINCIDAE
Ctenotus monticola Family SCINCIDAE
Ctenotus serotinus Family SCINCIDAE
Ctenotus zebrilla Family SCINCIDAE
Egernia coventryi Family SCINCIDAE
Pseudemoia baudini Family SCINCIDAE
Pseudemoia rawlinsoni Family SCINCIDAE
Phyllurus caudiannulatus Family GEKKONIDAE
Aclys concinna major Family PYGOPODIDAE
Egernia rugosa Family SCINCIDAE
Lerista kalumburu Family SCINCIDAE
Lerista macropisthopus galea Family SCINCIDAE
Lerista separanda Family SCINCIDAE
Lerista walkeri Family SCINCIDAE
Lygisaurus rococo Family SCINCIDAE
Ophioscincus cooloolensis Family SCINCIDAE
Aprasia haroldi Family PYGOPODIDAE
Furina barnardi Family ELAPIDAE
Crocodylus johnstoni Family CROCODYLIDAE
Crocodylus porosus Family CROCODYLIDAE
Emydura subglobosa Family CHELIDAE
Tympanocryptis uniformis Family AGAMIDAE
Ctenotus delli Family SCINCIDAE
Ctenotus terrareginae Family SCINCIDAE
Ctenotus yampiensis Family SCINCIDAE
Lampropholis colossus Family SCINCIDAE
Lerista haroldi Family SCINCIDAE
Notoscincus butleri Family SCINCIDAE
Diplodactylus fulleri Family GEKKONIDAE
Diplodactylus kenneallyi Family GEKKONIDAE
Ctenotus aphrodite Family SCINCIDAE
Lampropholis caligula Family SCINCIDAE
Lampropholis mirabilis Family SCINCIDAE
Lerista christinae Family SCINCIDAE

Pseudonaja affinis exilis Family ELAPIDAE
Pseudonaja affinis tanneri Family ELAPIDAE
Varanus primordius Family VARANIDAE
Ctenotus rawlinsoni Family SCINCIDAE
Cyclodomorphus sp. (samphire, SA) Family SCINCIDAE
Egernia arnhemensis Family SCINCIDAE
Egernia saxatilis saxatilis Family SCINCIDAE
Lerista allochira Family SCINCIDAE
Lerista apoda Family SCINCIDAE
Lerista axillaris Family SCINCIDAE
Menetia sadlieri Family SCINCIDAE
Nannoscincus maccoyi Family SCINCIDAE
Morelia carinata Family BOIDAE
Morelia oenpelliensis Family BOIDAE
Morelia spilota spilota Family BOIDAE
Simoselaps warro Family ELAPIDAE
Ctenophorus mckenziei Family AGAMIDAE
Varanus rosenbergi (SE Australia population) Family VARANIDAE
Ctenotus angusticeps Family SCINCIDAE
Ctenotus xenopleura Family SCINCIDAE
Egernia douglasi Family SCINCIDAE
Menetia concinna Family SCINCIDAE
Vermicella annulata Family ELAPIDAE
Natator depressus Family CHELONIIDAE
Lepidodactylus pumilus Family GEKKONIDAE
Lerista ingrami Family SCINCIDAE
Lerista lineata Family SCINCIDAE
Ramphotyphlops tovelli Family TYPHLOPIDAE
Ctenotus capricorni Family SCINCIDAE
Ctenotus eurydice Family SCINCIDAE
Varanus glauerti (Kakadu) Family VARANIDAE
Ctenotus astarte Family SCINCIDAE
Lerista carpentariae Family SCINCIDAE
Lerista stylis Family SCINCIDAE
Hydrelaps darwiniensis Family HYDROPHIIDAE
Parahydrophis mertoni Family HYDROPHIIDAE
Nactus galgajuga Family GEKKONIDAE
Carlia coensis Family SCINCIDAE
Carlia scirtetis Family SCINCIDAE
Cryptoblepharus fuhni Family SCINCIDAE
Ctenotus nullum Family SCINCIDAE
Eulamprus kosciuskoi Family SCINCIDAE
Liasis albertisii Family BOIDAE
Ramphotyphlops yirrikalae Family TYPHLOPIDAE
Ctenotus arnhemensis Family SCINCIDAE
Ctenotus septenarius Family SCINCIDAE
Ctenotus tanamiensis Family SCINCIDAE
Aipysurus pooleorum Family HYDROPHIIDAE
Calyptotis temporalis Family SCINCIDAE
Lampropholis robertsi Family SCINCIDAE
Eulamprus amplus Family SCINCIDAE
Chelodina expansa Family CHELIDAE
Carlia rimula Family SCINCIDAE
Acanthophis antarcticus Family ELAPIDAE
Cerberus rynchops Family COLUBRIDAE

Myron richardsonii Family COLUBRIDAE
Emydura macquarii Family CHELIDAE

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[1]Millsap, B.A., Gore, J.A., Runde, D.E. and Cerulean, S.I. 1990. Setting priorities for the conservation of fish and wildlife species in Florida. Wildlife Monographs 111: 1-57.

APPENDIX 3. AUSTRALIA'S THREATENED REPTILES: THEIR CONSERVATION STATUS ASSIGNED IN THIS REPORT COMPARED WITH THE STATUS ASSIGNED TO THEM BY AGENCIES AND INDIVIDUALS

E Endangered V Vulnerable SP Special Protection IN Insufficiently known
T Threatened R Rare I Indeterminate

Taxa with the same score are listed in taxonomic order of family, then in alphabetical order of genus and species.

TAXON	CONSERVATION STATUS ASSIGNED BY AGENCIES AND INDIVIDUALS				
	ANZECC 1991	IUCN 1990	State Agency List[1] ACT 1991 NSW 1992 SA 1991 TAS 1971 VIC 1993 WA 1990	Qld Museum 1991[2]	Nominations specifically for the Reptile Action Plan 1991[3]
ENDANGERED (CRITICAL)					
Pseudemydura umbrina	E	E	T(WA),SP(ACT)		E(HE,HJ,WO,GK,PW,GWe, GS)
ENDANGERED					
Tiliqua adelaidensis	E	I	E(SA),SP(ACT)		E(HE,HJ,WO)
Gen. nov. sp. nov. (Chelidae) (Mary River, QLD)					E(JCa,RS)
Ctenotus lancelini	V	R	T(WA),SP(ACT)		R(GS)
Aprasia aurita	E		T(VIC),SP(ACT)		E(WO,GS),V(HE)
Eulamprus leuraensis			T(NSW)		V(HE),R(GS)
Eulamprus tympanum ssp. nov. (basalt plains, VIC)					V(MH)
Lerista allanae				R	E(JCo,PC),V(HE)
Aspidites ramsayi (south-western WA)			SP(WA),V&R(NSW)		R(LS)
Egernia stokesii badia					V(GS)
Simoselaps calonotus			SP(ACT)		V(HE)
VULNERABLE					
Aprasia rostrata rostrata					R(HE,GS)
Ramphotyphlops exocoeti					E(HE)
Pseudemoia lichenigera			V&R(NSW)		E(PW),R
Lepidodactylus listeri					V(HE)
Anomalopus mackayi			T(NSW)	IN	V(HE,GS)
Notechis ater ater (Flinders Ranges, SA)					V(MH)
Hoplocephalus bungaroides	E	I	T(NSW),SP(ACT)		E(PW,WO),V(HE,HJ,GS)
Elseya sp. nov. (Namoi River, NSW)					V(JCa,RS)
Emydura signata (Bellinger River, NSW)					V(JCa,RS)

TAXON	CONSERVATION STATUS ASSIGNED BY AGENCIES AND INDIVIDUALS				
	ANZECC 1991	IUCN 1990	State Agency List[1] ACT 1991 NSW 1992 SA 1991 TAS 1971 VIC 1993 WA 1990	Qld Museum 1991[2]	Nominations specifically for the Reptile Action Plan 1991[3]
Austrelaps labialis (Adelaide, SA)					V(HE,JR)
Delma impar	V		T(VIC),V&R(NSW), SP(ACT)		V(HJ,WO,RL,JW,GS)
Delma torquata	V		SP(ACT)	V	V(HE,WO,GS)
Lerista vittata				IN	E(HE)
Coeranoscincus reticulatus			V&R(NSW)	R	
Denisonia maculata				V	V(GI)
Furina dunmalli				V	E(HE),V(GS)
Christinus guentheri			V&R(NSW)		E(PW),V(HE),R(GS)
Ctenophorus yinnietharra	V		T(WA),SP(ACT)		V,R(HE,GS)
Niveoscincus palfreymani	V	R	E(TAS),SP(ACT)		E(HJ,DR),V(WO),R(HE,GS)
Delma labialis				R	R(HE,GS)
Aprasia pseudopulchella					V(GS)
Morelia spilota imbricata			SP(WA)		
Echiopsis atriceps					V(HE,GS)
Echiopsis curta (pop. east of Adelaide, SA)			V&R(NSW)		V(HE)
Rheodytes leukops	V		SP(ACT)	IN	
Nephrurus deleani					R(HE,JR)
Underwoodisaurus sphyrurus			V&R(NSW)		V(HE),R(GS)
Tympanocryptis lineata pinguicolla			T(VIC)		E(HJ,RL,GWi,GS),R(WO)
Elapognathus minor					V(GS),R(HE)
Ctenotus zastictus					R(HE,GS)
Egernia kintorei					R(SM)
Egernia pulchra longicauda					R(GC)
Egernia stokesii aethiops	V		T(WA),SP(ACT)		R(GS)
Egernia stokesii stokesii					R(GS)
Ophidiocephalus taeniatus	V		E(SA),SP(ACT)		V(HE,WO),R(NG)
Paradelma orientalis				V	V(HE,GS)

TAXON	CONSERVATION STATUS ASSIGNED BY AGENCIES AND INDIVIDUALS				
	ANZECC 1991	IUCN 1990	State Agency List[1] ACT 1991 NSW 1992 SA 1991 TAS 1971 VIC 1993 WA 1990	Qld Museum 1991[2]	Nominations specifically for the Reptile Action Plan 1991[3]
VULNERABLE - MARINE TURTLES					
Caretta caretta	E	V	V&R(NSW)SP(ACT)	V	E(WO),V(PW)
Chelonia mydas	V	E	V&R(NSW)	IN	
Eretmochelys imbricata	V	E	SP(ACT)	IN	R(MG)
Lepidochelys olivacea	V	E	SP(ACT)		V(PW),R(MG)
Dermochelys coriacea	V	E	E(SA),SP(ACT), T(WA),V&R(NSW)		E(HE)
RARE OR INSUFFICIENTLY KNOWN					
Aprasia parapulchella	E		V&R(NSW)SP(ACT)		R(GS),V(WO)
Ramphotyphlops howi					R(HE)
Ramphotyphlops margaretae					R(HE)
Ramphotyphlops micromma					R(HE)
Ramphotyphlops troglodytes					R(HE)
Ramphotyphlops yampiensis					R(HE)
Elseya sp. nov. (Bellinger River, NSW)					R(JCa,RS)
Elseya sp. nov. (Manning River, NSW)					R(JCa,RS)
Eroticoscincus graciloides					V(HE),R(GS)
Delma mitella	V		SP(ACT)	IN	V(WO),R(HE,GS)
Varanus semiremex					R?(HJ)
Ctenotus nigrilineatus					R(LS)
Ctenotus schevilli				IN	R(GI,KM,SW)
Egernia slateri					R(SM)
Eulamprus luteilateralis				R	R(HE)
Lerista cinerea				IN	V(HE)
Lerista speciosa					R(MH)
Lerista wilkinsi				IN	V(HE)
Menetia koshlandae					R(GI,KM,SW)
Hoplocephalus stephensii			V&R(NSW)	R	V(HE)
Ramphotyphlops broomi					R(HE)
Anomalopus gowi				IN	R(GI,KM,SW)

TAXON	CONSERVATION STATUS ASSIGNED BY AGENCIES AND INDIVIDUALS				
	ANZECC 1991	IUCN 1990	State Agency List[1] ACT 1991 NSW 1992 SA 1991 TAS 1971 VIC 1993 WA 1990	Qld Museum 1991[2]	Nominations specifically for the Reptile Action Plan 1991[3]
Calyptotis thorntonensis					R(HE,GS)
Rhinoplocephalus sp. (Eyre Peninsula, SA, taxonomic status uncertain)					V(HE)
Bartleia jigurru				R	R(HE,GS)
Egernia sp. aff. saxatilis (Kaputar Range, NSW)					R(GS)
Eulamprus murrayi					R(GI,KM,SW)
Lerista storri				IN	R(GI,KM,SW)
Lygisaurus tanneri				IN	R(HE)
Pletholax gracilis edelensis					V(HE)
Varanus teriae				R	R?(HJ)
Lerista humphriesi					R(HE)
Ctenotus alleni					R(GS)
Lampropholis sp. aff. challengeri					V(HE)
Diplodactylus taenicauda					V(HE)
Oedura reticulata		V			
Cryptagama aurita					V,R(HE,NG)
Hypsilurus spinipes					V(HJ)
Ctenotus quinkan				IN	R(HE)
Emoia atrocostata australis					R(GI,KM,SW)
Eulamprus tigrinus					R(HE)
Glaphyromorphus fuscicaudis					R(HE)
Glaphyromorphus mjobergi				R	R(HE)
Lerista ameles				IN	V(HE)
Lerista maculosa					R(LS)
Lerista puncticauda					R(LS)
Lerista quadrivincula					R(LS)
Lerista robusta					R(LS)
Lerista stictopleura					R(GS)
Lerista viduata					R(LS)
Lerista yuna					R(LS)

TAXON	CONSERVATION STATUS ASSIGNED BY AGENCIES AND INDIVIDUALS				
	ANZECC 1991	IUCN 1990	State Agency List[1] ACT 1991 NSW 1992 SA 1991 TAS 1971 VIC 1993 WA 1990	Qld Museum 1991[2]	Nominations specifically for the Reptile Action Plan 1991[3]
Ophioscincus truncatus				R	
Chondropython viridis				R	R(GI,KM,SW)
Liasis olivaceus barroni			SP(WA)		
Stegonotus parvus					R(HE)
Simoselaps minimus					R(GS)
Anomalopus pluto				IN	R(HE)
Carettochelys insculpta		IN			R(GWe)
Diplodactylus occultus					V/R(MK)
Diporiphora convergens					R(HE)
Ctenotus ehmanni					R(HE)
Ctenotus hypatia				IN	R(GI,KM,SW)
Ctenotus monticola				IN	R(GI,KM,SW)
Ctenotus serotinus				IN	R(HE)
Ctenotus zebrilla				IN	R(GI,KM,SW)
Egernia coventryi					V(HE)
Pseudemoia baudini					R(MH)
Pseudemoia rawlinsoni					R(MH)
Phyllurus caudiannulatus				R	R(SW)
Aclys concinna major					R(LS)
Egernia rugosa				R	R(GI,KM,SW)
Lerista kalumburu					R(HE)
Lerista macropisthopus galea					R(LS)
Lerista separanda					R(HE)
Lerista walkeri					R(HE)
Lygisaurus rococo				IN	R(HE)
Ophioscincus cooloolensis				R	R(HE)
Aprasia haroldi					R(HE,GS)
Furina barnardi					R(GI,KM,SW)
Crocodylus johnstoni			SP(WA)		
Crocodylus porosus		V	SP(WA)		

TAXON	CONSERVATION STATUS ASSIGNED BY AGENCIES AND INDIVIDUALS				
	ANZECC 1991	IUCN 1990	State Agency List[1] ACT 1991 NSW 1992 SA 1991 TAS 1971 VIC 1993 WA 1990	Qld Museum 1991[2]	Nominations specifically for the Reptile Action Plan 1991[3]
Emydura subglobosa				IN	R(HE,GS)
Tympanocryptis uniformis					V(GS),R(HE,NG)
Ctenotus delli					R(HE)
Ctenotus terrareginae				IN	R(GI,KM,SW)
Ctenotus yampiensis					R(HE)
Lampropholis colossus				R	R(GI,KM,SW)
Lerista haroldi					R(HE)
Notoscincus butleri					R(HE)
Diplodactylus fulleri					R(HE)
Diplodactylus kenneallyi					R(MP)
Ctenotus aphrodite				IN	R(GI,KM,SW)
Lampropholis caligula					V(BG,GS)
Lampropholis mirabilis				R	R(GI,KM,SW)
Lerista christinae					R(HE)
Pseudonaja affinis exilis					R(LS)
Pseudonaja affinis tanneri					R(LS)
Varanus primordius					R(NG)
Ctenotus rawlinsoni				R	R(HE)
Cyclodomorphus sp. (samphire, SA)					V(HE)
Egernia arnhemensis					R(NG,GS)
Egernia saxatilis saxatilis					R(GS)
Lerista allochira					R(LS)
Lerista apoda					R(HE)
Lerista axillaris					R(LS)
Menetia sadlieri					R(GI,KM,SW)
Nannoscincus maccoyi				R	
Morelia carinata	V		T(WA),SP(ACT)		R(HE)
Morelia oenpelliensis					R(NG)
Morelia spilota spilota			T(VIC)		R
Simoselaps warro				IN	

TAXON	CONSERVATION STATUS ASSIGNED BY AGENCIES AND INDIVIDUALS				
	ANZECC 1991	IUCN 1990	State Agency List[1] ACT 1991 NSW 1992 SA 1991 TAS 1971 VIC 1993 WA 1990	Qld Museum 1991[2]	Nominations specifically for the Reptile Action Plan 1991[3]
Ctenophorus mckenziei					V,R(HE)
Varanus rosenbergi (SE Australia popn)			V&R(NSW)		V(TB),R(WO)
Ctenotus angusticeps	V		T(WA),SP(ACT)		
Ctenotus xenopleura					R(HE)
Egernia douglasi					R(HE,NG)
Menetia concinna					R(PH)
Vermicella annulata					V(HE)
Natator depressus					R(MG)
Lepidodactylus pumilus				R	R(HE)
Lerista ingrami				R	R(GI,KM,SW)
Lerista lineata			SP(ACT)		V(HE)
Ramphotyphlops tovelli					R(HE)
Ctenotus capricorni				IN	R(GI,KM,SW)
Ctenotus eurydice				IN	
Varanus glauerti (Kakadu, NT)					R(PH)
Ctenotus astarte				IN	R(GI,KM,SW)
Lerista carpentariae					R(HE,NG)
Lerista stylis				IN	
Hydrelaps darwiniensis					R(MG)
Parahydrophis mertoni				R	R(MG,HE)
Nactus galgajuga				R	R(GS)
Carlia coensis				R	
Carlia scirtetis				R	R(GS)
Cryptoblepharus fuhni				R	
Ctenotus nullum				IN	R(GI,KM,SW)
Eulamprus kosciuskoi			T(VIC)		R(GS)
Liasis albertisii					R(HE)
Ramphotyphlops yirrikalae					R(HE)
Ctenotus arnhemensis					R(PH)
Ctenotus septenarius					R(PH)

TAXON	CONSERVATION STATUS ASSIGNED BY AGENCIES AND INDIVIDUALS				
	ANZECC 1991	IUCN 1990	State Agency List[1] ACT 1991 NSW 1992 SA 1991 TAS 1971 VIC 1993 WA 1990	Qld Museum 1991[2]	Nominations specifically for the Reptile Action Plan 1991[3]
Ctenotus tanamiensis					R(PH)
Aipysurus pooleorum					R(LS)
Calyptotis temporalis				IN	R(GI,KM,SW)
Lampropholis robertsi				R	R(GI,KM,SW)
Eulamprus amplus				R	R(HE)
Chelodina expansa					V(HE)
Carlia rimula				R	
Acanthophis antarcticus					V(HE)
Cerberus rynchops					R(MG)
Myron richardsonii					R(MG)
Emydura macquarii					V(HE)

[1]State Agency Lists:
1991 Schedule 6 of the *ACT Nature Conservation Act 1980*;
1992 Revised (Interim) Schedule 12 of the *NSW Endangered Fauna (Interim Protection) Act 1991*;
1991 Schedule of the *SA National Parks and Wildlife Act 1972*;
Schedule 1A Part II of the Wildlife Regulations under the *Tasmanian National Parks and Wildlife Act 1971*;
1993 Schedule 2 of the *Victorian Flora and Fauna Guarantee Act 1988*;
1990 Schedule of the *WA Wildlife Conservation Act 1950*

[2]Qld Museum 1991:
McDonald, K.R., Covacevich, J.A., Ingram, G.J. and Couper, P.J. 1991. The status of frogs and reptiles. pp. 338-345 in G.J. Ingram and R.J. Raven (eds) An Atlas of Queensland's Frogs, Reptiles, Birds and Mammals. Queensland Museum, Brisbane.

[3]Individuals who nominated species for the Reptile Action Plan:
BG (Barb Graham, Tamworth NPA); DR (Dave Rounsevell); GC (Garry Connell, WA); GI (Glen Ingram, Keith McDonald & Steve Wilson); GK (Gerald Kuchling); GS (Glenn Shea); GWe (Grahame Webb); GWi (Geoff Witten); HE (Harald Ehmann); HJ (Hank Jenkins); JCa (John Cann); JCo (Jeanette Covacevich); JR (John Read; SA); JW (John Wombey); KM (Keith McDonald); LS (Laurie Smith); MG (Mike Guinea); MH (Mark Hutchinson); MK (Max King); MP (Magnus Peterson); NG (Nick Gambold, NT); PC (Patrick Couper); PH (Paul Horner); PW (Peter Wells, Sydney); RL (Rick Longmore); RS (Ross Sadlier); SM (Stephen Morton); SW (Steve Wilson); TB (Terry Boylan); WO (Will Osborne).

APPENDIX 4. HABITATS OF AUSTRALIA'S ENDANGERED AND VULNERABLE TERRESTRIAL REPTILES.

SPECIES	HABITAT																		
	Closed forest	Low closed forest	Tall open forest	Open forest	Wood-land	Open wood-land	Low wood-land	Low open wood-land	Tall shrub-land	Tall open shrub-land	Heath-land	Low shrub-land	Hum-mock grass-land	Tussock grass-land	Littoral complex	Swamps	Rivers	Riparian habitats	Rocky isolates
Elseya sp. nov.																	*		
Emydura signata																	*		
Pseudemydura umbrina																*			
Rheodytes leukops																	*		
Gen. nov. sp. nov. (Chelidae)																	*		
Christinus guentheri	*							*						*					*
Lepidodactylus listeri	*																		
Nephrurus deleani									*										
Underwoodisaurus sphyrurus						*													*
Aprasia aurita									*		*								
Aprasia pseudopulchella						*								*				*	*
Aprasia rostrata rostrata													*						*
Delma impar														*					
Delma labialis			*	*		*													
Delma torquata						*													
Ophidiocephalus taeniatus						*													

SPECIES	HABITAT																		
	Closed forest	Low closed forest	Tall open forest	Open forest	Wood-land	Open wood-land	Low wood-land	Low open wood-land	Tall shrub-land	Tall open shrub-land	Heath-land	Low shrub-land	Hum-mock grass-land	Tussock grass-land	Littoral complex	Swamps	Rivers	Riparian habitats	Rocky isolates
Paradelma orientalis				*	*														
Ctenophorus yinnietharra										*									
Tympanocryptis lineata pinguicolla														*					
Anomalopus mackayi						*													
Coeranoscincus reticulatus	*		*																
Ctenotus lancelini												*							*
Ctenotus zastictus										*									
Egernia kintorei										*			*						
Egernia pulchra longicauda												*							*
Egernia stokesii aethiops											*								*
Egernia stokesii badia					*				?*		*								
Egernia stokesii stokesii											*								*
Eulamprus leuraensis											*			*		*			
Eulamprus tympanum ssp. nov.						*								*		*			
Lerista allanae														*					
Lerista vittata		*			*														

SPECIES	HABITAT																		
	Closed forest	Low closed forest	Tall open forest	Open forest	Wood-land	Open wood-land	Low wood-land	Low open wood-land	Tall shrub-land	Tall open shrub-land	Heath-land	Low shrub-land	Hum-mock grass-land	Tussock grass-land	Littoral complex	Swamps	Rivers	Riparian habitats	Rocky isolates
Niveoscincus palfreymani																			*
Pseudemoia lichenigera	*							*						*	*				*
Tiliqua adelaidensis						*								*					
Ramphotyphlops exocoeti	*																		
Aspidites ramsayi									*		*								
Morelia spilota imbricata					*		*												
Austrelaps labialis				*	*														
Denisonia maculata				*	*													*	
Echiopsis atriceps						*			*										
Echiopsis curta									*										
Elapognathus minor			*		*						*								
Furina dunmalli				*	*														
Hoplocephalus bungaroides				*															*
Notechis ater ater						*												*	*
Simoselaps calonotus					*		*				*								
TOTAL	5	1	3	6	9	10	2	2	6	3	8	2	2	9	1	3	4	3	12

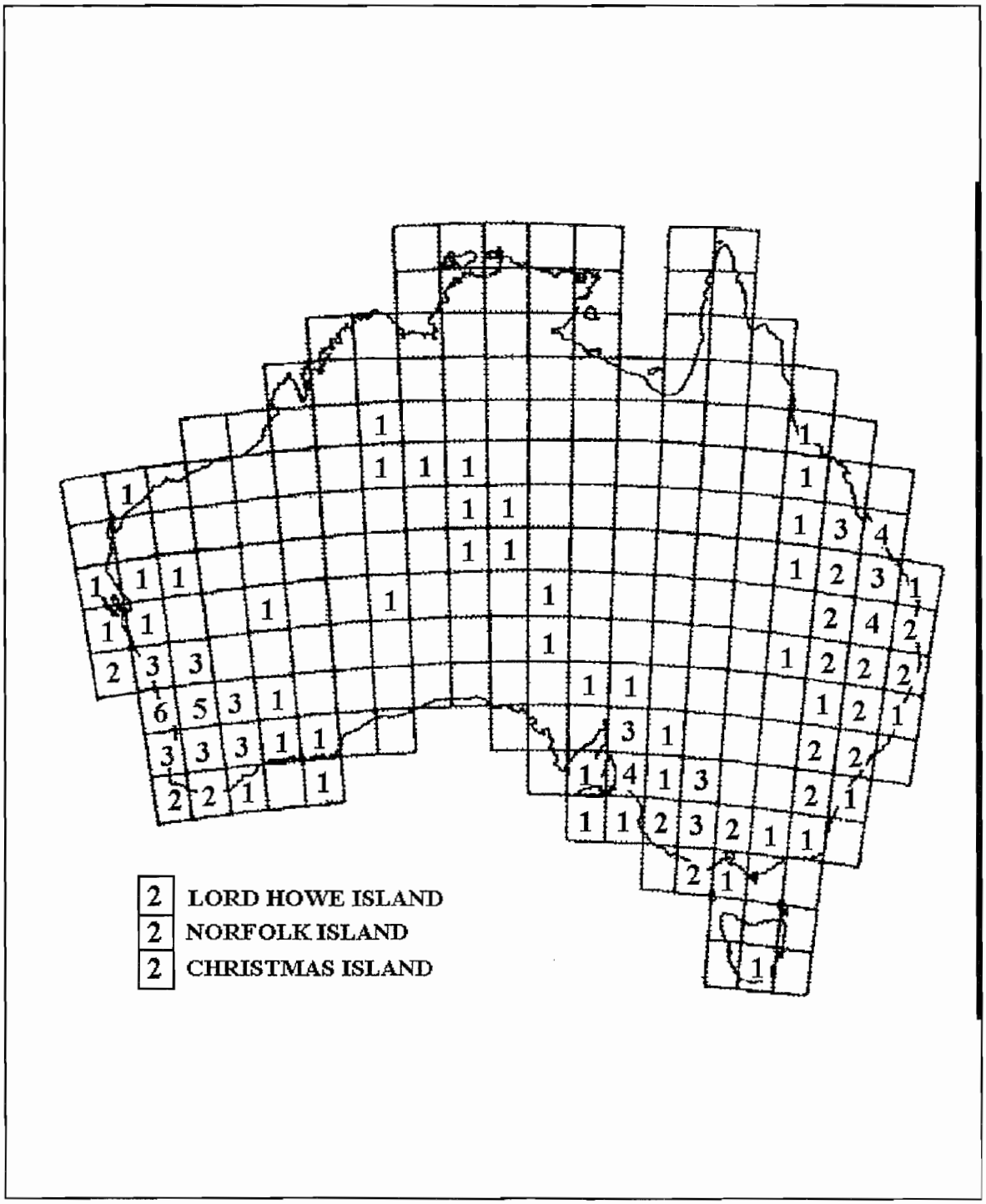
APPENDIX 5.1 DISTRIBUTION BY STATES AND TERRITORIES, OF AUSTRALIA'S THREATENED TERRESTRIAL REPTILES.

(Endangered and Vulnerable species are listed individually; Rare or Insufficiently Known species are included in the sub-total only)

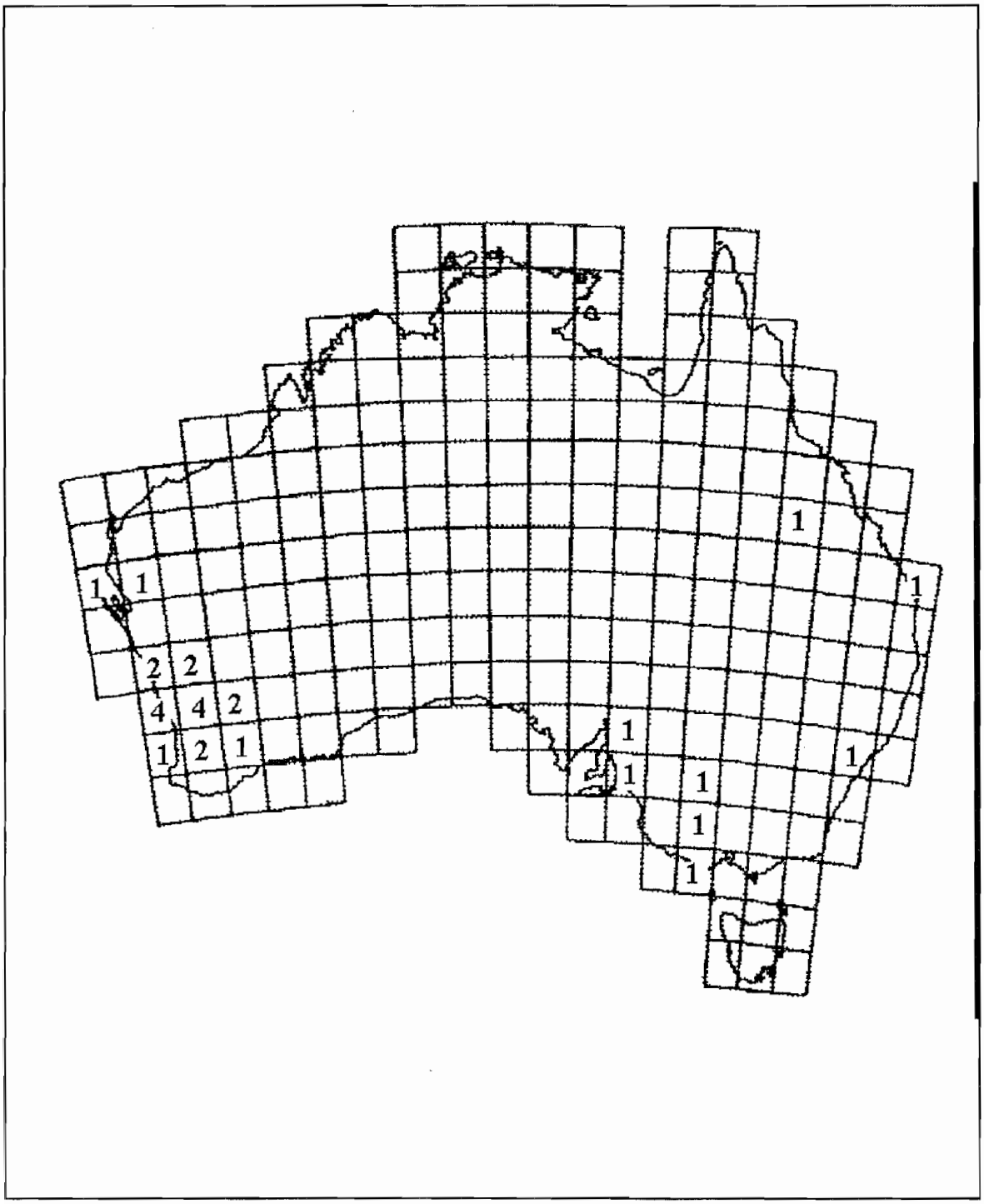
SPECIES AND STATUS	STATE/TERRITORY										
	SA	WA	NT	QLD	NSW	ACT	VIC	TAS	Norfolk Island	Lord Howe Island	Christmas Island
Elseya sp. nov. (V)					*						
Emydura signata (V)					*						
Pseudemydura umbrina (E)		*									
Rheodytes leukops (V)				*							
Gen. nov. sp. nov. (Chelidae) (E)				*							
Christinus guentheri (V)									*	*	
Lepidodactylus listeri (V)											*
Nephrurus deleani (V)	*										
Underwoodisaurus sphyrurus (V)				*	*						
Aprasia aurita (E)							*				
Aprasia pseudopulchella (V)	*										
Aprasia rostrata rostrata (V)		*									
Delma impar (V)	? *				*	*	*				
Delma labialis (V)				*							
Delma torquata (V)				*							
Ophidiocephalus taeniatus (V)	*		*								
Paradelma orientalis (V)				*							
Ctenophorus yinnietharra (V)		*									
Tympanocryptis lineata pinguicolla (V)					*	*	*				
Anomalopus mackayi (V)				*	*						
Coeranoscincus reticulatus (V)				*	*						
Ctenotus lancelini (E)		*									
Ctenotus zastictus (V)		*									
Egernia kintorei (V)		*	*								
Egernia pulchra longicauda (V)		*									
Egernia stokesii aethiops (V)		*									

SPECIES AND STATUS	STATE/TERRITORY										
	SA	WA	NT	QLD	NSW	ACT	VIC	TAS	Norfolk Island	Lord Howe Island	Christmas Island
Egernia stokesii badia (E)		*									
Egernia stokesii stokesii (V)		*									
Eulamprus leuraensis (E)					*						
Eulamprus tympanum ssp. nov. (E)							*				
Lerista allanae (E)				*							
Lerista vittata (V)				*							
Niveoscincus palfreymani (V)								*			
Pseudemoia lichenigera (V)									*	*	
Tiliqua adelaidensis (E)	*										
Ramphotyphlops exocoeti (V)											*
Aspidites ramsayi (E)		*									
Morelia spilota imbricata (V)		*									
Austrelaps labialis (V)	*										
Denisonia maculata (V)				*							
Echiopsis atriceps (V)		*									
Echiopsis curta (V)	*				*		*				
Elapognathus minor (V)		*									
Furina dunmalli (V)				*							
Hoplocephalus bungaroides (V)					*						
Notechis ater (V)	*										
Simoselaps calonotus (E)		*									
Endangered	1	5		2	1		2				
Vulnerable	7	10	2	10	9	2	3	1	2	2	2
Total Endangered + Vulnerable	8	15	2	12	10	2	5	1	2	2	2
Rare or Insufficiently Known	13	54	24	72	22	4	7	1			
Total Threatened Taxa	21	69	26	84	32	6	12	2	2	2	2

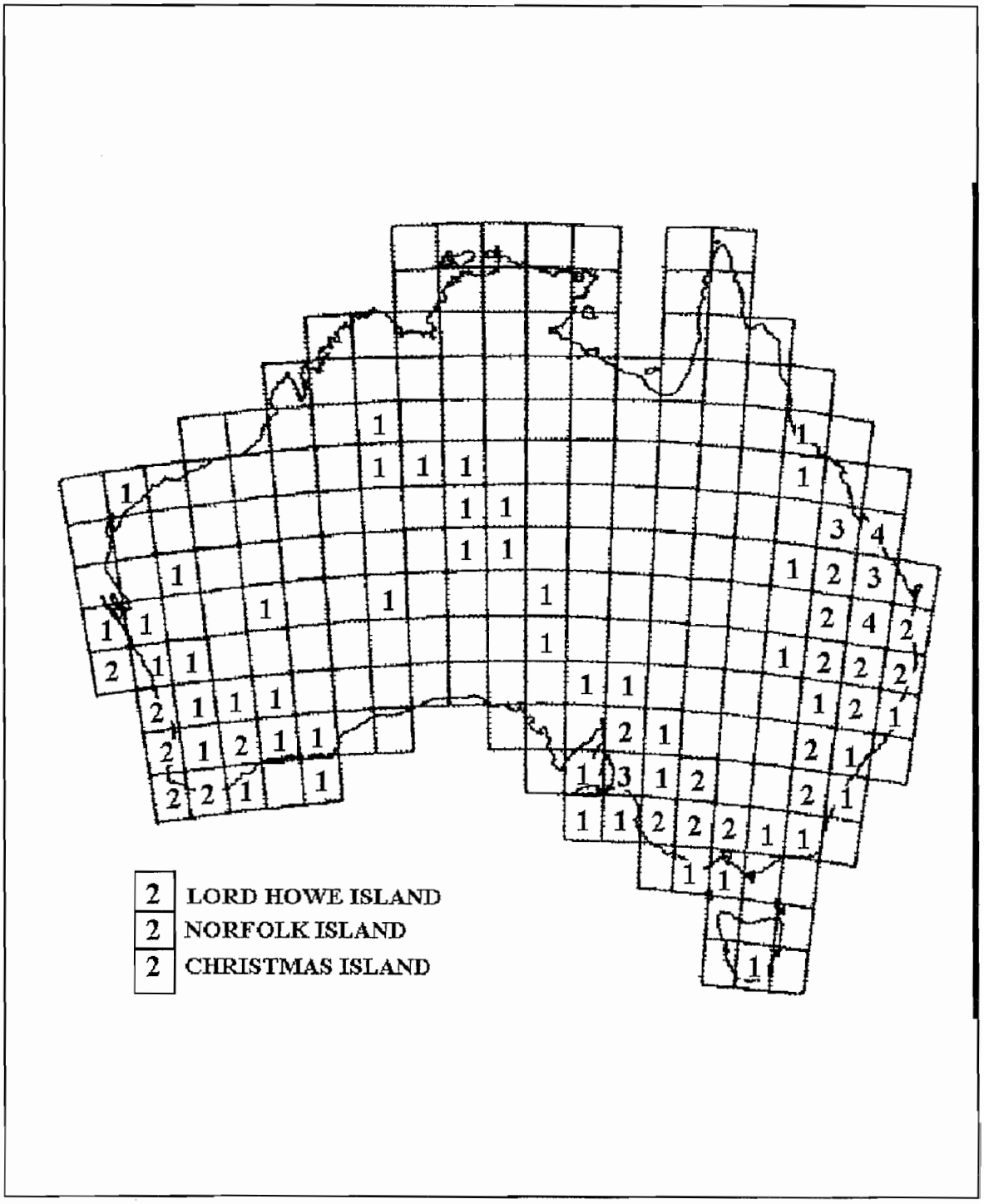
APPENDIX 5.2. SPECIES RICHNESS MAP FOR AUSTRALIA'S ENDANGERED AND VULNERABLE TERRESTRIAL REPTILES



APPENDIX 5.3. SPECIES RICHNESS MAP FOR AUSTRALIA'S ENDANGERED TERRESTRIAL REPTILES



APPENDIX 5.4. SPECIES RICHNESS MAP FOR AUSTRALIA'S VULNERABLE TERRESTRIAL REPTILES



APPENDIX 6.1 SPECIES PROFILES FOR AUSTRALIA'S VULNERABLE MARINE TURTLES

Species Profile **Loggerhead Turtle**

Family:	Cheloniidae
Scientific Name:	*Caretta caretta*
English Name:	Loggerhead Turtle

Infraspecific taxa: Most authors recognise *Caretta caretta* as a single polymorphic species.

Species survival status: Vulnerable. According to the Mace and Lande (1991) classification, the southern Queensland breeding unit of *Caretta caretta* would rank as critically endangered. The population has declined by 50-80% in the last 10-15 years and the decline is still in progress (Limpus and Reimer, in press).

Worldwide distribution: Coastal tropical and subtropical waters with temperature range 16° - 20°C, around the world; individuals stray into temperate waters. Major breeding aggregations occur in Oman (Indian Ocean), the eastern USA (Atlantic Ocean), southern Queensland and southern Japan (Pacific Ocean), and Greece and Turkey (Mediterranean Sea).

Australian distribution: Nesting has been recorded in the vicinity of Shark Bay and Exmouth Gulf in Western Australia, and on the Bundaberg coast and on the Capricorn Group of islands and the Swain Reefs on the southern Barrier Reef in Queensland. Recorded in coastal waters of all Australian states.

Conservation status under State and Commonwealth legislation: Listed as "endangered" on Schedule 1 of the Commonwealth's *Endangered Species Protection Act 1992* and "vulnerable and rare" on the 1992 Revised (Interim) Schedule 12 of the NSW Endangered Fauna (Interim Protection) Act 1991.

Organisations responsible for conservation of species and individuals involved: Australian Nature Conservation Agency, Western Australian Marine Turtle Project run by Dept of CALM (Bob Prince), Conservation Commission of the Northern Territory (Ray Chatto), Queensland Dept of Environment and Heritage (Col Limpus), New South Wales National Parks and Wildlife Service, South Australian Department of Environment and Land Management, Victorian Department of Conservation and Natural Resources, Tasmanian Department of Environment and Land Management.

Other organisations and individuals involved: Mike Guinea (Northern Territory University), West Australian Petroleum Pty Ltd (WAPET).

References:

Dodd, C.K., Jr 1988. Synopsis of the biological data on the loggerhead sea turtle *Caretta caretta* (Linnaeus, 1758). US Fish and Wildlife Service Biological Report 88(14): i-viii + 1-110.

Dodd, C.K., Jr 1990. *Caretta caretta* (Linnaeus) Loggerhead Sea Turtle. Catalogue of American Amphibians and Reptiles 483.1-483.7.

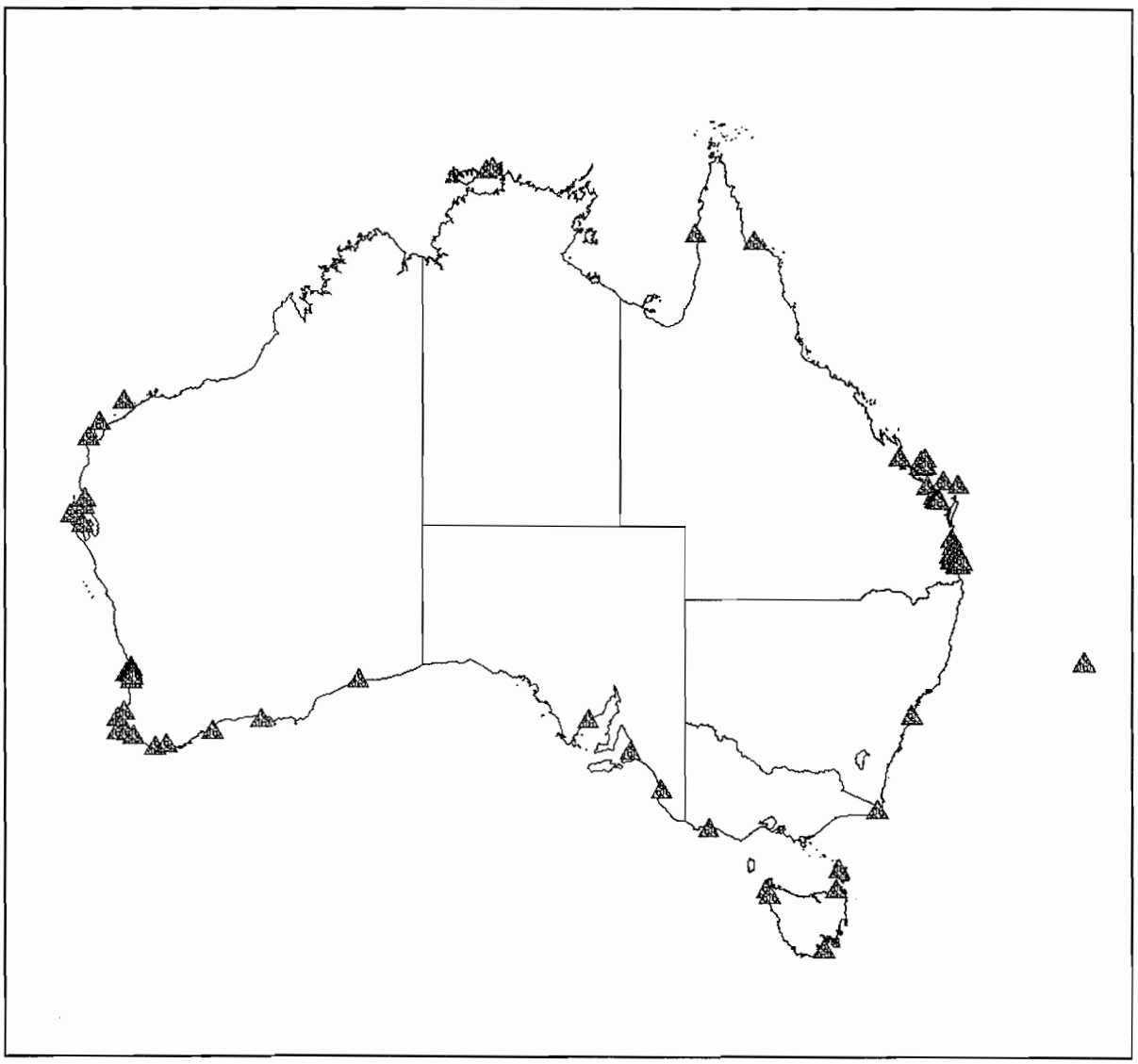
Limpus, C.J. and Reimer, D. in press. The Loggerhead Turtle, *Caretta caretta*, in Queensland: a population in decline. pp. 34-41 in Proceedings of the Australian Marine Turtle Conservation Workshop, November 1990. ANCA and Queensland Department of Environment and Heritage.

Mace, G.M. and Lande, R. 1991. Assessing extinction threats: towards a re-evaluation of IUCN threatened species categories. Conservation Biology 5: 148-157.

Marquez M., R. 1990. FAO Species Catalogue. Volume 11: Sea turtles of the world. An annotated and illustrated catalogue of sea turtle species known to date. FAO Fisheries Synopsis No. 125, Vol. 11. Rome. 81 pp.

Prince, R.I.T. in press. Status of the Western Australian marine turtle populations: the Western Australian Marine Turtle Project 1986-1990. pp. 1-12 in Proceedings of the Australian Marine Turtle Conservation Workshop, November 1990. ANCA and Queensland Department of Environment and Heritage.

Distribution of *Caretta caretta* records from Australian museum collections



Family:	Cheloniidae
Scientific Name:	*Chelonia mydas*
English Name:	Green Turtle

Infraspecific taxa: None.

Species survival status: Vulnerable.

Worldwide distribution: Widely distributed in tropical and subtropical waters but normally remains within the northern and southern limits of the 20°C isotherms (Marquez, 1990); individuals stray into temperate waters.

Australian distribution: Nesting has been recorded in the vicinity of Shark Bay and Lacépède Islands in Western Australia, Cobourg Peninsula in the Northern Territory, and in the Gulf of Carpentaria, Raine Island, and the Capricorn and Bunker Groups of islands on the southern Barrier Reef in Queensland. The species has been recorded in coastal waters of all Australian states.

Conservation status under State and Commonwealth legislation: Listed as "vulnerable" on Schedule 1 of the Commonwealth's *Endangered Species Protection Act 1992* and "vulnerable and rare" on the 1992 Revised (Interim) Schedule 12 of the NSW Endangered Fauna (Interim Protection) Act 1991.

Organisations responsible for conservation of species and individuals involved: Western Australian Marine Turtle Project run by Dept of CALM (Bob Prince), Conservation Commission of the Northern Territory (Ray Chatto), Queensland Dept of Environment and Heritage (Col Limpus), New South Wales National Parks and Wildlife Service, South Australian Department of Environment and Land Management, Victorian Department of Conservation and Natural Resources, Tasmanian Department of Environment and Land Management.

Other organisations and individuals involved: Mike Guinea (Northern Territory University), West Australian Petroleum Pty Ltd (WAPET).

Remarks: Limpus (1991) has estimated that the total slaughter of green turtles throughout Indonesia, Papua New Guinea, Australia and other western Pacific nations could be as high as 100,000 per year. As Green Turtles slaughtered in Indonesia are known to include individuals breeding in Australian waters (based on tag returns of females from Raine Island and other Great Barrier Reef Island rookeries), the high Indonesian harvest is having a significant but as yet unquantified impact on the Australian breeding stocks of *Chelonia mydas*.

References:

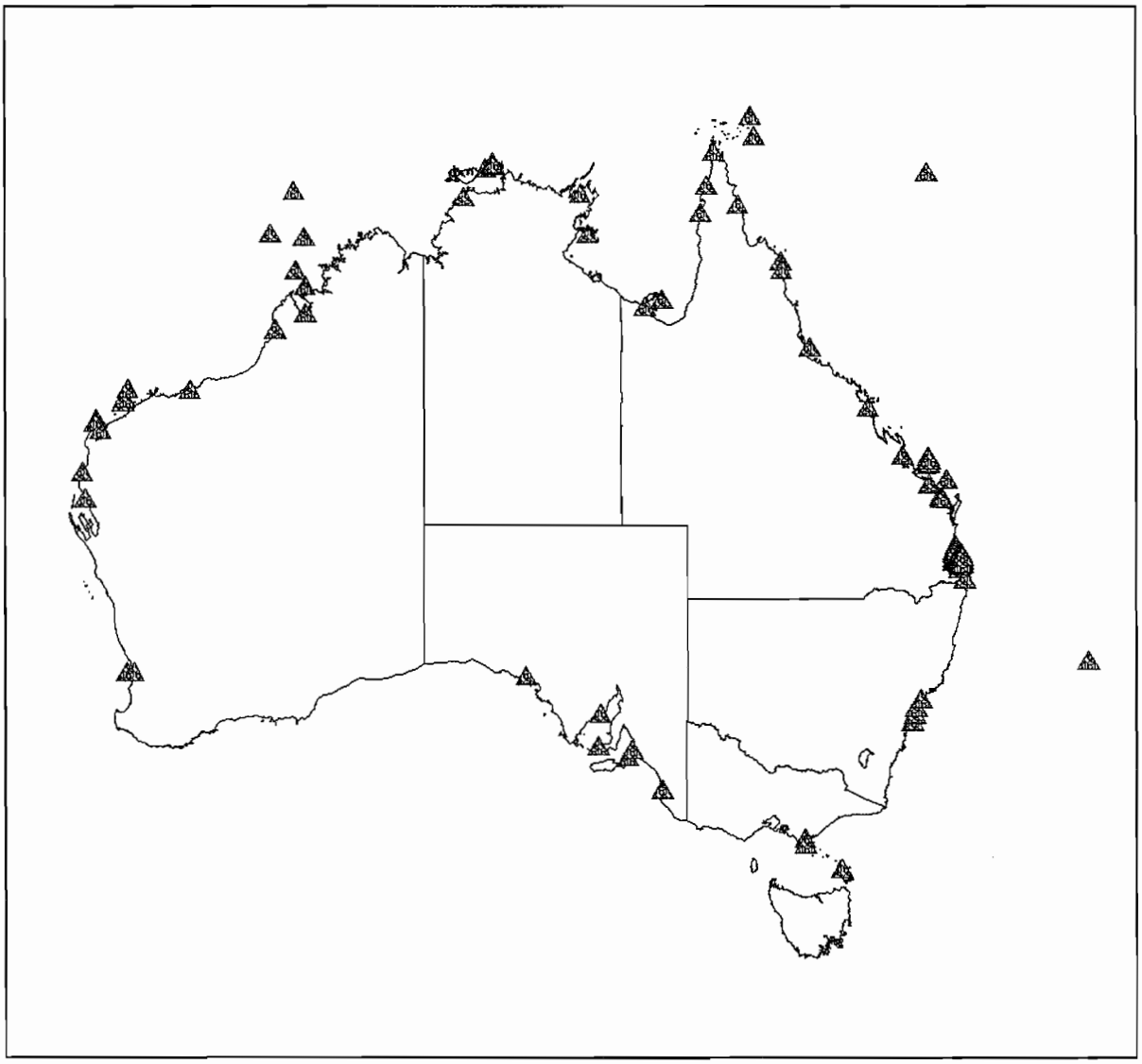
Guinea, M.L. in press. Sea turtles of the Northern Territory. pp. 15-21 in Proceedings of the Australian Marine Turtle Conservation Workshop, November 1990. Australian Nature Conservation Agency and Queensland Department of Environment and Heritage.

Limpus, C.J. 1991. The marine turtles in Australia: 1988 review. pp. 63-67 in I. Uchida (ed.) International Symposium on Sea Turtles in '88. Himeji City Aquarium with Hiwasa Chelonian Museum.

Marquez M., R. 1990. FAO Species Catalogue. Volume 11: Sea turtles of the world. An annotated and illustrated catalogue of sea turtle species known to date. FAO Fisheries Synopsis No. 125, Vol. 11. Rome. 81 pp.

Prince, R.I.T. in press. Status of the Western Australian marine turtle populations: the Western Australian Marine Turtle Project 1986-1990. pp. 1-12 in Proceedings of the Australian Marine Turtle Conservation Workshop, November 1990. Australian Nature Conservation Agency and Queensland Department of Environment and Heritage.

Distribution of *Chelonia mydas* records from Australian museum collections



Family:	Cheloniidae
Scientific Name:	*Eretmochelys imbricata*
English Name:	Hawksbill Turtle

Infraspecific taxa: None.

Species survival status: Vulnerable.

Worldwide distribution: Found in association with coral reefs throughout warm tropical waters of the central Atlantic and Indo-Pacific regions; rarely strays into temperate waters.

Australian distribution: Nesting in low densities has been recorded in the Dampier Archipelago of Western Australia, on many islands in the Northern Territory and on the northern Great Barrier Reef in Queensland, and in Torres Strait. There are few records of this species in the southern states.

Conservation status under State and Commonwealth legislation: Listed as "vulnerable" on Schedule 1 of the Commonwealth's *Endangered Species Protection Act 1992*.

Organisations responsible for conservation of species and individuals involved: Western Australian Marine Turtle Project run by Dept of CALM (Bob Prince), Conservation Commission of the Northern Territory (Ray Chatto), Queensland Dept of Environment and Heritage (Col Limpus, Jeff Miller).

Other organisations and individuals involved: Mike Guinea (Northern Territory University).

Remarks: Some Australian nesting and feeding populations may be threatened by harvest for the tortoiseshell trade in neighbouring countries, particularly Indonesia and the Solomon Islands.

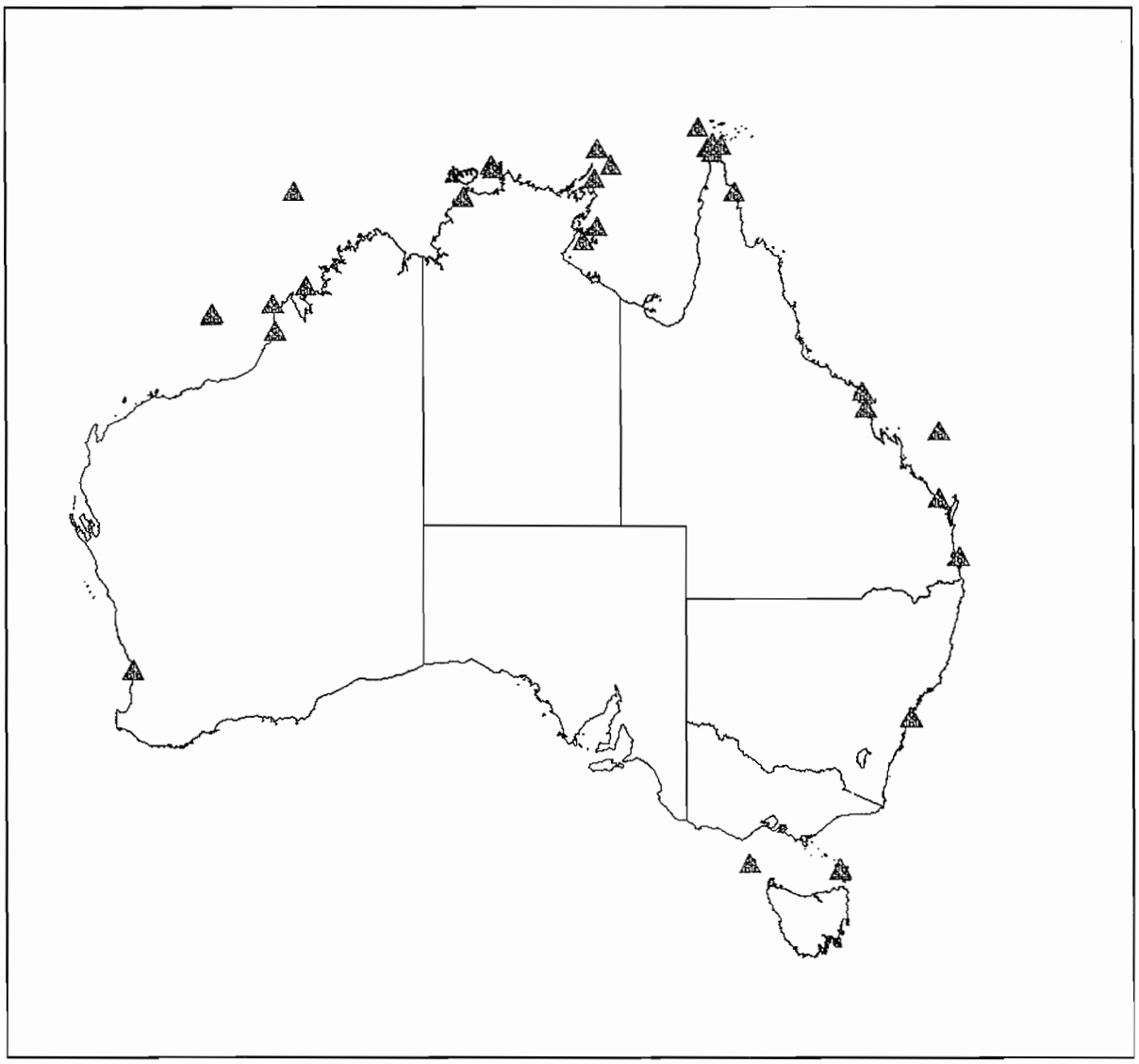
References: Guinea, M.L. in press. Sea turtles of the Northern Territory. pp. 13-33 in Proceedings of the Australian Marine Turtle Conservation Workshop, November 1990. Australian Nature Conservation Agency and Queensland Department of Environment and Heritage.

Limpus, C.J., Miller, J.D., Baker, V. and McLachlan, E. 1983. The Hawksbill Turtle, *Eretmochelys imbricata* (L.) in north-eastern Australia: the Campbell Island rookery. Australian Wildlife Research 10: 185-197.

Miller, J.D. in press. The Hawksbill Turtle, *Eretmochelys imbricata*: a perspective on the species. pp. 22-33 in Proceedings of the Australian Marine Turtle Conservation Workshop, November 1990. Australian Nature Conservation Agency and Queensland Department of Environment and Heritage.

Prince, R.I.T. in press. Status of the Western Australian marine turtle populations: the Western Australian Marine Turtle Project 1986-1990. pp. 1-12 in Proceedings of the Australian Marine Turtle Conservation Workshop, November 1990. Australian Nature Conservation Agency and Queensland Department of Environment and Heritage.

Distribution of *Eretmochelys imbricata* records from Australian museum collections



Family:	Cheloniidae
Scientific Name:	*Lepidochelys olivacea*
English Name:	Olive Ridley

Infraspecific taxa: None.

Species survival status: Vulnerable.

Worldwide distribution: Pantropical in distribution but rarely found around oceanic islands. Major breeding aggregations occur in Mexico, the west coast of Costa Rica, in Surinam, and the east coast of India.

Australian distribution: Nesting has been recorded at scattered sites in the Northern Territory and in the Gulf of Carpentaria, Queensland. With rare exceptions such as single specimens from Mon Repos in southern Queensland, and Corio Bay in Victoria, the species has not been recorded from elsewhere in Australia.

Conservation status under State and Commonwealth legislation: Listed as "vulnerable" on Schedule 1 of the Commonwealth's *Endangered Species Protection Act 1992*.

Organisations responsible for conservation of species and individuals involved: Queensland Dept of Environment and Heritage (Col Limpus), Conservation Commission of the Northern Territory (Ray Chatto).

Other organisations and individuals involved: Mike Guinea (Northern Territory University).

Remarks: Very little is known about the status of the Australian populations but recent information from the Northern Territory suggests a significant incidental catch is occurring in the shark fin fishery (Guinea and Chatto, 1992).

References:

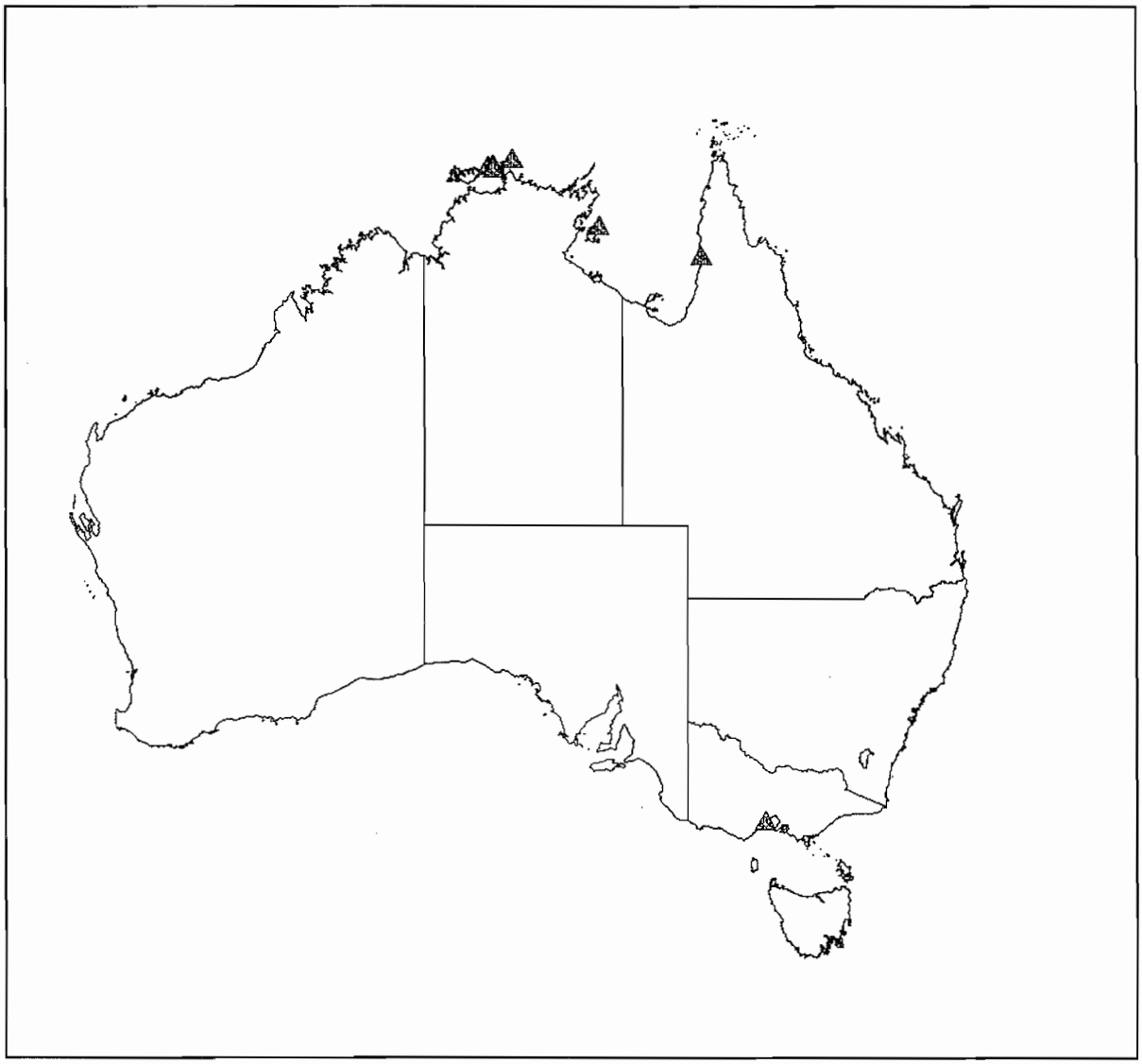
Cogger, H.G. and Lindner, D.A. 1969. Marine turtles in northern Australia. Australian Zoologist 15(2): 150-159.

Guinea, M.L. in press. Sea turtles of the Northern Territory. pp. 13-33 in Proceedings of the Australian Marine Turtle Conservation Workshop, November 1990. Australian Nature Conservation Agency and Queensland Department of Environment and Heritage.

Guinea, M.L. and Chatto, R. 1992. Sea turtles killed in Australian shark fin fishery. Marine Turtle Newsletter 57: 5-6.

Harris, A.N.M. in press. Species review: Olive Ridleys. pp. 58-61 in Proceedings of the Australian Marine Turtle Conservation Workshop, November 1990. Australian Nature Conservation Agency and Queensland Department of Environment and Heritage.

Distribution of *Lepidochelys olivacea* records from Australian museum collections



Family:	Dermochelyidae
Scientific Name:	*Dermochelys coriacea*
English Name:	Leatherback Turtle

Infraspecific taxa:

Species survival status: Vulnerable.

Worldwide distribution: Has the widest distribution of any marine turtle, occurring from the North Sea and the Gulf of Alaska in the Northern Hemisphere, to Chile and New Zealand in the Southern Hemisphere.

Australian distribution: Very low density nesting (1-3 nests per annum) have been reported in the Northern Territory, southern Queensland and northern New South Wales (Ballina, Lennox Head, NSW) (Limpus, 1991). The species has been recorded feeding in coastal waters of all Australian states.

Conservation status under State and Commonwealth legislation: Listed as "vulnerable" on Schedule 1 of the Commonwealth's *Endangered Species Protection Act 1992*, as "endangered" on the 1991 list of the South Australian National Parks and Wildlife Act and the 1990 Schedule of the WA Wildlife Conservation Act and as "insufficiently known" on the 1993 list of the Victorian Flora and Fauna Guarantee Act 1988.

Organisations responsible for conservation of species and individuals involved: Western Australian Marine Turtle Project run by Dept of CALM (Bob Prince), Queensland Dept of Environment and Heritage (Col Limpus), New South Wales National Parks and Wildlife Service, South Australian Department of Environment and Land Management, Victorian Department of Conservation and Natural Resources, Tasmanian Department of Environment and Land Management (David Rounsevell).

Other organisations and individuals involved:

Remarks: Although no significant nesting occurs in Australia, severe declines have been reported in nesting populations of *Dermochelys coriacea* throughout its range, which includes the source stocks of the Australian populations. Further, the species feeds commonly in sub-tropical and temperate Australian waters where it is subject to some mortality in fishery operations and shark netting programs.

References:

Guinea, M.L. in press. Sea turtles of the Northern Territory. pp. 13-33 in Proceedings of the Australian Marine Turtle Conservation Workshop, November 1990. Australian Nature Conservation Agency and Queensland Department of Environment and Heritage.

Limpus, C.J. 1991. The marine turtles in Australia: 1988 review. pp. 63-67 in I. Uchida (ed.) International Symposium on Sea Turtles in '88. Himeji City Aquarium with Hiwasa Chelonian Museum.

Limpus, C.J. and McLachlan, N. in press. The conservation status of the Leatherback Turtle, *Dermochelys coriacea*, in Australia. pp. 62- 66 in Proceedings of the Australian Marine Turtle Conservation Workshop, November 1990. Australian Nature Conservation Agency and Queensland Department of Environment and Heritage.

Prince, R.I.T. in press. Status of the Western Australian marine turtle populations: the Western Australian Marine Turtle Project 1986-1990. pp. 1-12 in Proceedings of the Australian Marine Turtle Conservation Workshop, November 1990. Australian Nature Conservation Agency and Queensland Department of Environment and Heritage.

Distribution of *Dermochelys coriacea* records from Australian museum collections

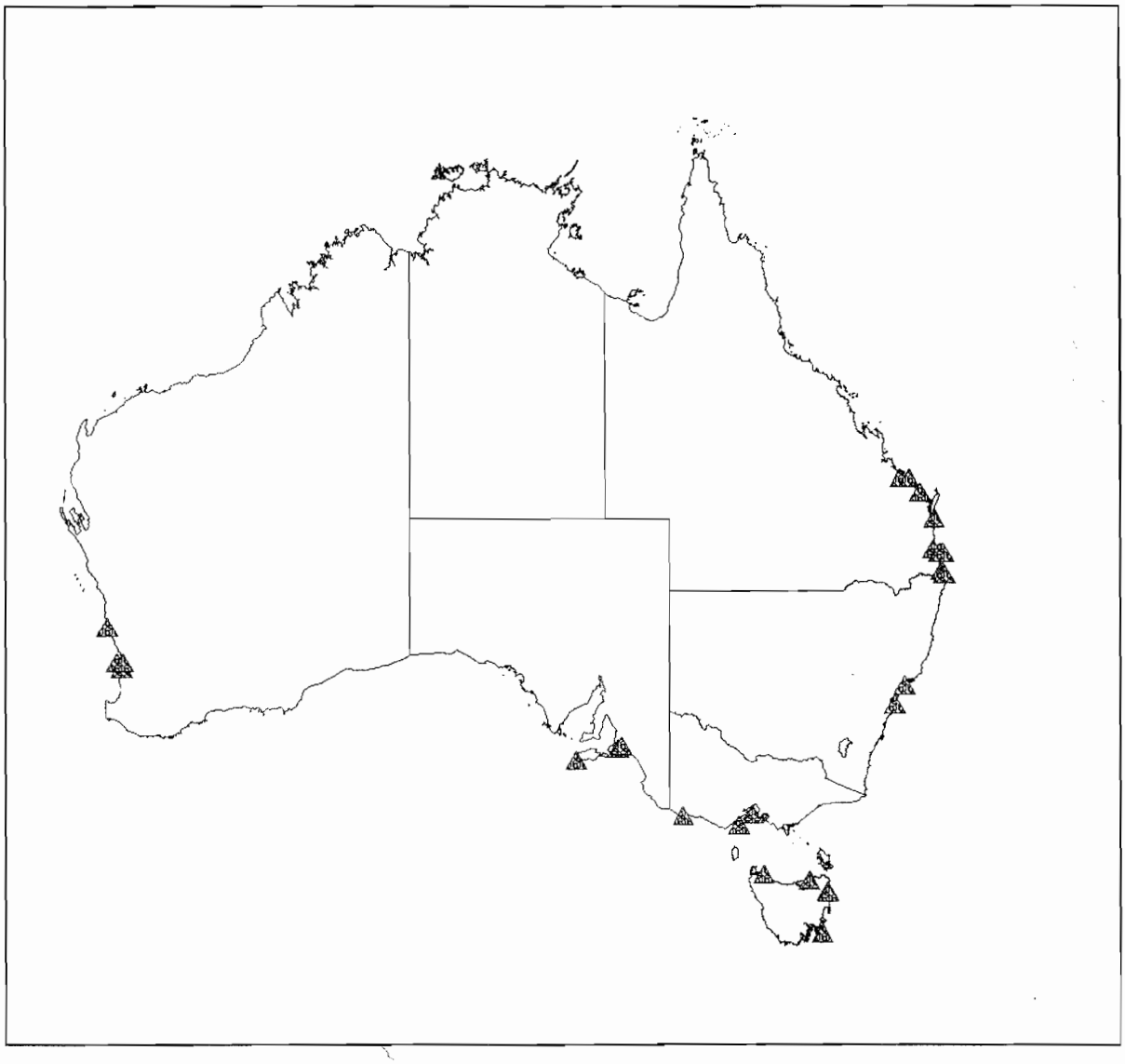
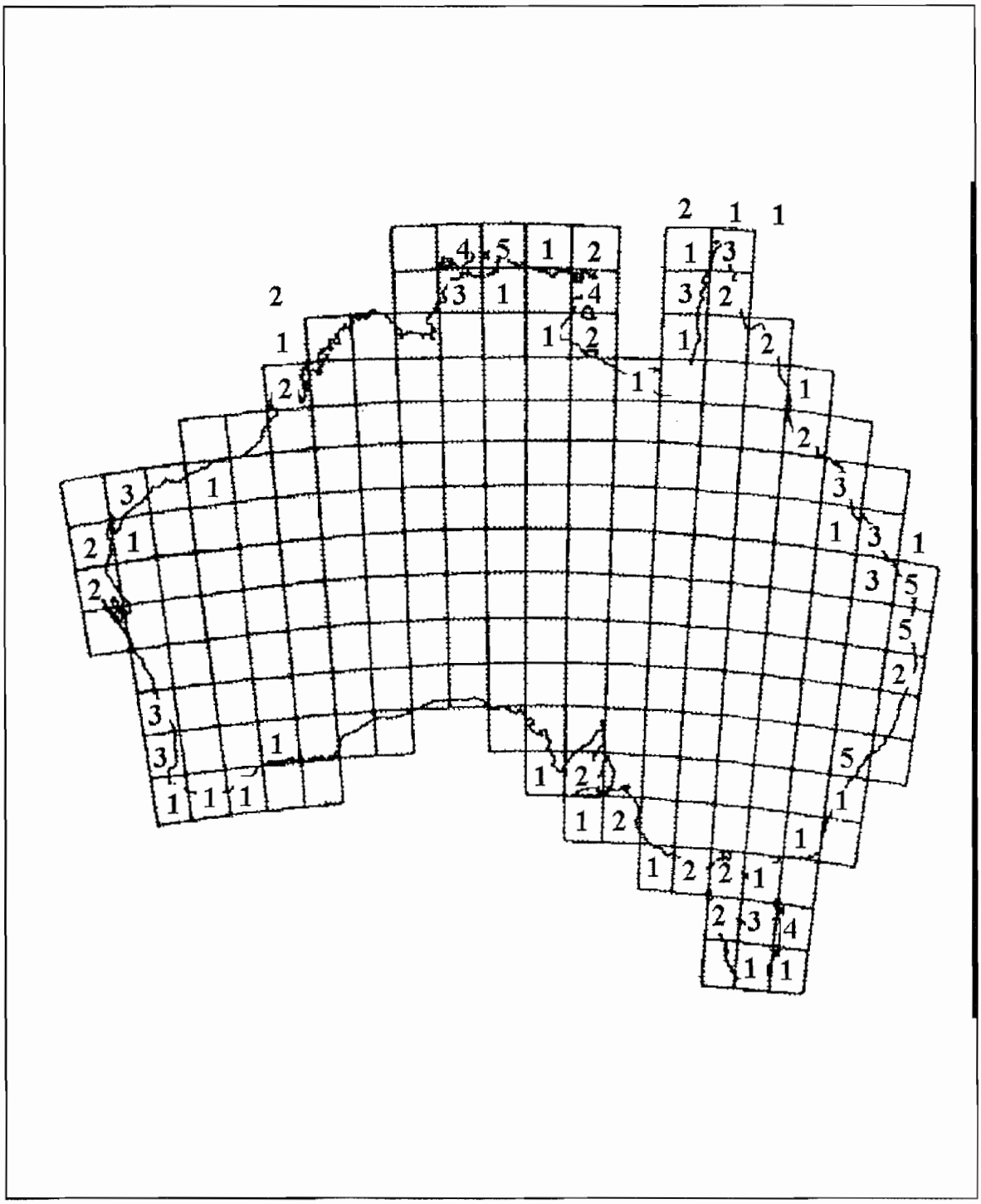


TABLE 2 DISTRIBUTION BY AUSTRALIAN STATES AND TERRITORIES, OF MARINE TURTLES.

(N) Regular nesting on a significant scale

SPECIES	STATE/TERRITORY										
	SA	WA	NT	QLD	NSW	VIC	TAS	Norfolk Island	Lord Howe Island	Christmas Island	Cocos (Keeling) Is.
Caretta caretta	*	*(N)	*	*(N)	*	*	*				
Chelonia mydas	*	*(N)	*(N)	*(N)	*	*	*		*	*(N)	*(N)
Eretmochelys imbricata		*(N)	*(N)	*(N)	*		*			*	*(N)
Lepidochelys olivacea			*(N)	*(N)							
Natator depressdus		*(N)	*(N)	*(N)	*						
Dermochelys coriacea	*	*	*	*	*	*	*				
Total	3	5	6	6	5	3	4	≥1	≥1	2	2

APPENDIX 6.2. SPECIES RICHNESS MAP FOR MARINE TURTLES (FAMILIES CHELONIIDAE AND DERMOCHELYIDAE) BASED ON SPECIMENS HELD IN AUSTRALIAN MUSEUMS



APPENDIX 7. PROCESSES THREATENING AUSTRALIA'S ENDANGERED AND VULNERABLE TERRESTRIAL REPTILES.

Most of these threats are speculative; few have been confirmed by research. See individual recovery outlines for further explanation of the processes which are believed to be responsible for declines.

SPECIES	THREATENING PROCESS																		
	Habitat clear-ance	Over-grazing by stock	Cropping	Pre-dation	Urban develop-ment	Pasture improve-ment	Fire regime	Soil degrad-ation	Visitor disturb-ance	Soil &/or water pollution	Mining	Native forest logging	Climatic vari-ation	Rabbit grazing	Habitat fragment-ation	Weed invasion	Habitat drainage	Rock removal	Other threats
Elseya sp. nov.	*							*		*							? *		
Emydura signata								*		*		*							Fishing ?water supply scheme
Pseudemydura umbrina	*		*	*	*		*				*		*				*		
Rheodytes leukops	*		*							*	*								
Gen. nov. sp. nov. (Chelidae)	*	*	*	*					*	*	*								Irrigation Captive trade
Christinus guentheri				*				*						*					
Lepidodactylus listeri	*			*							*					*			Displaced by introduced sp.
Nephrurus deleani		*						*						*					
Underwoodisaurus sphyrurus	*	*										*							Dam building
Aprasia aurita	*		*				*												
Aprasia pseudopulchella	*	*	*		*	*													
Aprasia rostrata rostrata				*					*										
Delma impar	*	*	*		*	*	*								*	*		*	

SPECIES	THREATENING PROCESS																		
	Habitat clear-ance	Over-grazing by stock	Cropping	Pre-dation	Urban develop-ment	Pasture improve-ment	Fire regime	Soil degrad-ation	Visitor disturb-ance	Soil &/or water pollution	Mining	Native forest logging	Climatic vari-ation	Rabbit grazing	Habitat fragment-ation	Weed invasion	Habitat drainage	Rock removal	Other threats
Delma labialis	*	*			*				*										
Delma torquata	*	*			*	*													
Ophidiocephalus taeniatus		*						*					*	*					Loss of litter
Paradelma orientalis	*	*	*			*						*							
Ctenophorus yinnietharra		*																	
Tympanocryptis lineata pinguicolla	*	*	*		*	*	*							*	*	*		*	Irrigation
Anomalopus mackayi	*	*	*					*		*									Loss of litter Irrigation
Coeranoscincus reticulatus	*	*	*			*						*			*				
Ctenotus lancelini									*							*			Disturbance by gull colony
Ctenotus zastictus		*					*		? *										
Egernia kintorei				*			*							*					Hunted for food
Egernia pulchra longicauda				*			*		*										Competition from introd. sp.
Egernia stokesii aethiops				*									*						Competition from native sp.
Egernia stokesii badia	*	*	*																

SPECIES	THREATENING PROCESS																		
	Habitat clear-ance	Over-grazing by stock	Cropping	Pre-dation	Urban develop-ment	Pasture improve-ment	Fire regime	Soil degrad-ation	Visitor disturb-ance	Soil &/or water pollution	Mining	Native forest logging	Climatic vari-ation	Rabbit grazing	Habitat fragment-ation	Weed invasion	Habitat drainage	Rock removal	Other threats
Egernia stokesii stokesii				*									*						
Eulamprus leuraensis				?*	*				*	*		*							Plantations
Eulamprus tympanum ssp. nov.	*																	*	
Lerista allanae		*	*			*													
Lerista vittata	*					*													
Niveoscincus palfreymani				*									*						Loss of food source
Pseudemoia lichenigera				*				*						*					
Tiliqua adelaidensis			*		*	*													
Ramphotyphlops exocoeti	*							*			*								
Aspidites ramsayi	*		*	?*															
Morelia spilota imbricata	*	*	*			*													
Austrelaps labialis	*		*	*	*														
Denisonia maculata	*	*	*		*	*													?poisoned by introd. sp.
Echiopsis atriceps	*		*								*								
Echiopsis curta	*	*	*				?*												

SPECIES	THREATENING PROCESS																		
	Habitat clear-ance	Over-grazing by stock	Cropping	Pre-dation	Urban develop-ment	Pasture improve-ment	Fire regime	Soil degrad-ation	Visitor disturb-ance	Soil &/or water pollution	Mining	Native forest logging	Climatic vari-ation	Rabbit grazing	Habitat fragment-ation	Weed invasion	Habitat drainage	Rock removal	Other threats
Elapognathus minor	*				*							*					*		Competition from native sp.
Furina dunmalli	*	*	*		*	*											? *		
Hoplocephalus bungaroides	*				*				*						*			*	Captive trade
Notechis ater ater	*	*					*	*		*									?Loss of food source
Simoselaps calonotus	*		*		*		*								*	*			
TOTAL	30	21	21	14	14	12	10	9	8	7	6	6	5	6	5	5	4	4	

APPENDIX 8.1 WORLDMAP - Analysis of Priority Areas for Conservation of Reptiles

Threatened species represent a high-priority subset of the overall biodiversity of any given area. The measurement of biodiversity, whether in geographical, geo-taxonomic or simply taxonomic terms, continues to present biologists with a major problem.

In practice, biodiversity is usually measured by some simple index of taxonomic diversity such as species richness. But species richness is only one measure of diversity, and one which is often inappropriate to conservation action because it weights all species equally. Consequently phylogenetically-distinctive organisms (such as species representing monotypic families or orders) must be separately identified and given special emphasis in conservation where appropriate.

The supplemental variables in the Millsap *et al.* (1990) ranking system described in Appendix 10 attempt, with some success, to assign higher values to phylogenetically significant taxa. However in recent years a number of attempts have been made to utilise a wide range of variables (including phylogenetic significance) in identifying areas or habitats of special conservation significance and in assigning conservation priorities (eg Pressey *et al.*, 1993). All such methodologies eventually depend for their effectiveness on the quality of their underlying database, and on the rigour of their underlying mathematical model.

These problems have been very thoroughly addressed by Vane-Wright *et al.* (1991) and Williams *et al.* (1991, 1993). These authors point out that phylogenies based on cladistic methods provide an effective measure of phylogenetic uniqueness, and Williams has developed special computer software ("WORLDMAP") to measure various components of biodiversity and, through a series of elegant algorithms, to use various criteria to identify geographic areas (on a variety of scales) of high biodiversity conservation value and hence of potential value as reserves.

While this software is still in the development stage, the Consultants are indebted to Dr Paul Williams and his colleagues at the British Museum (Natural History) for making copies of their software available for trialing in the Australian Reptile Action Plan.

In order to exploit the full capabilities of WORLDMAP it could be necessary to have available a cladistic analysis of the fauna being treated. However few groups of Australian reptiles have been subject to rigorous cladistic analysis.

Fortunately WORLDMAP currently uses only the *number of nodes* between the species and the root of the cladogram, and not *internodal distances*, as the principal measure of cladistic divergence. Consequently an equal-weight cladogram based on the current classification of the Australian reptile fauna provides the necessary cladistic input for a WORLDMAP analysis, and for the construction of the necessary cladistic codes.

The full WORLDMAP methodology, including the mathematical and statistical bases for the various analyses, is explained in the papers referred to above and should be consulted by the reader. The following brief descriptions of the nine principal biodiversity measures are extracted and only slightly modified from the WORLDMAP manual. As pointed out by Vane-Wright *et al.* (1991) no one measure can meet all of the criteria which need to be considered in setting biodiversity reserve priorities.

The following nine analyses were applied only to the 11 Endangered and 36 Vulnerable terrestrial reptiles.

Species richness
One of the simplest measures of diversity is unweighted species richness, an estimate of the number of species in an area.

The Species Richness maps (Appendices 5.2-5.4) display the unweighted numbers of species per square plotted as the raw numbers of species in the clade. The species richness map for marine turtles is shown in Appendix 6.1.

Endemism
While endemism is not a direct biodiversity measure, it represents an important criterion for conservation biologists seeking to prioritise protection measures for particular taxa. Centres of endemism can be identified by the co-occurrence of large numbers of species with very restricted distributions.

The Endemism map (Appendix 8.2) shows for Endangered and Vulnerable species combined,

the sum of the rarity scores (the inverse of the number of squares with records) for the species plotted as a percentage of the total rarity scores for all of the species in the clade.

"Close-to-root" species
Taxonomic root weighting measures diversity as species richness with higher weights for the early-diverging, "relict" species.

The Root Weight map (Appendix 8.3) displays for Endangered and Vulnerable species combined, the numbers of species per square, each weighted by its individual root weight, plotted as a percentage of the total root score for all of the species in the clade.

Mean root weight
Weighted faunal diversity scores can be thought of as consisting of two components: (A) the number of species per square, and (B) the mean weight per species in that square.

The Mean Root Weight map (Appendix 8.4) plots for Endangered and Vulnerable species combined, the weight component B and the mean root weighting per species for the fauna of each square as a percentage of the sum of the root weights of all of the species in the clade.

Higher-taxon richness
Higher-taxon richness weighting measures diversity as species richness with higher weights for faunas with more of the species from the more early-diverging, higher taxa, irrespective of the number of surviving species in these higher taxa.

The Higher Taxon Weighting map (Appendix 8.5) plots for Endangered and Vulnerable species combined, the numbers of species per square, weighted by the higher-taxon richness weight, as a percentage of the total higher-taxon richness score for all of the species in the clade.

Note that because higher-taxon richness is measured in terms of pairwise divergences, there must be at least two species in a square before its score can be greater than zero.

Mean higher taxonomic weight
Weighted faunal diversity scores can be thought of as consisting of two components: (A) the number of species per square, and (B) the mean weight per species in that square.

The Mean Higher Taxonomic Weight map (Appendix 8.6) plots for Endangered and Vulnerable species combined, the weight component B, the mean higher-taxon richness weighting per species for the fauna of each square as a percentage of the higher-taxon richness score for all of the species in the clade.

Spanning-tree length
Spanning-tree length weighting measures diversity as species richness, with higher weights for faunas with a greater variety of species as shown by the proportion of the classification represented.

The Span (unrooted-subtree) Weight map (Appendix 8.7) plots for Endangered and Vulnerable species combined, the numbers of species per square, weighted by the spanning-tree length weight, as a percentage of the total spanning-tree length score for all of the species in the clade.

Note that because spanning-tree length is measured in terms of the number of branching points between species, there must be at least two species in a square before its score can be greater than zero.

Mean spanning-tree weight
Weighted faunal diversity scores can be thought of as consisting of two components: (A) the number of species per square, and (B) the mean weight per species in that square.

The Mean Spanning Tree Weight map (Appendix 8.8) plots for Endangered and Vulnerable species combined, the weight component B, the mean spanning-tree length weighting per species for the fauna of each square, as a percentage of the entire spanning-tree length score for all of the species in the clade.

Taxonomic dispersion
Taxonomic dispersion weighting measures diversity as species richness, with higher weights for faunas with species that represent the variety of subgroups in the classification more evenly.

The Dispersion Weight map (Appendix 8.9) plots for Endangered and Vulnerable species combined, the numbers of species per square, weighted by their dispersion weight, as a percentage of the total dispersion score for all of the species in the clade.

Note that because cladistic dispersion is measured

in terms of the evenness of pairwise divergences, there must be at least three species in a square before its dispersion score can be greater than zero.

Mean taxonomic dispersion weight

Pairwise weighted faunal diversity scores can be thought of as consisting of two components: (A) the number of species per square, and (B) the mean pairwise weight per species in that square.

The Mean Dispersion Weight map (Appendix 8.10) plots for Endangered and Vulnerable species combined, the weight component B, the mean dispersion weighting per species for the fauna of each square, on the grid as a percentage of the dispersion score for all of the species in the clade.

Priority areas

Table 3 below shows the 13 areas (at a resolution of 2° of latitude and longitude) which rank highest in the various biodiversity analyses. In grid numerical order they are:

110 Christmas Island, Indian Ocean
345 Emerald, QLD
346 Rockhampton, QLD
383 Maryborough, QLD
418 Dalby, QLD
435 Houtman Abrolhos, WA
472 Perth, WA
473 Northam, WA
490 Armidale, NSW
520 Peterborough, SA
556 Adelaide, SA
593 Mt Gambier, SA & VIC
594 Ballarat, VIC

These areas therefore warrant special attention when designating new reserves or managing existing reserves to conserve Australia's Endangered and Vulnerable terrestrial reptiles.

References:

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Millsap, B.A., Gore, J.A., Runde, D.E. and Cerulean, S.I. 1990. Setting priorities for the conservation of fish and wildlife species in Florida. Wildlife Monographs 111: 1-57.

Vane-Wright, R.I., Humphries, C.J. and Williams, P.H. 1991. What to protect? - systematics and the agony of choice. Biological Conservation 55: 235-254.

Williams, P.H., Humphries, C.J. and Vane-Wright, R.I. 1991. Measuring biodiversity: taxonomic relatedness for conservation priorities. Australian Systematic Botany 4: 665-679.

Williams, P.H., Vane-Wright, R.I. and Humphries, C.J. 1993. Measuring biodiversity for choosing conservation areas. pp. 309-328 in J. LaSalle and I.D. Gauld (eds) Hymenoptera and Biodiversity. CAB International, Wallingford, UK.

TABLE 3 PRIORITY CONSERVATION AREAS (LISTED AS NUMBERED 2° GRID SQUARES) IDENTIFIED BY WORLDMAP'S NINE BIODIVERSITY MEASURES

	SEQUENCE OF PRIORITY FOR CONSERVATION AREAS			
BIODIVERSITY MEASURE	PRIORITY 1	PRIORITY 2	PRIORITY 3	PRIORITY 4
Species Richness	472	473	556,346,418	
Endemism	472	110	520	418
Root Weight	472	473	346	
Mean Root Weight	383	345,110		
Higher Taxon Weight	472	473	346	345
Mean Higher Taxon Weight	490	345	346	
Span Weight	472	473	594	556,346
Mean Span Weight	435, 593, 490	594		
Dispersion Weight	472	473	594	
Mean Dispersion Weight	594	435,593,490		

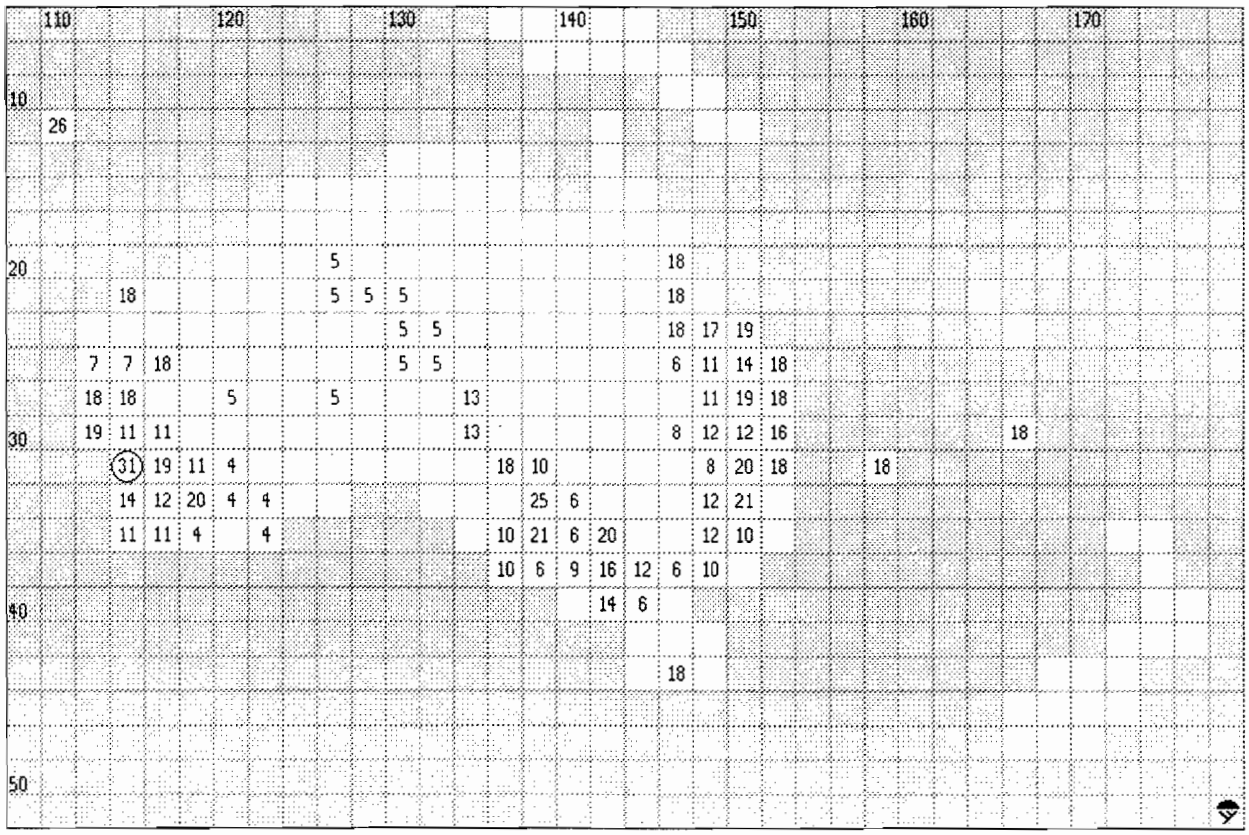
NUMBERS AND NAMES APPLIED TO THE 2° GRID SQUARES USED IN THE WORLDMAP ANALYSES

110	Christmas Island	193	Katherine	235	Cairns
120	Melville Island	194	Roper River	236	Innisfail
121	Cobourg Peninsula	195	Sir Edward Pellew	259	Lagrange
122	Cape Stewart	197	Edward River	260	Dampier Downs
123	Cape Wessel	198	Musgrave	261	Fitzroy Crossing
126	Cape York	199	Cooktown	262	Halls Creek
155	Cape Ford	224	Broome	263	Gardner Range
156	Darwin	225	King Leopold Ranges	264	Hooker Creek
157	Alligator Rivers	226	Durack Range	265	Renner Springs
158	Arnhem Land	227	Lake Argyle	266	Tennant Creek
159	Gove Peninsula	228	Victoria River Downs	267	Alexandria
161	Weipa	229	Newcastle Waters	268	Gunpowder
162	Iron Range	230	Anthony Lagoon	269	Norman River
189	Bonaparte Archipel.	231	Borroloola	270	Croydon
190	Forrest River	232	Mornington Island	271	Herbert River
191	Wyndham	233	Normanton	272	Townsville
192	Daly River	234	Mitchell River	292	North West Cape

293	Dampier	382	Mundubbera	484	Leigh Creek
294	Port Hedland	383	Maryborough	485	Broken Hill
295	Oakover River	399	Edel Land	486	Wilcannia
296	Lake Dora	400	Murchison River	487	Bourke
297	Percival Lakes	401	Nicholson Range	488	Nyngan
298	Balgo	402	Meekatharra	489	Narrabri
299	Lake Dennis	403	Wiluna	490	Armidale
300	The Granites	404	Lake Wells	491	Port Macquarie
301	Barrow Creek	405	Great Victoria	494	Lord Howe Island
302	Hatches Creek	406	Warburton	508	Bunbury
303	Austral Downs	407	Tomkinson Ranges	509	Narrogin
304	Mount Isa	408	Musgrave Ranges	510	Lake Grace
305	Cloncurry	409	Ernabella	511	Esperance
306	Richmond	410	Oodnadatta	512	Balladonia
307	Hughenden	411	Macumba Creek	513	Point Culver
308	Charters Towers	412	Warburton Creek	514	Eyre
309	Mackay	413	Cooper Creek	517	Ceduna
310	Percy Isles	414	Eromanga	518	Eyre Peninsula
327	Ningaloo	415	Quilpie	519	Whyalla
328	Exmouth Gulf	416	Charleville	520	Peterborough
329	Tome Price	417	Roma	521	Lake Victoria
330	Newman	418	Dalby	522	Menindee
331	Jigalong	419	Brisbane	523	Ivanhoe
332	Lake Disappointment	435	Houtman Abrolhos	524	Lake Cargelligo
333	Traeger Hills	436	Geraldton	525	Bathurst
334	Gibson Desert	437	Mount Magnet	526	Sydney
335	Lake Mackay	438	Lake Barlee	527	Myall Lakes
336	Haast Bluff	439	Leonora	544	Cape Leeuwin
337	Alice Springs	440	Laverton	545	Albany
338	Plenty River	441	Rason Lake	546	Cheyne Bay
339	Glenormiston	442	Jubilee Lake	554	Port Lincoln
340	Boulia	443	Serpentine Lakes	555	Kangaroo Island
341	Diamantina Lakes	444	Lake Maurice	556	Adelaide
342	Winton	445	Lake Maramangye	557	Renmark
343	Longreach	446	Coober Pedy	558	Mildura
344	Clermont	447	Lake Eyre	559	Deniliquin
345	Emerald	448	Lake Blanche	560	Griffith
346	Rockhampton	449	Cameron Corner	561	Canberra
363	Carnarvon	450	Tibooburra	562	Wollongong
364	Gascoyne Junction	451	Cunnamulla	591	South Kangaroo I.
365	Yinnietharra	452	Brewarrina	592	Coorong
366	Peak Hill	453	Moree	593	Mount Gambier
367	Canning Gap	454	Inverell	594	Ballarat
368	Glenayle	455	Lismore	595	Melbourne
369	Gibson Desert	462	Norfolk Island	596	Albury
370	Rawlinson Range	472	Perth	597	Cooma
371	Docker River	473	Northam	598	Narooma
372	Ayers Rock	474	Merredin	629	Portland
373	Erldunda	475	Kalgoorlie	630	Warrnambool
374	Finke	476	Cundeelee	631	Wilsons Promontory
375	Simpson Desert	477	Rawlinna	632	Bass Strait
376	Birdsville	478	Nullarbor	667	NW Tasmania
377	Diamantina River	479	Forrest	668	Launceston
378	Windorah	480	Cook	669	NE Tasmania
379	Blackall	481	Immarna	703	SW Tasmania
380	Tambo	482	Tarcoola	704	Hobart
381	Taroom	483	Woomera	705	SE Tasmania

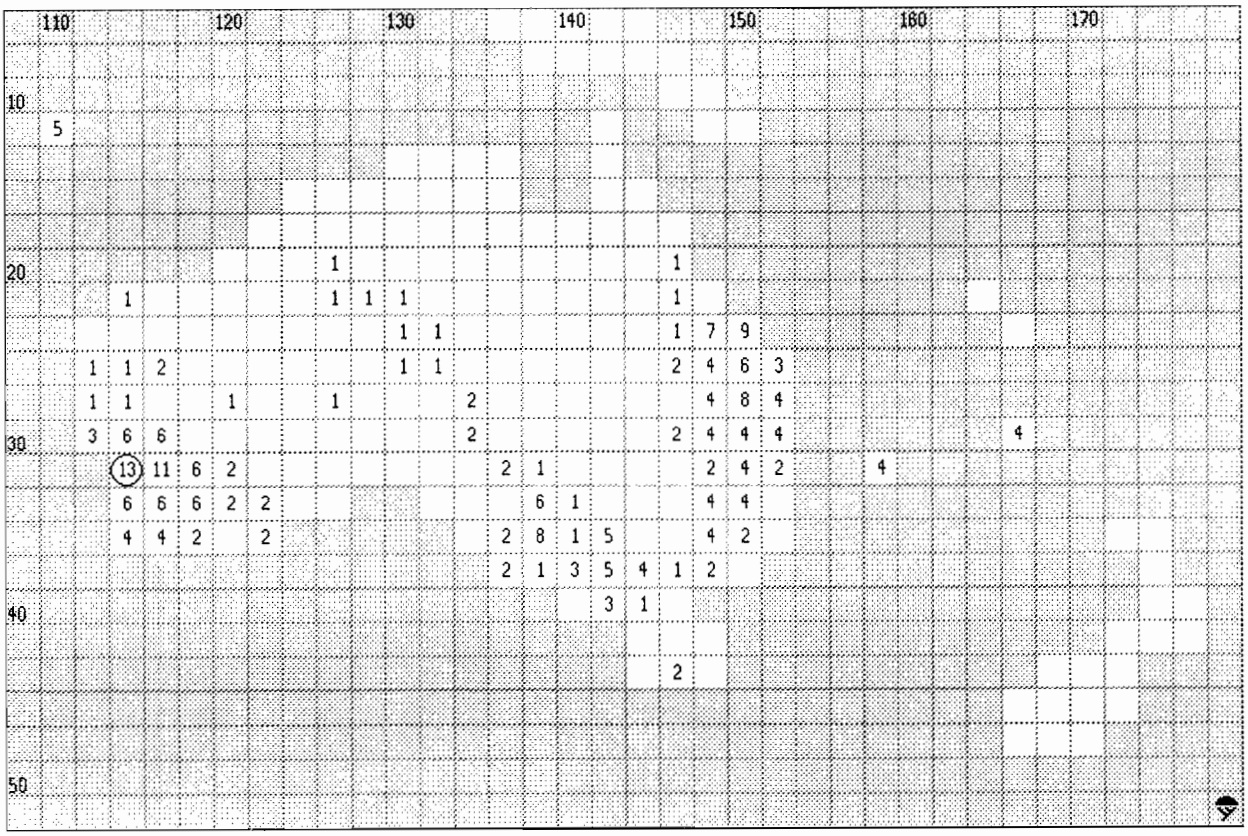
APPENDIX 8.2 MAP OF ENDEMISM VALUES BASED ON THE 47 TERRESTRIAL SPECIES OR GEOGRAPHICALLY DISCRETE POPULATIONS OF AUSTRALIAN REPTILES PROPOSED AS ENDANGERED OR VULNERABLE.

Highest endemism values are assigned to grid squares 472 (Perth, south-western WA), 110 (Christmas Island) and 520 (Peterborough, SA).



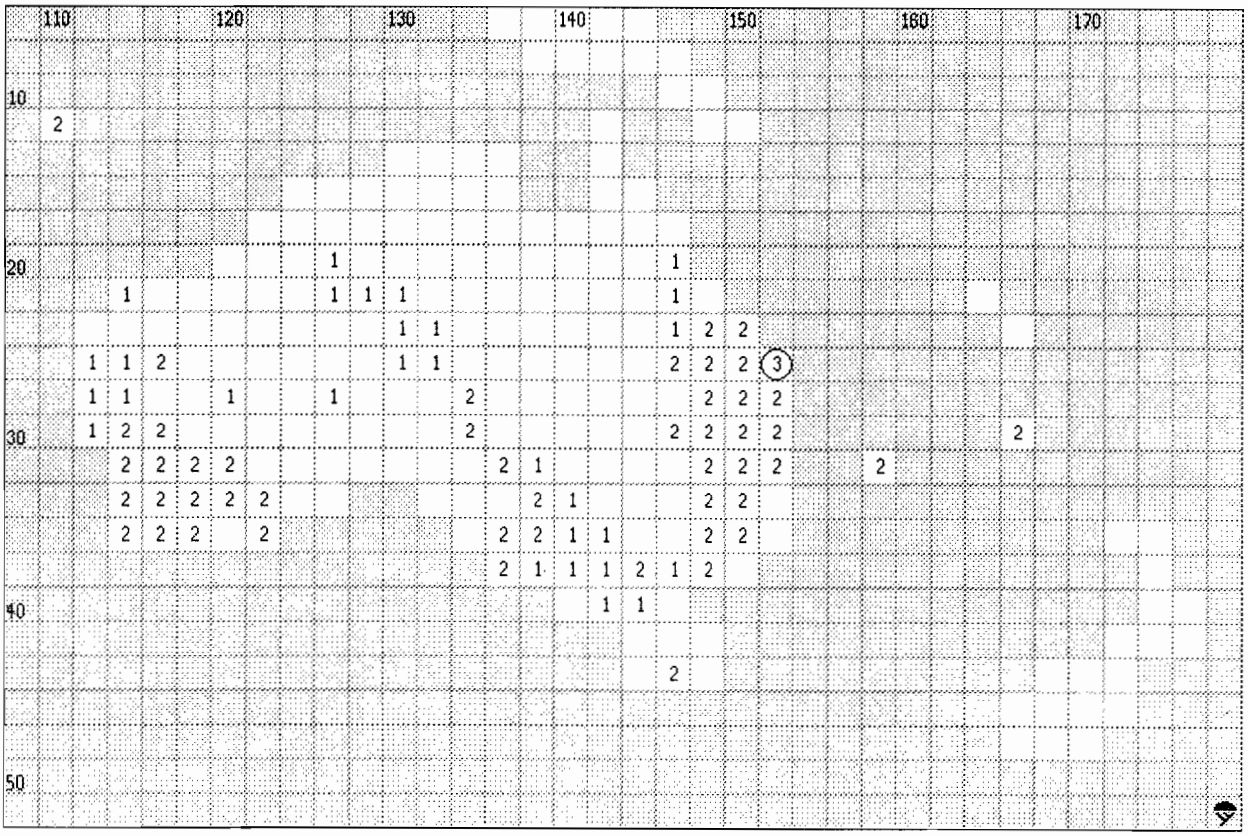
APPENDIX 8.3 MAP OF ROOT WEIGHT VALUES BASED ON THE 47 TERRESTRIAL SPECIES OR GEOGRAPHICALLY DISCRETE POPULATIONS OF AUSTRALIAN REPTILES PROPOSED AS ENDANGERED OR VULNERABLE.

Sequence of highest root weight values is found in grid squares 472 (Perth, south-western WA), 473 (Northam, southern WA), and 346 (Rockhampton, QLD).



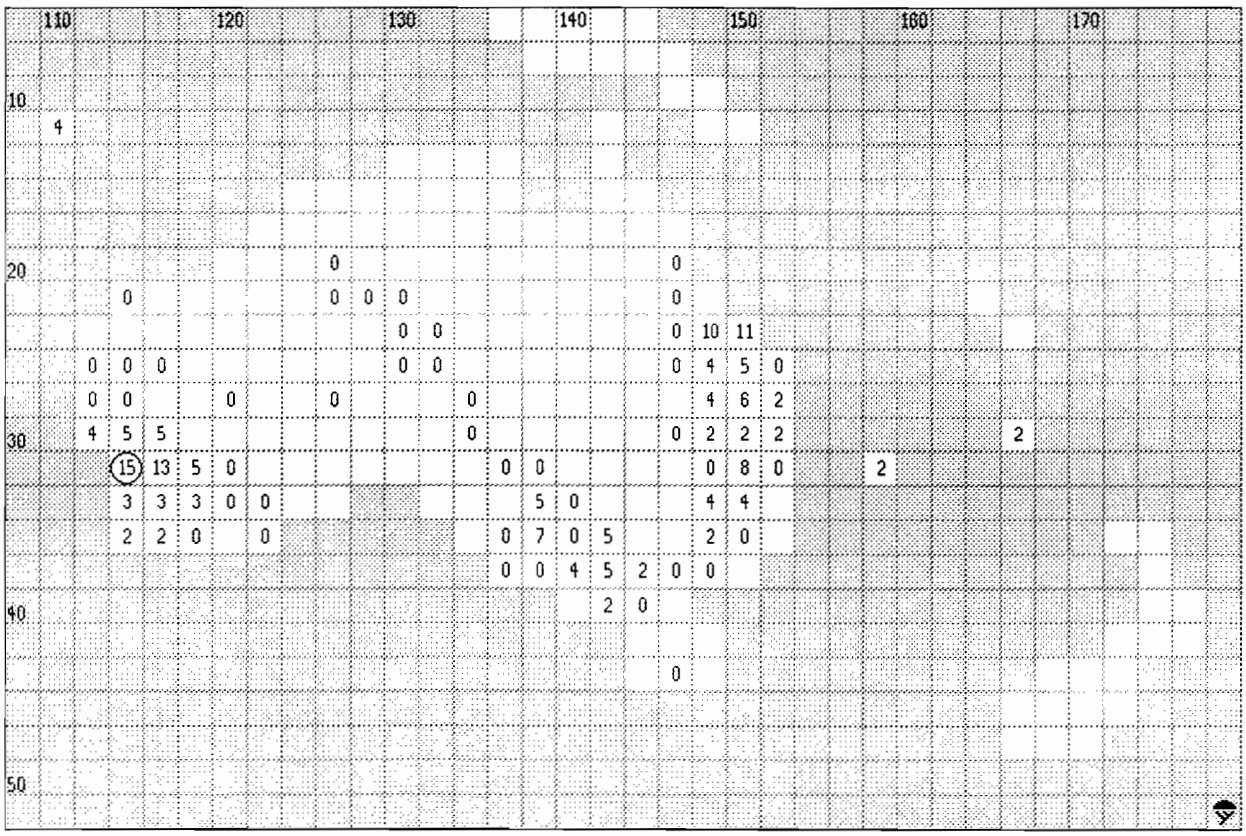
APPENDIX 8.4 MAP OF MEAN ROOT WEIGHT VALUES BASED ON THE 47 TERRESTRIAL SPECIES OR GEOGRAPHICALLY DISCRETE POPULATIONS OF AUSTRALIAN REPTILES PROPOSED AS ENDANGERED OR VULNERABLE.

Highest mean root weight value is assigned to grid square 383 (Maryborough, QLD).



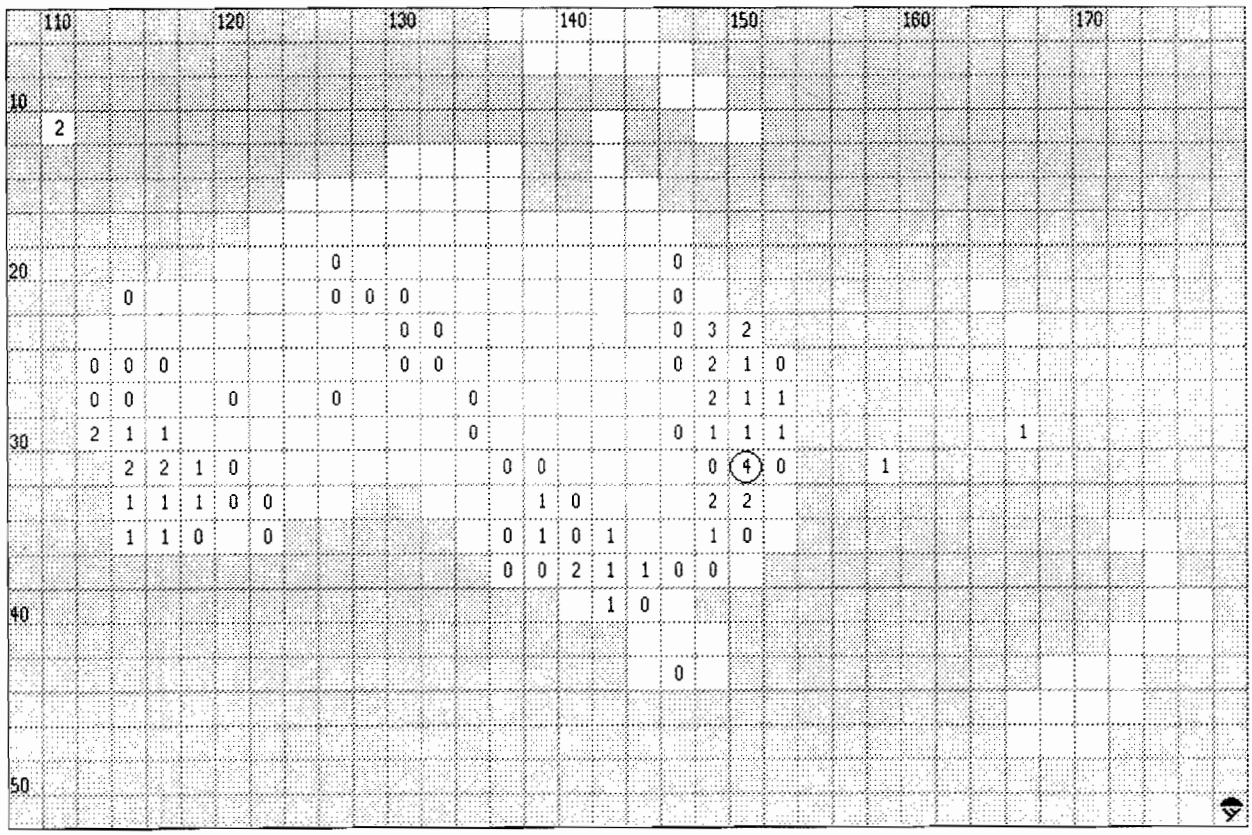
APPENDIX 8.5 MAP OF HIGHER TAXON WEIGHTINGS BASED ON THE 47 TERRESTRIAL SPECIES OR GEOGRAPHICALLY DISCRETE POPULATIONS OF AUSTRALIAN REPTILES PROPOSED AS ENDANGERED OR VULNERABLE.

Sequence of highest higher taxon weight values is found in grid squares 472 (Perth, southern WA), 473 (Northam, southern WA), 346 (Rockhampton, QLD) and 345 (Emerald, QLD). Note that grid squares represented by a single species or geographically discrete population will automatically be assigned zero values by this algorithm.



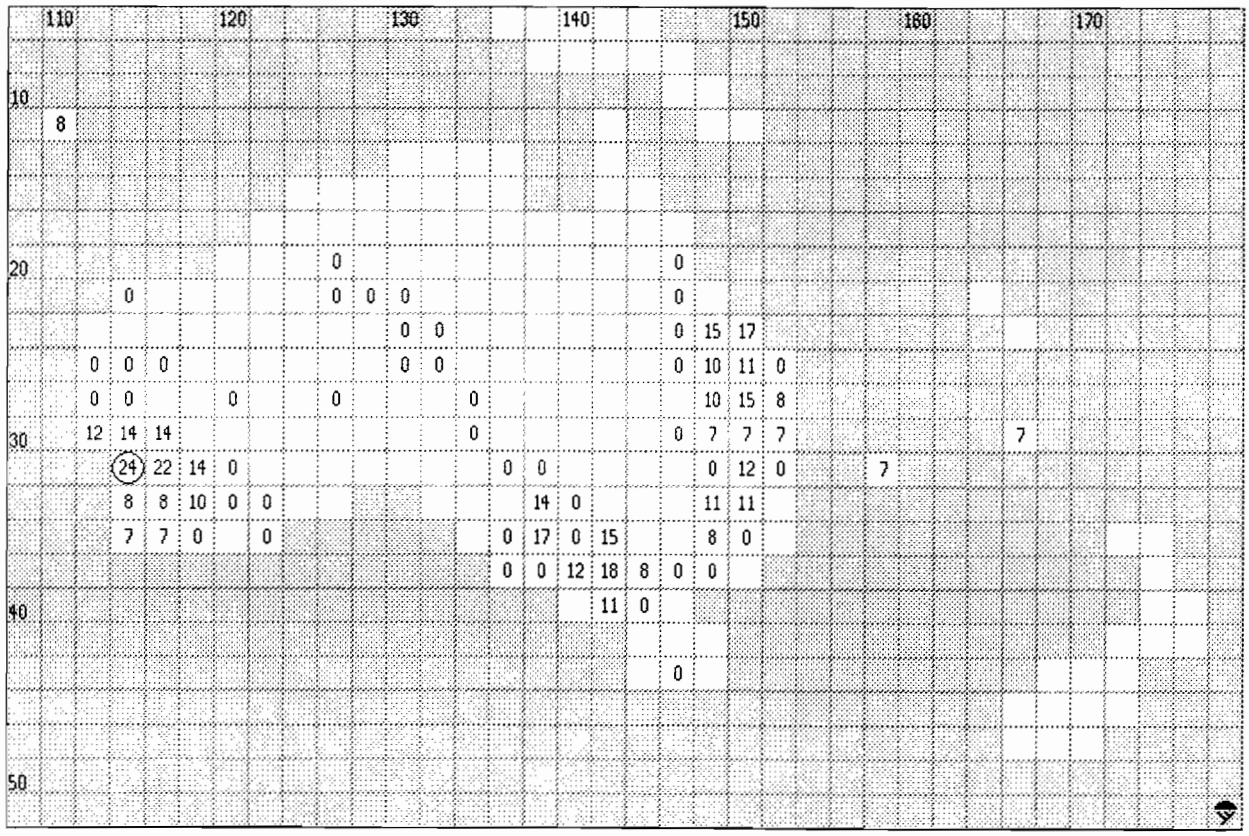
APPENDIX 8.6 MAP OF MEAN HIGHER TAXON WEIGHTINGS BASED ON THE 47 TERRESTRIAL SPECIES OR GEOGRAPHICALLY DISCRETE POPULATIONS OF AUSTRALIAN REPTILES PROPOSED AS ENDANGERED OR VULNERABLE.

Highest mean higher taxon values are found in grid squares 490 (Armidale, NSW), 345 (Emerald, QLD) and 346 (Rockhampton, QLD).



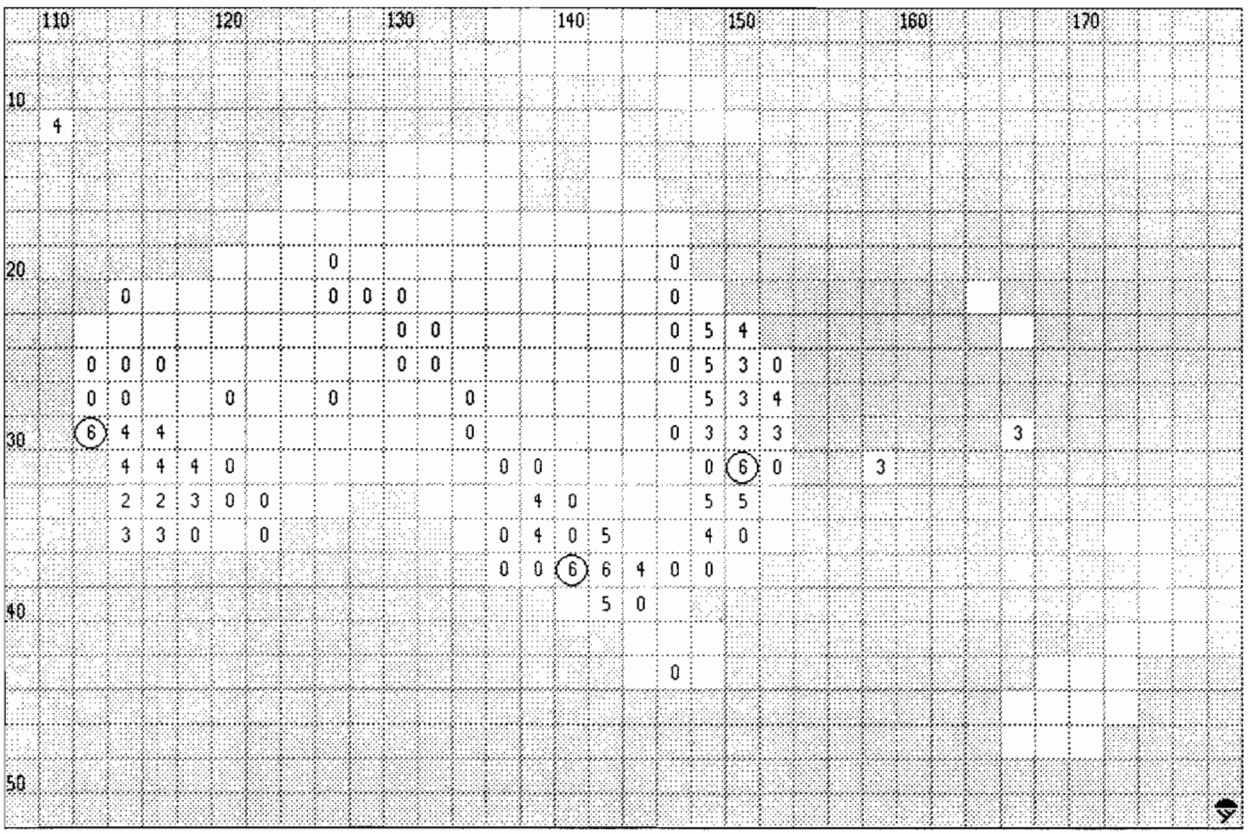
APPENDIX 8.7 MAP OF SPAN (UNROOTED-SUBTREE) WEIGHT VALUES BASED ON THE 47 TERRESTRIAL SPECIES OR GEOGRAPHICALLY DISCRETE POPULATIONS OF AUSTRALIAN REPTILES PROPOSED AS ENDANGERED OR VULNERABLE.

Highest span weight values are found in grid squares 472 (Perth, southern WA), 473 (Northam, WA), 594 (Ballarat, VIC) and 556 (Adelaide, SA).



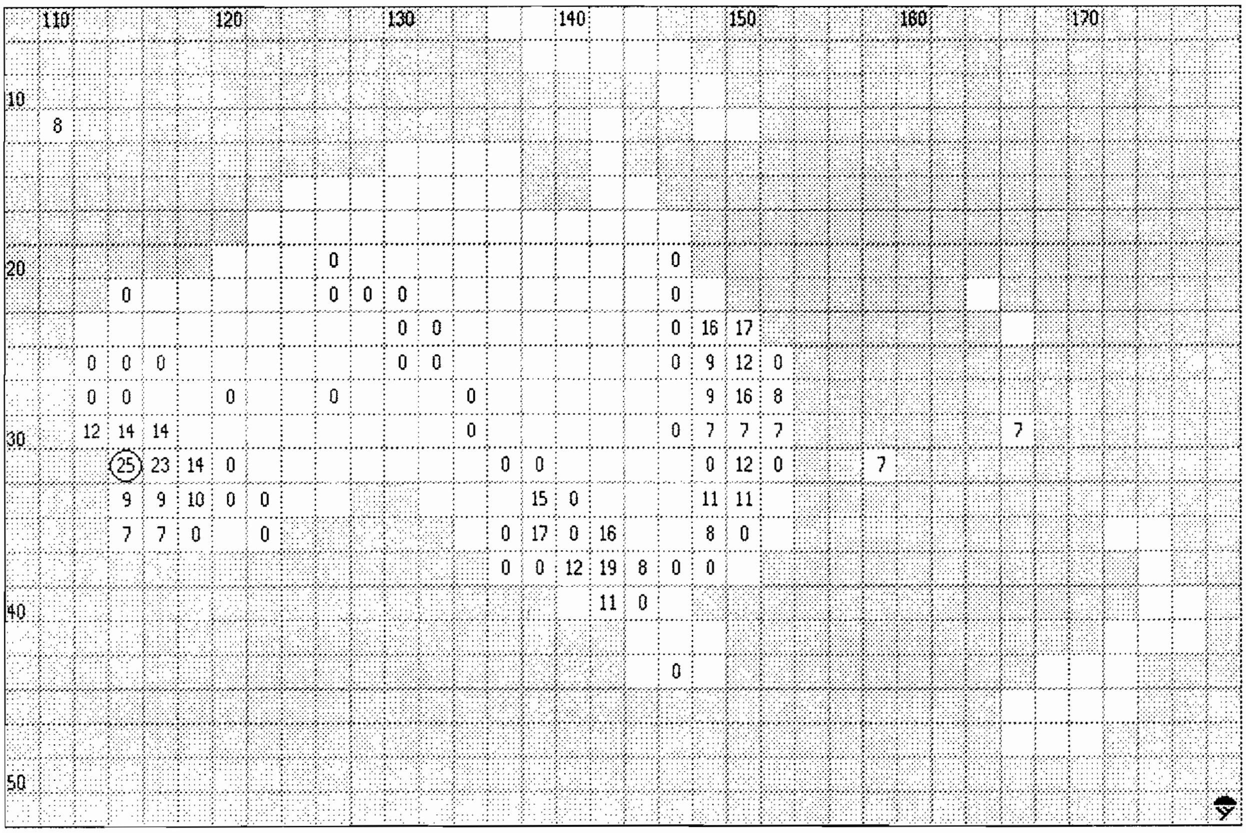
APPENDIX 8.8 MAP OF MEAN SPAN (UNROOTED-SUBTREE) WEIGHT VALUES BASED ON THE 47 TERRESTRIAL SPECIES OR GEOGRAPHICALLY DISCRETE POPULATIONS OF AUSTRALIAN REPTILES PROPOSED AS ENDANGERED OR VULNERABLE.

Highest mean span weight values are found in grid squares 435 (Houtman Abrolhos, WA), 593 (Mount Gambier, SA), 490 (Armidale, NSW) and 594 (Ballarat, VIC).



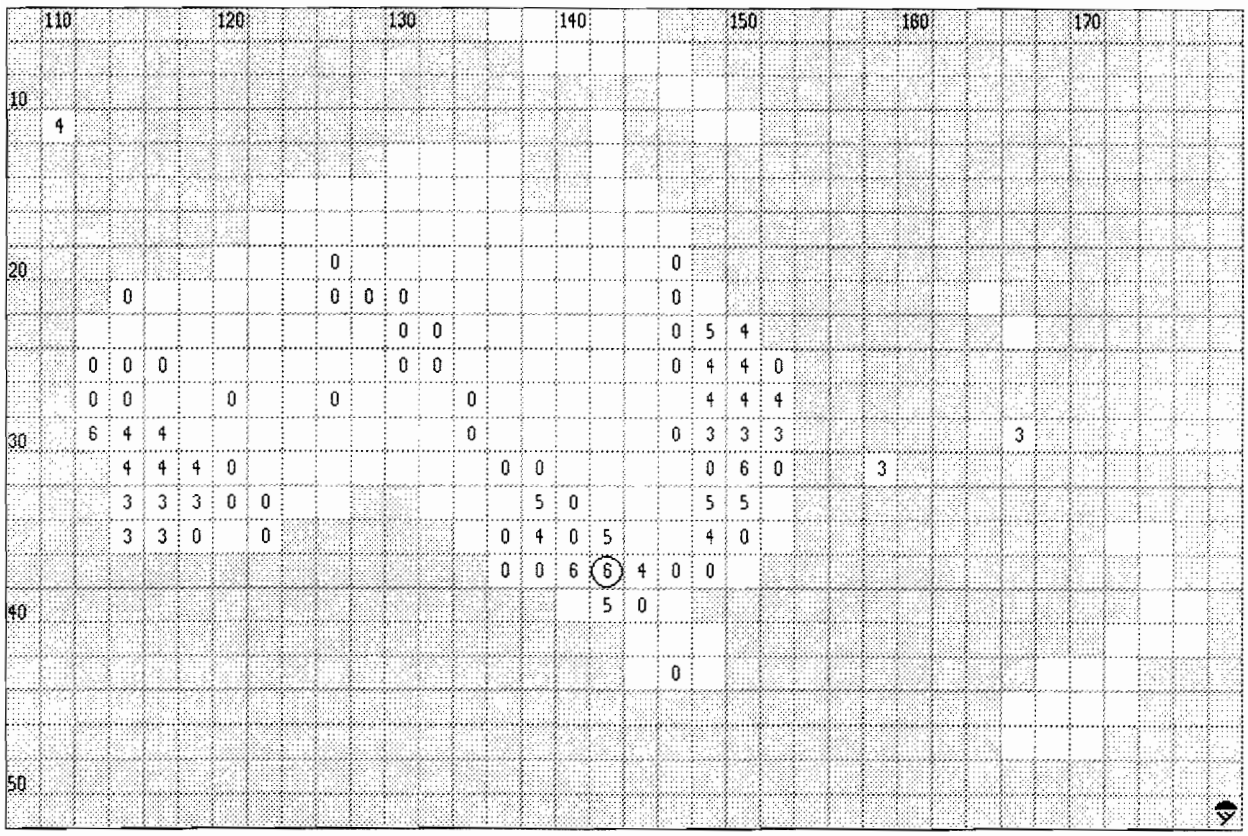
APPENDIX 8.9. MAP OF DISPERSION WEIGHT VALUES BASED ON THE 47 TERRESTRIAL SPECIES OR GEOGRAPHICALLY DISCRETE POPULATIONS OF AUSTRALIAN REPTILES PROPOSED AS ENDANGERED OR VULNERABLE.

Sequence of highest dispersion weight values is found in grid squares 472 (Perth, southern WA) and 473 (Northam, WA).



APPENDIX 8.10 MAP OF MEAN DISPERSION WEIGHT VALUES BASED ON THE 47 TERRESTRIAL SPECIES OR GEOGRAPHICALLY DISCRETE POPULATIONS OF AUSTRALIAN REPTILES PROPOSED AS ENDANGERED OR VULNERABLE.

The highest mean dispersion weight value is found in grid square 594 (Ballarat, VIC), 435 (Houtman Abrolhos, WA), 593 (Mt Gambier, SA) and 490 (Armidale, NSW).



APPENDIX 9. LIST OF HERPETOLOGICAL AUTHORITIES CONSULTED

The following list includes the names and addresses of all authorities consulted in the preparation of this Reptile Action Plan and the taxa and/or subject areas on which they provided information.

Mr Gary Backhouse
Arthur Rylah Institute
Dept of Conservation & Natural Resources
PO Box 137
HEIDELBERG VIC 3084
Aprasia aurita, Tympanocryptis lineata pinguicolla

Mr Terry Boylan
Taronga Zoo
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MOSMAN NSW 2088
Varanus rosenbergi

Mr Nigel Brothers
Dept Environment and Land Management
GPO Box 44A
HOBART TAS 7001
Niveoscincus palfreymani

Dr Andrew A. Burbidge
Western Australian Wildlife Research Centre
Dept of Conservation & Land Management
PO Box 51
WANNEROO WA 6065
Pseudemydura umbrina, Aprasia rostrata rostrata, Ctenophorus yinnietharra, Ctenotus lancelini, Egernia stokesii aethiops, Egernia s. stokesii, Morelia spilota imbricata, Elapognathus minor, Simoselaps calonotus
Policies of Western Australian Dept of CALM

Mr John Cann
26 Yarra Road
PHILLIP BAY NSW 2036
Elseya sp. nov. (Namoi River), *Emydura* tax. nov. (Bellinger River), Gen. nov. sp. nov. (Chelidae), *Rheodytes leukops*

Dr David Carter
Uluru-Kata Tjuta NP
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YULARA NT 0872
Egernia kintorei

Mr Garry Connell
Ecologia Environmental Consultants
120 McKenzie Street
WEMBLEY WA 6014
Egernia pulchra longicauda

Mr Graeme Coulson
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University of Melbourne
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Delma impar

Mr Patrick J. Couper
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PO Box 3300
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Delma labialis, Delma torquata, Paradelma orientalis, Coeranoscincus reticulatus, Lerista allanae, Furina dunmalli

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Aprasia aurita, Tympanocryptis lineata pinguicolla, Eulamprus sp. aff. tympanum

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School of Biological Sciences
Sydney Institute of Technology
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Mary Ann Street
ULTIMO NSW 2007
Chelodina expansa, Emydura macquarii, Diplodactylus taenicauda, Underwoodisaurus sphyrurus, Ophidiocephalus taeniatus, Pletholax gracilis, Cyclodomorphus sp. (samphire, SA), *Egernia coventryi, Lampropholis sp. aff. challengeri, Lerista allanae, Lerista ameles, Lerista cinerea, Lerista lineata, Lerista wilkinsi, Nannoscincus graciloides, Acanthophis antarcticus, Echiopsis atriceps, Hoplocephalus stephensii, Rhinoplocephalus sp.* (Eyre Peninsula), *Vermicella annulata*

Mr Nick Gambold
25 Waters Street
RAPID CREEK NT 0810
Cryptagama aurita, Tympanocryptis uniformis, Egernia arnhemensis, Egernia douglasi, Lerista carpentariae, Morelia oenpelliensis

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School of Applied Science
University of Canberra
PO Box 1
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Carettochelys insculpta, Chelodina expansa, Elseya sp. nov., Emydura macquarii, Emydura signata, Emydura subglobosa, Rheodytes leukops, gen. nov. sp. nov. (Mary River, QLD) (Chelidae)

Mr Dave Gibson
Conservation Commission of the NT
PO Box 1046
ALICE SPRINGS NT 0871
Ophidiocephalus taeniatus, Egernia kintorei

Mr Michael Guinea
Department of Biology
Northern Territory University
PO Box 40146
CASUARINA NT 0811
Eretmochelys imbricata, Lepidochelys olivacea, Natator depressus, Cerberus rynchops, Fordonia leucobalia, Myron richardsonii, Hydrelaps darwiniensis, Parahydrophis mertoni

Mr Harry Hines
NSW National Parks & Wildlife Service
PO Box 402
ARMIDALE NSW 2350
Coeranoscincus reticulatus, Underwoodisaurus sphyrurus

Mr Paul Horner
Vertebrate Terrestrial Zoology
NT Museum of Arts and Sciences
GPO Box 4646
DARWIN NT 0801
Varanus glauerti, Ctenotus arnhemensis, Ctenotus septenarius, Ctenotus tanamiensis, Egernia kintorei, Menetia concinna

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North Terrace
ADELAIDE SA 5000
Aprasia pseudopulchella, Delma impar, Ophidiocephalus taeniatus, Eulamprus sp. aff. tympanum, Pseudemoia baudini, Pseudemoia rawlinsoni, Tiliqua adelaidensis, Austrelaps labialis, Echiopsis curta, Notechis ater ater

Dr Glen J. Ingram
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PO Box 3300
SOUTH BRISBANE QLD 4101
Anomalopus gowi, Calyptotis temporalis, Ctenotus aphrodite, Ctenotus astarte, Ctenotus capricorni, Ctenotus hypatia, Ctenotus monticola, Ctenotus nullum, Ctenotus terrareginae, Ctenotus schevilli, Ctenotus zebrilla, Egernia rugosa, Eulamprus murrayi, Emoia atrocostata australis, Lampropholis colossus, Lampropholis mirabilis, Lampropholis robertsi, Lerista ingrami, Lerista storri, Menetia koshlandi, Menetia sadlieri, Chondropython viridis, Denisonia maculata, Furina barnardi

Messrs Steve and Bob Irwin
Queensland Reptile and Fauna Park
Glasshouse Tourist Route
BEERWAH QLD 4519
Paradelma orientalis, Furina dunmalli

Mr Hank Jenkins
Australian Nature Conservation Agency
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Delma impar, Hypsilurus spinipes, Tympanocryptis lineata pinguicolla, Niveoscincus palfreymani, Hoplocephalus bungaroides

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DARWIN NT 0801
Caretta caretta, Chelonia mydas, Eretmochelys imbricata, Lepidochelys olivacea, Natator depressus, Dermochelys coriacea, Carettochelys insculpta, Diplodactylus occultus

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University of Michigan
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USA
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University of Western Australia
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Pseudemydura umbrina

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TUGGERANONG ACT 2901
Delma impar, Tympanocryptis lineata pinguicolla

Mr Cameron Leary
NSW National Parks & Wildlife Service
LORD HOWE ISLAND NSW 2898
Christinus guentheri, Pseudemoia lichenigera

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Eulamprus leuraensis

Mr Rick Longmore
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Qld Dept of Environment & Heritage
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ATHERTON QLD 4883
Rheodytes leukops, Delma labialis, Delma torquata, Paradelma orientalis, Anomalopus gowi, Calyptotis temporalis, Ctenotus aphrodite, Ctenotus astarte, Ctenotus capricorni, Ctenotus hypatia, Ctenotus monticola, Ctenotus nullum, Ctenotus schevilli, Ctenotus terrareginae, Ctenotus zebrilla, Egernia rugosa, Emoia atrocostata australis, Eulamprus murrayi, Lampropholis colossus, Lampropholis mirabilis, Lampropholis robertsi, Lerista ingrami, Lerista storri, Lerista vittata, Menetia koshlandi, Menetia sadlieri, Chondropython viridis, Denisonia maculata, Furina barnardi, Furina dunmalli

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Notechis ater ater

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Dr Will S. Osborne
ACT Parks & Conservation Service
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TUGGERANONG ACT 2901
Aprasia parapulchella, Delma impar, Tympanocryptis lineata pinguicolla, Varanus rosenbergi

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FIGTREE POCKET QLD 4069
Delma torquata

Mr John L. Read
Environment Department
Olympic Dam Operations
PO Box 150
ROXBY DOWNS SA 5725
Nephrurus deleani, Austrelaps labialis

Mr Peter Robertson
Senior Scientist
Arthur Rylah Institute
Dept of Conservation & Natural Resources
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HEIDELBERG VIC 3084
Aprasia aurita, Delma impar, Paradelma orientalis

Mr David Rounsevell
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Niveoscincus palfreymani, Dept of Environment and Land Management policies

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Christmas Island
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USA
Insular reptile populations

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Dept of Veterinary Anatomy
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Emydura subglobosa, Nactus galgajuga, Aprasia haroldi, Aprasia pseudopulchella, Aprasia rostrata rostrata, Delma impar, Delma labialis, Delma mitella, Delma torquata, Paradelma orientalis, Ctenophorus yinnietharra, Tympanocryptis lineata pinguicolla, Tympanocryptis uniformis, Anomalopus mackayi, Bartleia jigurru, Calyptotis thorntonensis, Carlia scirtetis, Ctenotus alleni, Ctenotus zastictus, Egernia arnhemensis, Egernia pilbarensis, Egernia saxatilis saxatilis, Egernia stokesii badia, Eroticoscincus graciloides, Eulamprus kosciuskoi, Eulamprus leuraensis, Lampropholis caligula, Lerista allanae, Lerista stictopleura, Menetia amaura, Tiliqua adelaidensis, Simoselaps minimus

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Hoplocephalus bungaroides

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Aprasia aurita

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Aprasia rostrata rostrata, Ctenophorus yinnietharra, Ctenotus zastictus, Egernia pulchra longicauda, Egernia stokesii aethiops, Egernia stokesii badia, Egernia stokesii stokesii, Aspidites ramsayi, Morelia spilota imbricata, Echiopsis atriceps, Simoselaps calonotus

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Government Conservator
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NORFOLK ISLAND
SOUTH PACIFIC 2899
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ST IVES NSW 2057
Underwoodisaurus sphyrurus

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BOYNE ISLAND QLD 4680
Paradelma orientalis

Dr Grahame J.W. Webb
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WINNELLIE NT 0821
Carettochelys insculpta

Mr Jonathon Webb
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School of Biological Sciences
UNIVERSITY OF SYDNEY NSW 2006
Hoplocephalus bungaroides

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Delma impar

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Phyllurus caudiannulatus, Delma torquata, Paradelma orientalis, Anomalopus gowi, Anomalopus mackayi, Calyptotis temporalis, Coeranoscincus reticulatus, Ctenotus aphrodite, Ctenotus astarte, Ctenotus capricorni, Ctenotus hypatia, Ctenotus monticola, Ctenotus nullum, Ctenotus schevilli, Ctenotus terrareginae, Ctenotus zebrilla, Egernia rugosa, Emoia atrocostata australis, Eulamprus murrayi, Lampropholis colossus, Lampropholis mirabilis, Lampropholis robertsi, Lerista storri, Lerista ingrami, Menetia koshlandi, Menetia sadlieri, Chondropython viridis, Denisonia maculata, Furina barnardi, Furina dunmalli

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Delma impar
Reptiles of the NT and the ACT

APPENDIX 10. METHODOLOGY

Categories of threatened taxa

These categories have already been defined in the Introduction; they are repeated here so they can be consulted in relation to the methods used for the Reptile Action Plan.

The definitions of 'Endangered', 'Vulnerable' and 'Insufficiently Known' used in this publication are those used officially by the World Conservation Union (IUCN), with minor additions to the endangered and vulnerable categories. These modifications are used by the Endangered Species Program (ESP) and the Australian and New Zealand Environment and Conservation Council (ANZECC). The classifications 'Extinct' and 'Rare' are also used in this publication; their definitions appear in the Introduction and are repeated below:

Extinct: Taxa not definitely located in the wild during the past 50 years, or species that have not been found in recent years despite thorough searching.

Endangered: Taxa in danger of extinction and whose survival is unlikely if the causal factors continue to operate.
Included are taxa whose numbers have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to be in immediate danger of extinction. Also included are taxa that may now be extinct but have definitely been seen in the wild during the past 50 years and have not been subject to thorough searching.

Vulnerable: Taxa believed likely to move into the 'Endangered' category in the near future if the causal factors continue to operate.
Included are species of which most or all of the populations are decreasing because of over-exploitation, extensive destruction of habitat or other environmental disturbance; species with populations that have been seriously depleted and whose ultimate security has not yet been assured; and taxa with populations that are still abundant but are under threat from severe adverse factors throughout their range. Also included are taxa with low or localised populations or dependent on limited habitat that would be vulnerable to new threatening processes. In practice, both 'Endangered' and 'Vulnerable' categories may include, temporarily, species whose populations are beginning to recover as a result of remedial action, but whose recovery is at present insufficient to justify their transfer to another category.

Rare: Taxa with small populations that are not at present 'Endangered' or 'Vulnerable', but are threatened. These taxa are usually localised within restricted geographical areas or habitats or are thinly scattered over a more extensive range.

Insufficiently known: Species that are *suspected* of being 'Endangered', 'Vulnerable' or 'Rare' but whose true status cannot be determined without more information.

While these categories may appear relatively unambiguous to the layman, they are highly subjective, with the boundaries between one category and the other being difficult to define in any objective way: boundaries between these categories vary widely in different countries and regions, and in different taxonomic groups.

More recently (Mace and Lande, 1991) the shortcomings of these categories have been recognised and a new classification, using more objective criteria, has been proposed to replace them.

The proposed categories are:

Critical: 50% probability of extinction within 5 years or 2 generations, whichever is the longer.

Endangered: 20% probability of extinction within 20 years or 10 generations, whichever is the longer.

Vulnerable: 10% probability of extinction within 100 years.

The criteria used to assign species to the above categories are summarised in Table 4 below.

TABLE 4 THE NUMERICAL CHARACTERISTICS OF THREAT CATEGORIES (FROM GARNETT, 1992 AFTER MACE AND LANDE, 1991)

A taxon is assigned to Critical if it meets any *two* of the Critical criteria, to Endangered if it meets any *two* of the Endangered criteria or any *one* of the Critical criteria, and to Vulnerable if it meets any *two* of the Vulnerable criteria or any *one* of the Endangered criteria. Also criteria are considered to have been met if observed, inferred or projected habitat alteration (i.e. degradation, loss or fragmentation) or observed, inferred or projected commercial exploitation or ecological interactions with introduced species (predators, competitors, pathogens or parasites) results in the characteristics of any of the criteria.

Criteria of Threat	Critical	Endangered	Vulnerable
Total population	N < 250 individuals	N < 2500 individuals	N < 10,000 individuals
Extent of fragmentation	≤ 2 populations of > 125 individuals	≤ 5 populations of > 500 individuals or ≤ 2 populations of > 1250 individuals and immigration of < 1 individual/ generation	≤ 5 populations of > 2500 individuals or ≤ 2 populations of > 5000 individuals and immigration of < 1 individual/ generation
Rate of population decline	> 20%/yr for 2 yr > 50% in last generation	> 5%/yr for 5 yr > 10% in 2 generations	> 1%/yr for 10 yr
Frequency and extent of catastrophes (sub-population highly correlated in population fluctuations)	> 50% reduction in population/5-10 yr or every 2-4 generations	> 20% reduction in population/5-10 yr or every 2-4 generations or > 50% reduction in population/10-20 yr or every 5-10 generations	> 10% reduction in populations/5-10 yr or > 20% reduction in population/10-20 yr or > 50% reduction in population/50 yr

These new categories are still being assessed and await acceptance by the relevant agencies. Nevertheless it is important to make some assessment of their value, *vis à vis* the older categories, in the present study on Australian reptiles. The Mace and Lande categories clearly offer more objective criteria for managers and more useful information for priority-setting when allocating scarce financial and human resources for threatened species conservation.

However it is the view of the Consultant that the Mace and Lande classification has little applicability in the context of the Australian reptile fauna simply because the underlying information base is usually absent. Such an information base would require relatively reliable information on a number of life history parameters (e.g. reproductive rates, survivorship, population density) and on ecological/distributional parameters (e.g. overall range, range fragmentation, habitat preferenda, etc). As indicated above, such relatively complete data sets are available for less than 2% of Australian reptile species and the lack of data for <u>any</u> of the species proposed for Endangered status is exemplified in Table 5 below.

TABLE 5 ENDANGERED AUSTRALIAN TERRESTRIAL REPTILES: EXTENT OF KNOWLEDGE ON POPULATION AND DECLINE WHICH CAN BE APPLIED TO THE MACE AND LANDE SYSTEM OF CLASSIFICATION

TAXON	Population size	No. populations	Size of each population	Rate of decline	Frequency & extent of catastrophes
Pseudemydura umbrina	c. 30 alive in the wild (Burbidge & Kuchling, in press)	1 (Ellen Brook NR)	30	100% in Twin Swamps NR (Burbidge & Kuchling, in press)	Area occupied declined 25-74% (RAP Workshop)
Tiliqua adelaidensis	≥ 50 individuals recorded in Burra region since October 1992	4 populations are known, 3 of them within 8 km of each other.		Known to be declining; not recorded between 1959 and 1992	Area occupied declined 90-100% (RAP Workshop)
Gen. nov. sp. nov.	Unknown but suspected to be small (14 specimens in museum collections)	Known from 2 localities about 30 km apart		Unknown, suspected to be declining (Cann & Sadlier, pers. comm.)	Area occupied declined 25-74% (Cann & Sadlier, pers. comm.)
Ctenotus lancelini	Total area of suitable habitat 1.5 ha (Andrew Burbidge, *in litt.*); ∴ pop. ≤ 2,500	2 isolated areas of suitable habitat (Peterson, *in litt.*)		90% based on sight records: 1981/83: 10+ 1992/93: 0-1	Area occupied declined 25-74% (RAP Workshop)
Aprasia aurita	Unknown, suspected to be small; only 15 recorded since 1985 (Backhouse & Robertson, 1992)	Known from only 4 localities within an area of about 400 ha		Unknown, suspected to be declining; not recorded between 1911 and 1985	Area occupied declined 25-74% (RAP Workshop)
Eulamprus leuraensis	Unknown but suspected to be small (RAP Workshop)	Known from only 3 localities	≥10 sight records at one site in 1991	Known to be declining (RAP Workshop)	Area occupied declined 25-74% (RAP Workshop)
Eulamprus tympanum ssp. nov.	Unknown but suspected to be small (RAP Workshop) 65 specimens in museum collns			Known to be declining (RAP Workshop)	Area occupied declined 25-74% (RAP Workshop)
Lerista allanae	Unknown but suspected to be small (Jeanette Covacevich & Patrick Couper, *in litt.*) 10 specimens in museums	Known from only 4 localities		Unknown but suspected to be declining (Covacevich & Couper, *in litt.*) no records since 1960	Area occupied declined 75-89% (Covacevich & Couper, *in litt.*)
Aspidites ramsayi	Fewer than 500 (Laurie Smith, pers. comm.)	Probably many - habitat fragmented		Known to be declining (Laurie Smith, pers. comm.); in WAM colln only 8 specimens since 1960, only 1 since 1980	Area occupied declined 75-89% (Laurie Smith, pers. comm.)
Simoselaps calonotus	Unknown but suspected to be small (RAP Workshop)	Probably many - habitat fragmented		Unknown but suspected to be declining (RAP Workshop)	Area occupied declined 24-75% (RAP Workshop)
Egernia stokesii badia	Unknown but suspected to be small (Laurie Smith, pers. comm.)	Probably many - habitat fragmented		Known to be declining (Laurie Smith, pers. comm.); in WAM colln no specimens since 1977	Area occupied declined 75-89% (Laurie Smith, pers. comm.)

On the basis of these data, only *Pseudemydura umbrina* and *Ctenotus lancelini* could be assigned to a category in the Mace and Lande classification - both would rank as Endangered (Critical). However, knowledge of the true size of the *C. lancelini* population is inadequate to confidently assign it to such a category. Consequently the authors have not been able to assess the Mace and Lande classification in any objective way against other systems used to rank the conservation status of Australian reptiles.

The nomination process

It was not possible within the time constraints of the consultancy to compile the necessary database and apply analytical methodology to all 765 currently-recognised species of Australian reptiles.

Consequently, in order to focus on those species which were most at risk and were therefore potential candidates for Endangered or Vulnerable status, an initial subgroup of potentially-threatened species or populations was identified from a variety of published sources: the threatened species schedules of State conservation agencies and ANZECC, the 1990 IUCN Red List, and various published papers.

To this list were added further species or populations nominated by agencies or individuals in response to the circulated questionnaires (section 10.3 below), creating a final list of 204 species for further consideration. These species, together with the source of their nomination, are listed in Appendix 3.

Questionnaire

A questionnaire seeking nominations of species or populations thought to be potentially endangered, vulnerable or rare, together with information on past and present distribution and the threatening processes which might be operating, was developed early in the consultancy.
120 questionnaires were distributed to individuals and organisations with herpetological, biological or natural history interests and 26 were returned; individuals who responded are listed in Appendix 9, and organisations that responded are acknowledged in the Introduction.

A modified version of the questionnaire was sent to the nine State and Territory wildlife conservation agencies and six were returned; agency staff who provided information at various stages of the consultancy are acknowledged in Appendix 9 and/or the Introduction.

Assessing and ranking nominations

In the original consultancy tender it was proposed to develop a methodology for ranking all Australian reptile species on a continuous scale of relative "vulnerability". The rationale for such a proposal was that the biological and ecological knowledge base for Australian reptiles was fragmentary and dynamic, with new information becoming available almost monthly.

A major shortcoming of much of the existing classification and legislation for threatened species is that the processes to revise and change the status of listed species are cumbersome and bureaucratic, and lack the flexibility to respond quickly to a changing knowledge base. This is not simply the result of bureaucratic inertia, but arises largely because the biological basis for identifying threatened species is highly subjective and qualitative.

Further, existing evaluation systems for threatened species rarely assign weighted values to such variables as phylogenetic uniqueness, previous rates of decline, extent to which threatening processes have been moderated, etc.

The authors proposed the development of a dynamic methodology (not necessarily *de novo*, as a number of methodologies have already been proposed and applied to particular taxonomic groups or geographic regions eg Ahern *et al.*, 1985; Molloy and Davis, 1992) which would allow species or populations of Australian reptiles to be ranked, on some sort of continuous scale. More importantly, the ranking criteria should be as objective as possible to allow immediate re-ranking of the included taxa as new information about individual taxa became available.

Such a methodology was being developed when the senior author was made aware of a new scheme proposed by wildlife authorities in Florida (Millsap *et al.* 1990). This method appeared to fulfil most of the above requirements identified in the consultancy, and

so a subset of 20 Australian reptiles (including taxa which were not regarded as being under any threat) was selected for trialing under the Millsap et al. system which was modified to apply to the Australian situation (i.e. a continental rather than a small regional fauna).

One of the most attractive features of the Millsap *et al.* approach is that it takes appropriate account of the knowledge base; lack of knowledge about a particular parameter is assigned a score commensurate with the significance of that parameter in identifying threatening processes.

The resultant trial proved to be surprisingly robust, with the ranking of all trial taxa strongly correlated with the subjective opinions of a range of specialists. The Millsap *et al.* methodology was therefore adopted (with some further modifications, discussed below) to rank the 204 species which had been nominated as threatened.

The essential feature of the Millsap *et al.* methodology is the recognition of three distinct but often related data sets, each of which consists of a suite of scored criteria. These data sets are:

1. **Biological variables** which assess the state of a series of biological/ecological parameters for each taxon;

2. **Action variables** which attempt to assess the state of the knowledge base available from which to develop effective **management** actions for the taxon (it also assesses the current level of management); and

3. **Supplemental variables** which attempt to assess the genetic significance of the taxon, its residence status in Australia, and its level of protection from harvesting.

The table of variables with the scale of scores (modified for Australian conditions from Tables 1-3 in Millsap *et al.* (1990)) appears at the end of this Appendix as Table 6.

Only the scores assigned in the "biological variables" data set were used to rank the nominated taxa. This data set assesses the extent and trend of a taxon's distribution and population size and the factors which influence its potential for recovery - reproductive parameters and degree of ecological specialisation. It is the data set which identifies the conservation status of a taxon - the higher the score, the more the species is at risk.

The "action variables" data set, while identifying the level of knowledge on a taxon, does not reflect the degree of risk; the Saltwater Crocodile (*Crocodylus porosus*) and the Western Swamp Tortoise (*Pseudemydura umbrina*) have similar, very low scores for this data set (indicating that much is known about their distribution, population trend and population limitations) but the former is considered only rare, while the latter is critically endangered. The supplemental variables are weighted to rank high those taxa which are endemic to Australia and are genetically distinctive, not necessarily the parameters which should be given precedence in assigning conservation priorities.

Specialist Workshop

It became evident early in the consultancy that the effective assessment of the adopted methodologies would require a group of herpetologists with specialist knowledge of the biology, ecology and systematics of Australian reptiles to (a) input data directly into the various scoring and ranking systems, and (b) assess whether the rankings obtained from the application of the Millsap *et al.* methodology reflected the subjective opinions of Australian specialists.

To this end a workshop was held over three days in December 1991 at the University of Sydney's Crommelin Biological Field Station at Pearl Beach. It was attended by 17 representative herpetologists who used the modified Florida scheme to assess and score the relative conservation status of the 204 species on the working list.

The selection of participants was carefully designed to include taxonomists, ecologists, and both professional and non-professional field herpetologists from most parts of Australia. In addition, Dr Arnold Kluge was currently visiting the Australian Museum and so was invited to participate. Dr Kluge's extensive knowledge of the Australian reptile fauna, and his impeccable credentials as a cladistician, provided valuable input to the workshop and to improving the

methodology. The participants at the workshop are listed in the Introduction. The scores they assigned to the taxa appear in Appendix 11, and the immediate outcomes of the workshop - the ranked sequence of Endangered, Vulnerable and Rare or Insufficiently Known according to the total scores for biological variables - appears in Appendix 2.

Species Recovery Outlines

The Species Recovery Outlines were compiled from the following sources: museum collection databases, published papers, books and maps, personal knowledge of the species, and most importantly, the collective knowledge of numerous herpetologists and conservation officers whose valuable and generous contribution is acknowledged in Appendix 9.

Data on specimens of Endangered and Vulnerable species held in Australian museum collections were entered on a database from which were created distribution maps based on a 2° grid map of Australia. Locality data were searched for conservation reserves and these formed the basis of information in Field **10. Conservation reserves on which species occurs.**

The ERIN database of Australian Nature Conservation Reserves (January 1992) was interrogated to create a list of reserves situated in the same grid squares as the specimen records; the list was culled to exclude reserves with unsuitable habitat or topography, to produce a final list - Field **10A. Other conservation reserves where species might be expected to occur**).

References:

Garnett, S. 1992. The Action Plan for Australian Birds. Australian National Parks and Wildlife Service, Canberra. 262 pp.

World Conservation Monitoring Centre with IUCN and the International Council for Bird Preservation 1990. 1990 IUCN Red List of Threatened Animals. IUCN - the World Conservation Union, Gland. 192 pp.

Mace, G.M. and Lande, R. 1991. Assessing extinction threats: towards a re-evaluation of IUCN threatened species categories. Conservation Biology 5: 148-157.

Millsap, B.A., Gore, J.A., Runde, D.E. and Cerulean, S.I. 1990. Setting priorities for the conservation of fish and wildlife species in Florida. Wildlife Monographs 111: 1-57.

Molloy, J. and Davis, A. 1992. Setting priorities for the conservation of New Zealand's threatened plants and animals. Department of Conservation, Te Papa Atawhai, Wellington.

TABLE 6 VARIABLES USED TO ASSESS AND RANK AUSTRALIAN REPTILES NOMINATED FOR THREATENED STATUS (BASED ON MILLSAP ET AL., 1990)

1. BIOLOGICAL VARIABLES, CATEGORIES WITHIN VARIABLES, AND SCORES USED IN RANKING TAXA.

Biological variables and categories within variables	Assigned Points
1. Population size - the estimated no. of adults throughout the range of taxon (ie worldwide).	
(a) 0-500 individuals	10
(b) 501-1,000 individuals, or population size is unknown but suspected to be small	8
(c) 1,001-3,000 individuals	6
(d) unknown population size	5
(e) 3,001-10,000 individuals	4
(f) 10,001-50,000 individuals, or size is unknown but suspected to be large	2
(g) >50,000 individuals	0
2. Population trend in Australia - overall trend in no. of individuals throughout taxon's range over last 5 decades. If population trend is unknown, consider trends in the availability and condition of the taxon's habitat as indicative of population trend.	
(a) Population size known to be decreasing	10
(b) Trend unknown but population size suspected to be decreasing	8
(c) Population formerly experienced serious declines but is presently stable or increasing	6
(d) Population trend unknown	5
(e) Population size stable or suspected to be stable or increasing	2
(f) Population size known to be increasing	0
3. Range size in Australia - the size of area over which the taxon is distributed during the season when distribution is most restricted (eg for a species that nests over 1,000 km^2 on the coast, use the breeding range).	
(a) < 100 km^2	10
(b) 101-1,000 km^2	9
(c) 1,001-80,000 km^2 (up to 1% area of Aust; approx the area of Tas).	7
(d) 80,001-1,000,000 km^2 (up to 12% area of Aust. or about the size of South Australia)	4
(e) 1,000,001-4,000,000 km^2 (about 50%of the area of Australia)	1
(f) >4,000,000 km^2	0
4. Distribution trend - % change (since European settlement) in area occupied by the taxon. (This is an estimate of change in the portion of the total range that is occupied or utilised; it may not equal the change in total range.)	
(a) Area occupied has declined by 90-100%	10
(b) Area occupied has declined by 75-89%	8
(c) Area occupied has declined by 25-74%	5
(d) Area occupied has declined by 1-24%	2
(e) Area occupied is stable or has increased	0

5. Geographic population concentration - degree to which individuals within populations congregate or aggregate seasonally (eg at hibernacula, breeding sites, migration focal points) or daily (eg communal roosts) at specific locations. Implies a regular temporal compression of the distribution independent of factors considered in variables 3 and 4 above.
   (a) Majority concentrates at single location 10
   (b) Concentrates at 1-25 locations 6
   (c) Concentrates at >25 locations 2
   (d) Does not concentrate 0

6. Reproductive potential for recovery - ability of the taxon to recover from serious declines in population size.
   A. Average number of eggs or live young produced/adult female/yr
      (a) <1 offspring/female/yr 5
      (b) 1-9 offspring/female/yr 3
      (c) 10-100 offspring/female/yr 1
      (d) >100 offspring/female/yr 0
   B. Minimum age at which females typically first reproduce.
      (a) >8 yr 5
      (b) 4-8 yr 3
      (c) 2-3 yr 1
      (d) <2 yr 0

7. Ecological specialisation - degree to which the taxon is dependent upon certain environmental factors.
   A. Dietary specialisation - choices below relate to the extent to which local populations are likely to be able to respond to decreases in availability of preferred food type.
      (a) No. of individuals declines; no substantial shift in diet
         (i) Taxonomic specialist ie eat only vertebrates of one family group (or lower) taxon OR only invertebrates of one order group (or lower) taxon. 1.6
         (ii) Food class specialist (eg eggs and larvae of ants and termites; plants) 1.7
      (b) Substantial shift in diet with little change in no. of individuals 0
   B. Reproductive specialisation - choices below relate to the primary way in which local populations respond to decreases in availability of preferred breeding sites (eg turtle's breeding beach).
      (a) No. of individuals or no. of breeding attempts declines but no substantial shift to other breeding sites 3.3
      (b) Substantial shift to alternate breeding sites with little change in no. of individuals 0
   C. Other specialisations - ecological, behavioural or morphological specialisations not covered in variables 7A or 7B (eg strict requirements for hibernacula, narrow ambient temperature limits, specific roosting structures or large number of derived advanced characters (apomorphies)).
      (a) Highly specialised 3.3
      (b) Moderately specialised 1.7
      (c) Not specialised 0

2. ACTION VARIABLES, CATEGORIES WITHIN VARIABLES, AND SCORES USED IN RANKING TAXA.

Action variables and categories within variables	Assigned Points
1. Knowledge of distribution in Australia (survey score).	
(a) Distribution is extrapolated from a few locations or knowledge limited to general maps or known only from single records, type series etc	10
(b) Broad range limits or habitat associations are known, but local occurrence cannot be predicted accurately	5
(c) Distribution is well known and occurrence can be accurately predicted throughout the range	0
2. Knowledge of population trend in Australia (monitoring score).	
(a) Not currently monitored	10
(b) Monitored locally	6
(c) Statewide monitoring, but not with statistical sensitivity	4
(d) Statewide monitoring with statistical sensitivity, or nearly complete census	0
3. Knowledge of Australian population limitations (research score).	
(a) Factors affecting population size and distribution are unknown or unsubstantiated	10
(b) Some factors affecting population size and distribution are known, but 1 or more major factors are unknown	5
(c) All major factors affecting population size and distribution are known	0
4. Ongoing management activities in Australia (management score).	
(a) None directed primarily at the taxon	10
(b) Management mostly related to enforcement of conservation laws	5
(c) Some direct management/interventionist (ie manipulation of natural populations) activities in addition to enforcement of conservation laws	0

3. SUPPLEMENTAL VARIABLES AND CATEGORIES WITHIN VARIABLES

Supplemental variables and categories within variables	Assigned Points
1. Systematic significance of the taxon (select *all* categories that apply).	
(a) Monotypic family	5
(b) Monotypic genus	4
(c) Monotypic species (no described subspecies)	3
(d) Disjunct subspecies	2
(e) Intergrading subspecies or taxonomic distinctiveness uncertain	1
2. % of taxon's total range that occurs in Australia (select category that best applies).	
(a) endemic to Australian island(s)	5
(b) endemic to Australia	4
(c) 75-99% of total range in Australia	3
(d) 50-74% of total range in Australia	2
(e) 25-49% of total range in Australia	1
(f) <25% of total range in Australia	0
3. Trend in taxon's Australian population (select category that best applies).	
(a) Australian population known to be decreasing	6
(b) Australian population trend unknown or suspected to be declining	5
(c) Australian population stable or increasing overall but declining in some areas	4
(d) Australian population formerly experienced serious declines but is presently stable or increasing	3
(e) Australian population is stable or suspected to be stable or increasing	2
(f) Australian population is known to be increasing	1
4. Period of occurrence in Australia (select category that best applies).	
(a) Permanent resident	4
(b) Resident during breeding season	3
(c) Resident during winter or non-breeding season	2
(d) Transient	1
5. Harvest of the taxon in Australia (select category that best applies).	
(a) Harvested, with no legal protection	4
(b) No substantial harvest other than accidental take or harvest of nuisance animals; no legal protection	3
(c) Harvested, but harvest regulated (includes taxa utilised by Aboriginal and Torres Strait Islander communities)	2
(d) Harvest prohibited by regulation	1

APPENDIX 11. SCORES ASSIGNED TO AUSTRALIA'S THREATENED REPTILES, BASED ON MILLSAP ET AL. (1990)

TAXON	Biological Variables										Biological Score	Action Variables				Action Score	Supplemental Variables							
	1	2	3	4	5	6A	6B	7A	7B	7C		1	2	3	4		1(a)	1(b)	1(c)	1(d)	1(e)	2	3	4	5
FAMILY CROCODYLIDAE																									
Crocodylus johnstoni	0	6	4	0	2	1	5	0	3.3	1.7	23	5	4	0	0	9	0	0	3	0	0	4	3	4	2
Crocodylus porosus	0	6	4	0	2	1	5	0	3.3	1.7	23	0	4	0	0	4	0	0	3	0	0	1	3	4	2
FAMILY CHELONIIDAE																									
Caretta caretta	0	10	7	0	2	0	5	0	0	1.7	25.7	5	4	5	5	19	0	4	0	2	0	0	6	3	2
Chelonia mydas	0	8	7	0	2	0	5	0	0	1.7	23.7	5	4	5	5	19	0	4	0	2	0	0	5	3	2
Eretmochelys imbricata	0	8	7	0	2	0	5	0	0	1.7	23.7	5	10	5	5	25	0	4	0	2	0	0	5	3	2
Lepidochelys olivacea	0	8	7	0	0	0	5	0	0	1.7	21.7	5	10	5	5	25	0	4	0	2	0	0	5	3	2
Natator depressus	2	2	7	0	2	1	5	0	0	1.7	20.7	5	6	5	5	21	0	4	3	0	0	3	2	3	2
FAMILY DERMOCHELYIDAE																									
Dermochelys coriacea	0	8	0	0	0	0	5	1.6	0	1.7	16.3	5	10	5	5	25	5	4	0	2	0	0	5	2	2
FAMILY CARETTOCHELYDIDAE																									
Carettochelys insculpta	2	2	7	0	2	1	5	0	3.3	1.7	24	5	6	5	5	21	5	4	3	2	0	1	5	4	2
FAMILY CHELIDAE																									
Chelodina expansa	2	2	4	0	0	1	5	0	0	1.7	15.7	0	10	10	5	25	0	0	3	2	0	4	2	4	1
Elseya sp. nov. (Bellinger R.)	5	5	9	2	0	1	5	0	0	0	27	0	10	5	10	25	0	0	0	2	0	4	5	4	1
Elseya sp. nov. (Manning R.)	5	5	9	2	0	1	5	0	0	0	27	0	10	10	10	30	0	0	3	0	0	4	5	4	1
Elseya sp. nov. (Namoi R.)	8	8	9	2	0	1	5	0	0	0	33														
Emydura macquarii	0	2	4	0	0	1	5	0	0	0	12	0	6	0	5	11	0	0	3	0	0	4	2	4	1
Emydura signata (Bellinger R.)	10	5	10	2	0	1	5	0	0	0	33	0	6	0	5	11	0	0	3	2	0	4	2	4	1
Emydura subglobosa	2	5	10	0	0	1	5	0	0	0	23	0	10	10	5	25	0	0	3	0	0	0	2	4	1

TAXON	Biological Variables										Biological Score	Action Variables				Action Score	Supplemental Variables								
	1	2	3	4	5	6A	6B	7A	7B	7C		1	2	3	4		1(a)	1(b)	1(c)	1(d)	1(e)	2	3	4	5
Pseudemydura umbrina	10	10	10	5	0	3	5	0	0	3.3	46.3	0	0	5	0	5	0	4	3	0	1	4	6	4	1
Rheodytes leukops	8	5	9	0	0	1	3	0	0	3.3	29.3	5	10	10	5	30	0	4	3	0	0	4	2	4	1
Gen. nov. sp. nov. (Mary R.)	8	8	9	5	6	1	5	0	0	1.7	43.7	5	10	5	10	30	0	4	3	0	0	4	5	4	1
FAMILY GEKKONIDAE																									
Christinus guentheri	2	6	9	8	0	3	1	0	3.3	0	32.3	0	10	5	5	20	0	0	3	0	0	5	3	4	1
Diplodactylus fulleri	5	2	10	0	0	3	1	0	0	1.7	22.7	10	10	10	5	35	0	0	3	0	0	4	2	4	1
Diplodactylus kenneallyi	5	2	10	0	0	3	1	0	0	1.7	22.7	10	10	10	5	35	0	0	3	0	0	4	2	4	1
Diplodactylus occultus	8	2	10	0	0	3	1	0	0	0	24	5	6	10	5	26	0	0	3	0	0	4	2	4	1
Diplodactylus taenicauda	2	8	7	2	0	3	1	0	0	1.7	24.7	5	10	5	5	25	0	0	3	0	0	4	5	4	1
Lepidodactylus listeri	5	10	10	5	0	3	0	0	0	1.7	34.7	5	10	5	5	25	0	0	3	0	0	5	6	4	1
Lepidodactylus pumilus	5	2	9	0	0	3	0	0	0	1.7	20.7	10	10	10	5	35	0	0	3	0	0	3	2	4	1
Nactus galgajuga	2	2	10	0	0	3	0	0	0	1.7	18.7	0	10	5	5	20	0	0	3	0	0	4	2	4	1
Nephrurus deleani	5	8	7	2	0	3	1	0	0	3.3	29.3	5	10	5	5	25	0	0	3	0	0	4	5	4	1
Oedura reticulata	2	6	4	5	0	3	3	0	0	1.7	24.7	0	6	0	5	11	0	0	3	0	0	4	3	4	1
Phyllurus caudiannulatus	5	2	9	2	0	3	1	0	0	1.7	23.7	5	10	5	10	30	0	0	3	0	0	4	2	4	1
Underwoodisaurus sphyrurus	5	8	7	5	0	3	1	0	0	0	29	5	10	10	5	30	0	0	3	0	0	4	5	4	1
FAMILY PYGOPODIDAE																									
Aclys concinna major	5	2	9	2	0	3	1	0	0	1.7	23.7	10	10	10	5	35	0	4	0	2	0	4	2	4	1
Aprasia aurita	8	8	10	5	0	3	1	1.7	0	1.7	38.4	0	4	5	5	14	0	0	3	0	0	4	5	4	1
Aprasia haroldi	5	2	9	0	0	3	1	1.7	0	1.7	23.4	10	10	10	5	35	0	0	3	0	0	4	2	4	1
Aprasia parapulchella	5	6	7	2	0	3	1	1.7	0	1.7	27.4	5	6	5	5	21	0	0	3	0	0	4	3	4	1
Aprasia pseudopulchella	5	6	7	5	0	3	1	1.7	0	1.7	30.4	5	10	5	5	25	0	0	3	0	0	4	3	4	1
Aprasia rostrata rostrata	8	8	10	2	0	3	1	1.7	0	1.7	35.4	0	10	5	5	20	0	0	0	2	0	5	5	4	1
Delma impar	5	10	4	8	0	3	1	0	0	1.7	32.7	5	6	5	0	16	0	0	3	0	0	4	6	4	1

TAXON	Biological Variables										Biological Score	Action Variables				Action Score	Supplemental Variables								
	1	2	3	4	5	6A	6B	7A	7B	7C		1	2	3	4		1(a)	1(b)	1(c)	1(d)	1(e)	2	3	4	5
Delma labialis	5	8	7	5	0	3	1	0	0	1.7	30.7	10	10	10	5	35	0	0	3	0	0	4	5	4	1
Delma mitella	5	5	9	2	0	3	1	0	0	1.7	26.7	10	10	10	5	35	0	0	3	0	0	4	5	4	1
Delma torquata	5	10	7	5	0	3	1	0	0	1.7	32.7	5	10	5	5	25	0	0	3	0	0	4	6	4	1
Ophidiocephalus taeniatus	5	8	7	2	0	3	1	0	0	1.7	27.7	10	10	10	5	35	0	4	3	0	0	4	5	4	1
Paradelma orientalis	5	8	4	5	0	3	1	0	0	1.7	27.7	10	10	10	5	35	0	4	3	0	0	4	5	4	1
Pletholax gracilis edelensis	5	2	9	2	0	3	1	0	0	3.3	25.3	10	10	10	5	35	0	4	0	2	0	4	2	4	1
FAMILY AGAMIDAE																									
Cryptagama aurita	5	5	7	2	0	3	1	0	0	1.7	24.7	10	10	10	5	35	0	4	3	0	0	4	5	4	1
Ctenophorus mckenziei	5	5	7	0	0	3	1	0	0	0	21	10	10	10	5	35	0	0	3	0	0	4	2	4	1
Ctenophorus yinnietharra	8	5	10	0	2	3	1	0	0	3.3	32.3	5	10	5	5	25	0	0	3	0	0	4	2	4	1
Diporiphora convergens	5	5	10	0	0	3	1	0	0	0	24	10	10	10	5	35	0	0	3	0	0	4	2	4	1
Hypsilurus spinipes	2	6	4	5	0	3	3	0	0	1.7	24.7	5	10	5	5	25	0	0	3	0	0	4	3	4	1
Tympanocryptis lineata pinguicoll	5	8	7	5	0	3	1	0	0	0	29	5	6	5	0	16	0	0	0	2	0	4	6	4	1
Tympanocryptis uniformis	5	5	7	2	0	3	1	0	0	0	23	10	10	10	5	35	0	0	3	0	0	4	5	4	1
FAMILY VARANIDAE																									
Varanus glauerti (Kadadu)	5	2	7	0	0	3	3	0	0	0	20	5	10	10	5	30	0	0	3	0	1	4	2	4	2
Varanus primordius	5	2	7	2	0	3	1	0	0	1.7	21.7	5	10	10	5	30	0	0	3	0	0	4	2	4	1
Varanus rosenbergi	0	8	4	5	0	3	1	0	0	0	21	10	10	5	10	35	0	0	3	0	0	4	5	4	1
Varanus semiremex	5	8	4	2	0	3	3	0	0	1.7	26.7	5	10	10	5	30	0	0	3	0	0	4	5	4	1
Varanus teriae	5	2	9	0	0	3	3	0	0	3.3	25.3	5	10	10	5	30	0	0	3	0	0	4	3	4	1
FAMILY SCINCIDAE																									
Anomalopus gowi	5	5	7	2	0	3	1	0	0	3.3	26.3	5	10	5	5	25	0	0	3	0	0	4	5	4	1
Anomalopus mackayi	5	10	7	5	0	3	1	0	0	3.3	34.3	5	10	5	5	25	0	0	3	0	0	4	6	4	1
Anomalopus pluto	5	2	9	2	0	3	0	0	0	3.3	24.3	5	10	10	5	30	0	0	3	0	0	4	5	4	1
Bartleia jigurru	8	2	10	0	0	3	1	0	0	1.7	25.7	0	10	5	5	20	0	4	3	0	0	4	2	4	1

TAXON	Biological Variables										Biological Score	Action Variables				Action Score	Supplemental Variables								
	1	2	3	4	5	6A	6B	7A	7B	7C		1	2	3	4		1(a)	1(b)	1(c)	1(d)	1(e)	2	3	4	5
Calyptotis temporalis	5	2	4	2	0	3	0	0	0	1.7	17.7	5	10	5	5	25	0	0	3	0	0	4	5	4	1
Calyptotis thorntonensis	8	2	10	0	0	3	0	0	0	3.3	26.3	0	10	5	5	20	0	0	3	0	0	4	2	4	1
Carlia coensis	5	2	7	0	0	3	0	0	0	1.7	18.7	5	10	5	5	25	0	0	3	0	0	4	2	4	1
Carlia rimula	2	2	7	0	0	3	0	0	0	1.7	15.7	5	10	5	5	25	0	0	3	0	0	4	2	4	1
Carlia scirtetis	2	2	10	0	0	3	0	0	0	1.7	18.7	5	10	5	5	25	0	0	3	0	0	4	2	4	1
Coeranoscincus reticulatus	5	8	7	5	0	3	1	1.7	0	1.7	32.4	5	10	5	5	25	0	0	3	0	0	4	5	4	1
Cryptoblepharus fuhni	2	2	10	0	0	3	0	0	0	1.7	18.7	5	10	5	5	25	0	0	3	0	0	4	2	4	1
Ctenotus alleni	5	5	9	2	0	3	1	0	0	0	25	10	10	10	5	35	0	0	3	0	0	4	4	4	1
Ctenotus angusticeps	5	5	7	0	0	3	1	0	0	0	21	10	10	10	5	35	0	0	3	2	0	4	5	4	1
Ctenotus aphrodite	5	5	7	0	0	3	1	0	0	1.7	22.7	5	10	10	5	30	0	0	3	0	0	4	5	4	1
Ctenotus arnhemensis	5	2	7	0	0	3	1	0	0	0	18	10	10	10	5	35	0	0	3	0	0	4	2	4	1
Ctenotus astarte	2	5	7	0	0	3	1	0	0	1.7	19.7	5	10	10	5	30	0	0	3	0	0	4	5	4	1
Ctenotus capricorni	2	5	9	0	0	3	1	0	0	0	20	10	10	10	5	35	0	0	3	0	0	4	5	4	1
Ctenotus delli	5	5	9	0	0	3	1	0	0	0	23	5	6	10	5	26	0	0	3	0	0	3	2	4	1
Ctenotus ehmanni	5	5	10	0	0	3	1	0	0	0	24	10	10	10	5	35	0	0	3	0	0	4	2	4	1
Ctenotus eurydice	2	5	7	2	0	3	1	0	0	0	20	10	10	10	5	35	0	0	3	0	0	4	5	4	1
Ctenotus hypatia	5	5	10	0	0	3	1	0	0	0	24	10	10	10	5	35	0	0	3	0	0	4	5	4	1
Ctenotus lancelini	10	10	10	5	0	3	1	0	0	0	39	0	6	5	5	16	0	0	3	0	0	5	6	4	1
Ctenotus monticola	5	5	10	0	0	3	1	0	0	0	24	10	10	10	5	35	0	0	3	0	0	4	5	4	1
Ctenotus nigrilineatus	5	5	9	2	0	3	1	0	0	1.7	26.7	10	10	10	5	35	0	0	3	0	0	4	5	4	1
Ctenotus nullum	2	2	7	2	0	3	1	0	0	1.7	18.7	10	10	10	5	35	0	0	3	0	0	4	5	4	1
Ctenotus quinkan	5	5	9	0	0	3	1	0	0	1.7	24.7	10	10	5	5	30	0	0	3	0	0	4	2	4	1
Ctenotus rawlinsoni	5	2	9	0	0	3	1	0	0	1.7	21.7	10	10	10	5	35	0	0	3	0	0	4	4	4	1
Ctenotus schevilli	5	5	9	2	0	3	1	0	0	1.7	26.7	5	10	5	5	25	0	0	3	0	0	4	5	4	1
Ctenotus septenarius	5	2	7	0	0	3	1	0	0	0	18	10	10	10	5	35	0	0	3	0	0	4	2	4	1
Ctenotus serotinus	5	5	10	0	0	3	1	0	0	0	24	10	10	10	5	35	0	0	3	0	0	4	5	4	1
Ctenotus tanamiensis	5	2	7	0	0	3	1	0	0	0	18	10	10	10	5	35	0	0	3	0	0	4	2	4	1
Ctenotus terrareginae	5	5	9	0	0	3	1	0	0	0	23	10	10	10	5	35	0	0	3	0	0	4	2	4	1
Ctenotus xenopleura	5	5	7	0	0	3	1	0	0	0	21	5	10	10	5	30	0	0	3	0	0	4	2	4	1
Ctenotus yampiensis	5	5	9	0	0	3	1	0	0	0	23	5	10	10	5	30	0	0	3	0	0	4	2	4	1
Ctenotus zastictus	8	5	10	0	0	3	1	0	0	1.7	28.7	5	10	5	5	25	0	0	3	0	0	4	2	4	1
Ctenotus zebrilla	5	5	10	0	0	3	1	0	0	0	24	10	10	10	5	35	0	0	3	0	0	4	5	4	1
Cyclodomorphus sp. (SA samphir	2	8	4	2	0	3	1	0	0	1.7	21.7	10	10	10	5	35	0	0	3	0	1	4	5	4	1

TAXON	Biological Variables										Biological Score	Action Variables				Action Score	Supplemental Variables								
	1	2	3	4	5	6A	6B	7A	7B	7C		1	2	3	4		1(a)	1(b)	1(c)	1(d)	1(e)	2	3	4	5
Egernia arnhemensis	5	2	9	0	0	3	1	0	0	1.7	21.7	5	10	10	5	30	0	0	3	0	0	4	2	4	2
Egernia coventryi	2	6	7	5	0	3	1	0	0	0	24	5	10	5	5	25	0	0	3	0	0	4	3	4	1
Egernia douglasi	5	5	7	0	0	3	1	0	0	0	21	10	10	10	5	35	0	0	3	0	0	4	2	4	1
Egernia kintorei	5	8	4	2	2	3	3	0	0	1.7	28.7	10	10	10	5	35	0	0	3	0	0	4	5	4	2
Egernia pulchra longicauda	8	5	10	0	0	3	1	0	0	1.7	28.7	0	10	5	5	20	0	0	0	2	0	5	2	4	1
Egernia rugosa	5	5	4	2	0	3	3	0	0	1.7	23.7	5	10	5	5	25	0	0	3	0	0	4	5	4	1
Egernia saxatilis saxatilis	5	2	9	0	0	3	1	0	0	1.7	21.7	5	10	5	5	25	0	0	0	2	0	4	2	4	1
Egernia sp. aff. saxatilis	5	5	10	0	0	3	1	0	0	1.7	25.7	5	10	5	5	25	0	0	3	0	1	4	2	4	1
Egernia slateri	5	10	4	2	0	3	1	0	0	1.7	26.7	10	10	10	5	35	0	0	0	2	0	4	6	4	1
Egernia stokesii aethiops	8	5	10	0	0	3	1	0	0	1.7	28.7	0	10	5	5	20	0	0	0	2	0	5	5	4	1
Egernia stokesii badia	8	10	7	8	0	3	1	0	0	0	37	5	10	10	5	30	0	0	0	2	0	4	6	4	1
Egernia stokesii stokesii	8	5	10	0	0	3	1	0	0	1.7	28.7	0	10	5	5	20	0	0	0	2	0	5	2	4	1
Emoia atrocostata australis	8	2	9	0	0	3	1	0	0	1.7	24.7	5	10	5	5	25	0	0	0	2	0	4	2	4	1
Eroticoscincus graciloides	5	6	7	5	0	3	1	0	0	0	27	5	10	5	5	25	0	4	3	0	0	4	5	4	1
Eulamprus amplus	2	2	7	0	0	3	1	0	0	1.7	16.7	5	10	5	5	25	0	0	3	0	0	4	2	4	1
Eulamprus kosciuskoi	2	2	7	2	0	3	1	0	0	1.7	18.7	5	10	5	5	25	0	0	3	0	0	4	2	4	1
Eulamprus leuraensis	8	10	9	5	0	3	1	0	0	1.7	37.7	5	10	5	5	25	0	0	3	0	0	4	6	4	1
Eulamprus luteilateralis	8	2	9	2	0	3	1	0	0	1.7	26.7	5	10	5	5	25	0	0	3	0	0	4	2	4	1
Eulamprus murrayi	5	6	7	2	0	3	1	0	0	1.7	25.7	5	10	5	5	25	0	0	3	0	0	4	6	4	1
Eulamprus tigrinus	2	8	7	2	0	3	1	0	0	1.7	24.7	5	10	10	5	30	0	0	3	0	0	4	3	4	1
Eulamprus tympanum ssp. nov.	8	10	9	5	0	3	1	0	0	1.7	37.7	0	10	5	5	20	0	0	3	0	1	4	6	4	1
Glaphyromorphus fuscicaudis	2	8	7	2	0	3	1	0	0	1.7	24.7	5	10	5	5	25	0	0	3	0	0	4	3	4	1
Glaphyromorphus mjobergi	2	8	7	2	0	3	1	0	0	1.7	24.7	5	10	10	5	30	0	0	3	0	0	4	3	4	1
Lampropholis caligula	5	5	7	2	0	3	0	0	0	0	22	5	10	5	5	25	0	0	3	0	0	4	5	4	1
Lampropholis sp. aff. challengeri	5	6	7	2	2	3	0	0	0	0	25	5	10	5	5	25	0	0	0	0	1	4	5	4	1
Lampropholis colossus	8	2	10	0	0	3	0	0	0	0	23	5	10	5	5	25	0	0	3	0	0	4	2	4	1
Lampropholis mirabilis	8	2	9	0	0	3	0	0	0	0	22	5	10	5	5	25	0	0	3	0	0	4	2	4	1
Lampropholis robertsi	5	2	7	0	0	3	0	0	0	0	17	5	10	5	5	25	0	0	3	0	0	4	3	4	1
Lerista allanae	8	8	9	8	0	3	0	0	0	1.7	37.7	5	10	10	5	30	0	0	3	0	0	4	5	4	1
Lerista allochira	5	5	7	0	0	3	0	0	0	1.7	21.7	10	10	10	5	35	0	0	3	0	0	4	2	4	1
Lerista ameles	5	5	10	0	0	3	0	0	0	1.7	24.7	10	10	10	5	35	0	0	3	0	0	4	2	4	1
Lerista apoda	5	5	7	0	0	3	0	0	0	1.7	21.7	10	10	10	5	35	0	0	3	0	0	4		4	

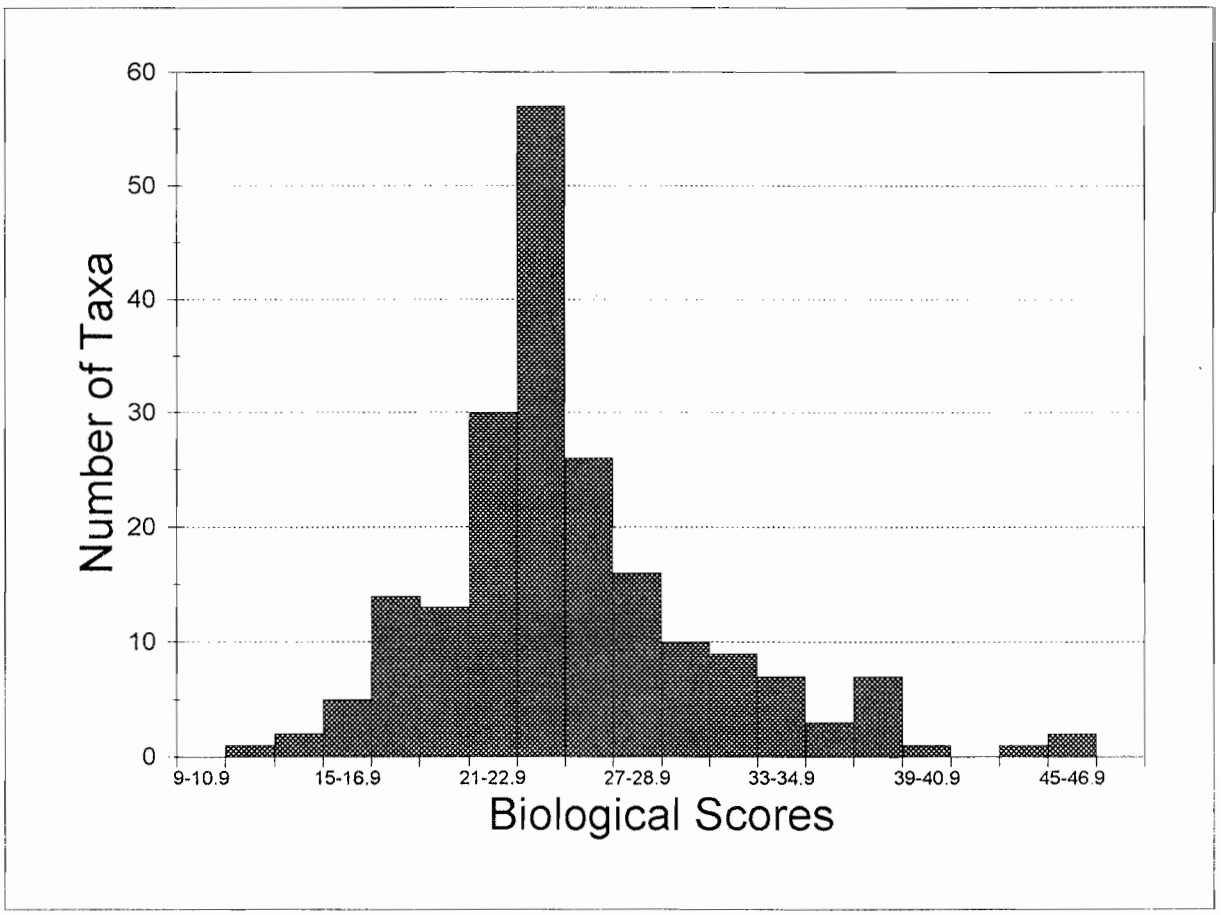
TAXON	Biological Variables										Biological Score	Action Variables				Action Score	Supplemental Variables								
	1	2	3	4	5	6A	6B	7A	7B	7C		1	2	3	4		1(a)	1(b)	1(c)	1(d)	1(e)	2	3	4	5
Lerista axillaris	5	5	7	0	0	3	0	0	0	1.7	21.7	10	10	10	5	35	0	0	3	0	0	4	2	4	1
Lerista carpentariae	5	2	7	0	0	3	1	0	0	1.7	19.7	5	10	10	5	30	0	0	3	0	0	5	2	4	1
Lerista christinae	5	5	7	2	0	3	0	0	0	0	22	10	10	10	5	35	0	0	3	0	0	4		4	
Lerista cinerea	5	8	7	2	0	3	0	0	0	1.7	26.7	10	10	5	5	30	0	0	3	0	0	4	5	4	1
Lerista haroldi	5	5	10	0	0	3	0	0	0	0	23	10	10	10	5	35	0	0	3	0	0	4	2	4	1
Lerista humphriesi	5	5	9	0	0	3	0	0	0	3.3	25.3	10	10	10	5	35	0	0	3	0	0	4	2	4	1
Lerista ingrami	5	2	9	0	0	3	0	0	0	1.7	20.7	10	10	10	5	35	0	0	3	0	0	4	2	4	1
Lerista kalumburu	5	5	9	0	0	3	0	0	0	1.7	23.7	10	10	10	5	35	0	0	3	0	0	4	2	4	1
Lerista lineata	2	5	7	2	0	3	0	0	0	1.7	20.7	5	10	10	5	30	0	0	3	0	0	4	5	4	1
Lerista macropisthopus galea	5	5	9	0	0	3	0	0	0	1.7	23.7	10	10	10	5	35	0	0	0	2	0	4	2	4	1
Lerista maculosa	5	5	10	0	0	3	0	0	0	1.7	24.7	10	10	10	5	35	0	0	0	2	0	4	2	4	1
Lerista puncticauda	5	5	10	0	0	3	0	0	0	1.7	24.7	10	10	10	5	35	0	0	3	0	0	4	2	4	1
Lerista quadrivincula	5	5	10	0	0	3	0	0	0	1.7	24.7	10	10	10	5	35	0	0	3	0	0	4	2	4	1
Lerista robusta	5	5	10	0	0	3	0	0	0	1.7	24.7	10	10	10	5	35	0	0	3	0	0	4	2	4	1
Lerista separanda	5	5	9	0	0	3	0	0	0	1.7	23.7	10	10	10	5	35	0	0	3	0	0	4	2	4	1
Lerista speciosa	5	5	10	2	0	3	0	0	0	1.7	26.7	10	10	10	5	35	0	0	3	0	0	4	5	4	1
Lerista stictopleura	5	5	10	0	0	3	0	0	0	1.7	24.7	10	10	10	5	35	0	0	3	0	0	4	2	4	1
Lerista storri	5	5	9	2	0	3	0	0	0	1.7	25.7	10	10	10	5	35	0	0	3	0	0	4	5	4	1
Lerista stylis	5	2	7	0	0	3	1	0	0	1.7	19.7	5	10	10	5	30	0	0	3	0	0	4	2	4	1
Lerista viduata	5	5	10	0	0	3	0	0	0	1.7	24.7	10	10	10	5	35	0	0	3	0	0	4	2	4	1
Lerista vittata	5	8	10	5	0	3	0	0	0	1.7	32.7	10	10	5	5	30	0	0	3	0	0	4	6	4	1
Lerista walkeri	5	5	9	0	0	3	0	0	0	1.7	23.7	10	10	10	5	35	0	0	3	0	0	4	2	4	1
Lerista wilkinsi	5	8	7	2	0	3	0	0	0	1.7	26.7	10	10	5	5	30	0	0	3	0	0	4	5	4	1
Lerista yuna	5	5	10	0	0	3	0	0	0	1.7	24.7	10	10	10	5	35	0	0	3	0	0	4	2	4	1
Lygisaurus rococo	5	5	9	0	0	3	0	0	0	1.7	23.7	10	10	5	5	30	0	0	3	0	0	4	4	4	1
Lygisaurus tanneri	5	5	9	2	0	3	0	0	0	1.7	25.7	5	10	5	5	25	0	0	3	0	0	4	5	4	1
Menetia concinna	5	2	10	0	0	3	1	0	0	0	21	5	10	10	5	30	0	0	3	0	0	4	2	4	1
Menetia koshlandae	5	8	7	2	0	3	0	0	0	1.7	26.7	10	10	10	5	35	0	0	3	0	0	4	5	4	1
Menetia sadlieri	5	2	10	0	0	3	0	0	0	1.7	21.7	10	10	10	5	35	0	0	3	0	0	4	2	4	1
Nannoscincus maccoyi	2	8	4	2	0	3	1	0	0	1.7	21.7	5	10	5	5	25	0	4	3	0	0	4	5	4	1
Niveoscincus palfreymani	6	2	10	0	6	3	1	1.7	0	1.7	31.4	0	10	5	5	20	0	0	3	0	0	5	2	4	1
Notoscincus butleri	5	5	7	2	0	3	1	0	0	0	23	10	10	5	10	35	0	0	3	0	0	4	5	4	1
Ophioscincus cooloolensis	8	2	9	0	0	3	0	0	0	1.7	23.7	5	10	5	5	25	0	0	3	0	0	4	2	4	1

TAXON	Biological Variables										Biological Score	Action Variables				Action Score	Supplemental Variables								
	1	2	3	4	5	6A	6B	7A	7B	7C		1	2	3	4		1(a)	1(b)	1(c)	1(d)	1(e)	2	3	4	5
Ophioscincus truncatus	2	8	7	2	0	3	1	0	0	1.7	24.7	5	10	5	5	25	0	0	3	0	0	4	5	4	1
Pseudemoia baudini	8	2	9	2	0	3	0	0	0	0	24	5	10	5	5	25	0	0	3	0	0	4	2	4	1
Pseudemoia lichenigera	5	6	9	8	0	3	1	0	3.3	0	35.3	5	10	5	5	25	0	0	3	2	0	5	3	4	1
Pseudemoia rawlinsoni	5	10	4	2	0	3	0	0	0	0	24	5	10	5	5	25	0	0	3	0	0	4	6	4	1
Tiliqua adelaidensis	10	10	10	10	0	3	1	0	0	1.7	45.7	10	10	10	5	35	0	0	3	0	0	4	6	4	1
FAMILY TYPHLOPIDAE																									
Ramphotyphlops broomi	5	5	7	2	0	3	1	1.7	0	1.7	26.4	10	10	10	5	35	0	0	3	0	0	4	5	4	1
Ramphotyphlops exocoeti	8	6	9	5	0	3	1	1.7	0	1.7	35.4	10	10	10	5	35	0	0	3	0	0	5	6	4	1
Ramphotyphlops howi	5	5	10	0	0	3	1	1.7	0	1.7	27.4	10	10	10	5	35	0	0	3	0	0	4	2	4	1
Ramphotyphlops margaretae	5	5	10	0	0	3	1	1.7	0	1.7	27.4	10	10	10	5	35	0	0	3	0	0	4	2	4	1
Ramphotyphlops micromma	5	5	10	0	0	3	1	1.7	0	1.7	27.4	10	10	10	5	35	0	0	3	0	0	4	2	4	1
Ramphotyphlops tovelli	2	2	7	2	0	3	1	1.7	0	1.7	20.4	0	10	5	5	20	0	0	3	0	0	4	2	4	1
Ramphotyphlops troglodytes	5	5	10	0	3	1		1.7	0	1.7	27.4	10	10	10	5	35	0	0	3	0	0	4	2	4	1
Ramphotyphlops yampiensis	5	5	10	0	0	3	1	1.7	0	1.7	27.4	10	10	10	5	35	0	0	3	0	0	4	2	4	1
Ramphotyphlops yirrikalae	5	2	4	0	0	3	1	1.7	0	1.7	18.4	10	10	10	5	35	0	0	3	0	0	4	2	4	1
FAMILY BOIDAE																									
Aspidites ramsayi (SW WA)	10	10	4	8	0	1	3	0	0	1.7	37.7	5	10	5	5	25	0	0	3	0	1	4	6	4	1
Chondropython viridis	8	2	7	0	0	3	3	0	0	1.7	24.7	5	10	10	5	30	0	4	3	0	0	0	4	4	1
Liasis albertisii	2	2	9	0	0	1	3	0	0	1.7	18.7	10	10	5	5	30	0	0	3	0	0	0	2	4	2
Liasis olivaceus barroni	5	5	7	2	0	1	3	0	0	1.7	24.7	5	10	10	5	30	0	0	0	2	0	4	5	4	1
Morelia carinata	5	2	9	0	0	1	3	0	0	1.7	21.7	10	10	10	5	35	0	0	3	0	0	4	2	4	2
Morelia oenpelliensis	5	2	9	0	0	1	3	0	0	1.7	21.7	5	10	10	5	30	0	0	3	0	0	4	2	4	2
Morelia spilota imbricata	5	10	4	5	0	1	3	0	0	1.7	29.7	5	10	10	5	30	0	0	0	2	0	4	6	4	1
Morelia spilota spilota	2	8	4	2	0	1	3	0	0	1.7	21.7	5	10	5	5	25	0	0	0	2	0	4	5	4	1
FAMILY COLUBRIDAE																									
Cerberus rynchops	2	2	4	0	0	3	1	0	0	1.7	13.7	5	10	10	5	30	0	4	3	0	1	0	2	4	1
Myron richardsoni	2	2	4	0	0	3	1	0	0	1.7	13.7	5	10	10	5	30	0	4	3	0	0	0	2	4	1

TAXON	Biological Variables										Biological Score	Action Variables				Action Score	Supplemental Variables								
	1	2	3	4	5	6A	6B	7A	7B	7C		1	2	3	4		1(a)	1(b)	1(c)	1(d)	1(e)	2	3	4	5
Stegonotus parvus	5	2	10	2	0	3	1	0	0	1.7	24.7	10	10	10	5	35	0	0	3	0	0	0	5	4	1
FAMILY ELAPIDAE																									
Acanthophis antarcticus	2	5	1	2	0	3	1	0	0	1.7	15.7	5	10	5	5	25	0	0	3	0	0	4	6	4	1
Austrelaps labialis (Adelaide)	5	10	9	5	0	3	1	0	0	0	33	5	10	5	5	25	0	0	3	0	1	4	6	4	1
Denisonia maculata	5	8	7	5	0	3	1	1.7	0	1.7	32.4	5	10	5	5	25	0	0	3	0	0	4	6	4	1
Echiopsis atriceps	8	5	9	2	0	3	1	0	0	1.7	29.7	10	10	10	5	35	0	0	3	0	0	4	2	4	1
Echiopsis curta	5	10	4	5	0	3	1	0	0	1.7	29.7	5	10	5	5	25	0	0	3	0	0	4	6	4	1
Elapognathus minor	5	8	7	5	0	3	1	0	0	0	29	5	10		5	20	0	4	3	0	0	4	5	4	1
Furina barnardi	5	5	4	2	0	3	1	1.7	0	1.7	23.4	5	10	5	5	25	0	0	3	0	0	4	2	4	1
Furina dunmalli	5	8	7	5	0	3	1	1.7	0	1.7	32.4	5	10	5	5	25	0	0	3	0	0	4	5	4	1
Hoplocephalus bungaroides	5	10	7	2	0	3	3	1.7	0	1.7	33.4	5	10	5	5	25	0	0	3	0	0	4	6	4	1
Hoplocephalus stephensii	5	8	4	2	0	3	3	0	0	1.7	26.7	5	10	5	5	25	0	0	3	0	0	4	5	4	1
Notechis ater ater	8	10	10	2	0	1	1	1.7	0	0	33.7	5	10	5	5	25	0	0	0	2	1	4	6	4	1
Pseudonaja affinis exilis	5	2	9	2	0	3	1	0	0	0	22	0	10	5	5	20	0	0	0	2	0	5	2	4	1
Pseudonaja affinis tanneri	5	2	9	2	0	3	1	0	0	0	22	5	10	5	5	25	0	0	0	2	0	5	2	4	1
Rhinoplocephalus sp. (Eyre Pen.)	5	8	7	2	0	3	1	0	0	0	26	10	10	5	5	30	0	0	3	0	1	4	5	4	1
Simoselaps calonotus	8	8	7	5	0	3	1	3.3	0	1.7	37	5	10	5	5	25	0	0	3	0	0	4	5	4	1
Simoselaps minimus	5	5	7	2	0	3	1	0	0	1.7	24.7	10	10	10	5	35	0	0	3	0	0	4	2	4	1
Simoselaps warro	5	5	4	2	0	3	1	0	0	1.7	21.7	5	10	10	5	30	0	0	3	0	0	4	5	4	1
Vermicella annulata	2	5	1	2	0	3	3	3.3	0	1.7	21	5	10	5	5	25	0	0	3	0	0	4	5	4	1
FAMILY HYDROPHIIDAE																									
Aipysurus pooleorum	5	2	7	0	0	3	1	0	0	0	18	10	10	10	5	35	0	0	3	0	0	4	2	4	1

TAXON	Biological Variables										Biological Score	Action Variables				Action Score	Supplemental Variables								
	1	2	3	4	5	6A	6B	7A	7B	7C		1	2	3	4		1(a)	1(b)	1(c)	1(d)	1(e)	2	3	4	5
Hydrelaps darwiniensis	5	2	7	0	0	3	1	0	0	1.7	19.7	10	10	10	5	35	0	4	3	0	0	3	2	4	1
Parahydrophis mertoni	5	2	7	0	0	3	1	0	0	1.7	19.7	10	10	10	5	35	0	4	3	0	0	4	2	4	1

APPENDIX 11.1 DISTRIBUTION OF BIOLOGICAL SCORES OF ALL THREATENED TAXA



INDEX OF THREATENED REPTILE TAXA Recovery outlines are indicated by bold type