Western Spiny-tailed Skink (*Egernia stokesii*) National Recovery Plan

Wildlife Management Program No. 53

Prepared by David Pearson
Department of Environment and Conservation

Australian Government

Government of **Western Australia**
Department of **Environment and Conservation**

WESTERN AUSTRALIAN WILDLIFE MANAGEMENT PROGRAM NO. 53

Western Spiny-tailed Skink (*Egernia stokesii*) Recovery Plan

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FOREWORD

Recovery Plans are developed within the framework laid down in Department of Environment and Conservation (DEC) Policy Statements Nos. 44 and 50 (CALM, 1992; CALM, 1994), and the Australian Government Department for Sustainability, Environment, Water, Population and Communities (SEWPaC) Recovery Planning Compliance Checklist for Legislative and Process Requirements (DEWHA, 2008). Recovery Plans outline the recovery actions that are required to urgently address those threatening processes most affecting the ongoing survival of threatened taxa or ecological communities, and begin the recovery process. The attainment of objectives and the provision of funds necessary to implement actions are subject to budgetary and other constraints affecting the parties involved, as well as the need to address other priorities.

This Recovery plan was approved by the Department of Environment and Conservation, Western Australia. Approved Recovery Plans are subject to modification as dictated by new findings, changes in status of the taxon or ecological community, and the completion of recovery actions.

Information in this Recovery Plan was accurate at June 2012.

Recovery Plan Preparation: This recovery plan was prepared by David Pearson (Department of Environment and Conservation, Science Division). Holly Raudino and Manda Page assisted with editing and formatting, and Amy Mutton and Brianna Wingfield prepared the map.

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Cover Photograph: Western Spiny-tailed Skink *Egernia stokesii badia.* (David Pearson, Department of Environment and Conservation)**.**

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ABBREVIATIONS

AWC	Australian Wildlife Conservancy
DAFWA	Department of Agriculture and Food Western Australia
DEC	Department of Environment and Conservation; formerly Department of Conservation and Land Management
DoF	Department of Fisheries
EPBC	Environment Protection and Biodiversity Conservation Act
IBRA	Interim Biogeographic Regionalisation for Australia
IUCN	International Union for the Conservation of Nature
SA	South Australia
WA	Western Australia
WWF	WWF-Australia; formerly World Wide Fund for Nature
NACC	Northern Agricultural Catchment Council
NRM	Natural Resource Management
NT	Northern Territory
SEWPaC	Department of Sustainability, Environment, Water, Population and Communities
SVL	Snout-vent length

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SUMMARY

Species: *Egernia stokesii* (Gray, 1845)

Family: Scincidae

Taxonomic and Conservation Status:

The Spiny-tailed or Gidgee Skink, *Egernia stokesii* (J.E. Gray, 1845) has a wide but patchy distribution, occurring in the southern NT, eastern SA, south-west and central Queensland and Western Australia. At present, four subspecies are generally recognized; *E. stokesii stokesii*, *E.s. aethiops* (Storr, 1978) and *E.s. badia* (Storr, 1978) are all restricted to WA, while *E. s. zellingi* (De Vis, 1884) refers to central and eastern Australian populations. The taxonomic relationships of the species complex requires clarification and it is likely that the species will be further subdivided into a number of other species or subspecies. Genetic work has found that there is considerable genetic heterogeneity within and between populations of *E. stokesii* in WA and further work is required to resolve taxa boundaries (Gardner *et al*., 2008). These taxonomic uncertainties may be clarified within the life of the Plan. Genetic analyses will be addressed by tasks under Recovery Action 2 in the plan and include examination of the differences between taxa in eastern and western Australia.

Some Western Australian populations of the Spiny-tailed Skink (*E. stokesii*) are listed under the *Environment Protection and Biodiversity Conservation Act 1999*:

- *Egernia stokesii badia* Western Spiny-tailed Skink - ENDANGERED
- *Egernia stokesii aethiops* Baudin Island Spiny-tailed Skink - VULNERABLE

Under Western Australian legislation (*Wildlife Conservation Act 1950: Wildlife Conservation (Specially Protected Fauna) Notice 2010(2))*, these taxa are listed as follows:

- *Egernia stokesii badia* - Schedule 1: Fauna that is rare or is likely to become extinct
- *Egernia stokesii aethiops* -Schedule 1: Fauna that is rare or is likely to become extinct

The nominate subspecies, *Egernia stokesii stokesii*, is listed on a DEC fauna priority list with a ranking of "4"- being "Taxa which are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could be if present circumstances change. These taxa are usually represented on conservation lands."

This recovery plan is concerned only with those populations that occur within Western Australia and includes the recognised subspecies; *Egernia stokesii stokesii, E. s. badia* and *E. s. aethiops*. The Plan will also be used to inform the management of an as yet unnamed black taxon (referred to as the "black form") that occurs in granite outcrops and lateritic breakaways in the Cue-Yalgoo-Mt Magnet region. Other populations of unclear taxonomic status occur on Dirk Hartog Island and several sites in and around Shark Bay (Peron Peninsula, Edel Land and Callagiddy and Woodleigh Stations), and the management of these taxa will also be informed through this Plan if they are determined to be separate taxa.

Distribution and habitat requirements

The nominate subspecies, *Egernia stokesii stokesii*, is known to have occurred on nine islands of the Abrolhos Archipelago off Geraldton on the mid-west coast of Western Australia. It remains extant on Tattler, Seagull, Oystercatcher, Pigeon, East and West Wallabi in the Wallabi Group, and Middle and Murray in the Pelsaert Group. The subspecies formerly occurred on Rat Island in the Easter Group, but disappeared between 1889 and 1913, presumably due to the introduction of rats and cats to this island.

Egernia s. stokesii typically shelters under limestone slabs or in cracks and crevices in limestone caprock on these arid windswept islands. The typical vegetation is low open shrubland. Similarly, *E. s. aethiops* shelters under limestone slabs and crevices in fractured limestone on Baudin Island.

Egernia s. badia occurs in open eucalypt woodlands and *Acacia*-dominated shrublands in semi-arid to arid areas of south-western WA (Geraldton Sandplains and Yalgoo IBRA) and, depending on taxonomic clarification, around Shark Bay including Peron Peninsula, Edel Land and Dirk Hartog Island (Geraldton Sandplain and Carnarvon IBRA). It tends to shelter in logs, in cavities in the trunks and branches of shrubs, as well as in houses and ruins, especially in accumulations of old corrugated iron.

The “black form” occurs in an area approximately bounded by Yalgoo, Mt. Magnet, Cue and Murchison Settlements. It lives on granite outcrops and ironstone breakaways and shelters in horizontal crevices.

Threats

Known threats include:

- The clearance of habitat for mining, mining infrastructure and farming (particularly in remnant woodlands in the WA wheatbelt)
- Degradation of existing habitat due to rising water tables and salinisation, grazing by rabbits, feral goats and domestic stock
- Discontinuation or modification of natural processes (such as fire) that generate hollows, logs and regenerate woodlands
- Firewood collecting that removes logs and hollow trees
- Removal of alternative refugia such as rubbish piles, abandoned farm houses and infrastructure (e.g. piles of railway sleepers)

Potential threats include:

- Introduction of exotic predators or rats onto islands occupied by *E. stokesii*

- Illegal collection for the illicit pet trade
- Climate change

Recovery Objective

To improve the conservation status and ensure the long-term survival of the three identified taxa (and the six genetic management groups) in the *E. stokesii* complex through increased knowledge and understanding of the taxa, the protection of habitat and the abatement of threats.

Performance Criteria

Criteria for success over the life of the plan (five years):

- Maintain or increase in the number of populations or habitat occupied by all taxa.
- Habitat occupied by *E.s. badia* and the black form of the species plus potentially suitable habitat has been identified and mapped.
- At least 50% of known remnant woodland populations are being managed for conservation (e.g. through voluntary management agreements).
- All incursions of exotic vertebrate predators and rats are prevented from establishing on islands where populations of *E. stokesii* occur.
- At least 75% of all attempted translocations result in establishing viable populations.

Criteria for failure:

- Any taxa have decreased in terms of number of populations or apparent abundance.
- Habitat and potential habitat for any taxa of the species remains unclear and not mapped.
- Less than 30% of known remnant woodland populations are being managed for conservation.
- Less than 50% of all attempted translocations result in establishing viable populations.

- Exotic vertebrate predators and/or rats establish on islands where populations of *E. stokesii* occur.

Recovery Actions

Action 1 Determine the essential habitat requirements of mainland WA populations.

Action 2 Clarify the distribution and conservation status of the various taxa of *E. stokesii* and their population trends.

Action 3 Identify threatening processes and techniques to mitigate their impact.

Action 4 Manage known populations in remnant woodland areas.

Action 5 Protect habitat and create new habitat where required for populations to persist.

Action 6 Prevent the introduction of exotic vertebrate predators and rats onto islands occupied by *E. stokesii.*

Action 7 Prevent illegal collection.

Action 8 Engage landholders and local communities to promote awareness of the existence of the species and its conservation requirements.

Action 9 Encourage landholders to remove or minimise the impact of stock and introduced herbivores on habitat, especially remnant woodlands.

Action 10 Develop and implement conservation agreements with landholders and mining companies to retain habitat and link remnant woodland patches as identified in Action 1.

Action 11 Manage the ongoing recovery process to ensure that actions are delivered and monitored effectively.

Action 12 Develop a strategy to translocate at-risk populations to suitable sites when the need arises.

1. SPECIES INFORMATION

1.1 Introduction

This plan has been developed for Western Australian populations of *Egernia stokesii*. The species is also known from widely scattered locations in the Northern Territory, South Australia, New South Wales and Queensland (these populations are generally referred to as the subspecies *E. s. zellingi*, Wilson and Swan 2003). The genetic and taxonomic relationships between, and within, western and eastern populations are currently being explored (P. Doughty, pers. comm. 2012). The central and eastern populations are little known but are not generally considered threatened.

In Western Australia, *E. stokesii* has a relatively restricted distribution, occurring in an arc from the central wheatbelt region to Shark Bay. Three subspecies have been recognised in past literature. In addition to these taxa, there is at least one other undescribed taxon, as well as considerable variation in size and colour between populations.

1.2 Description

Egernia stokesii is a stout-bodied skink with well-developed limbs each with 5 digits. It can reach snout-vent lengths (SVL) of up to 195 mm, with the tail up to a further 45% of the SVL. However, there are large variations in adult size between populations (recorded range of adult sizes: 81-195 mm SVL). The dorsal scales are keeled to spinose. In the centre of the back, scales have 2 (rarely 3) short blunt keels, while towards the flanks, each scale has a single spinose keel (Storr *et al.,* 1999).

The tail is short and broad, tapering sharply to an abrupt point. It is covered on the dorsal and lateral surfaces by long spinose scales which are very prickly to touch. The head is relatively short and strong with eyes protected by a strong brow ridge. The ear opening is a narrow vertical slit.

Mid-body scale rows range from 32 to 38. It is distinguished from its most similar, sometimes sympatric sibling species, *Egernia depressa*, by its larger size, the presence of nuchal scales, 2-spined (versus 3-spined) dorsals, and when spots are present in the pattern, by the spots being paler than the background colour in *E. stokesii* (Storr *et al.,* 1999).

Colouration and maximum adult body size varies considerably across the range of the species in WA. *Egernia s. stokesii* is dark-brown to black with a pattern of cream blotches on the dorsal surface and sometimes orange scales on the head and an adult body size of 56-158 mm SVL (Storr *et al.,* 1999).

The smaller *E. s. aethiops* is dark brown to black with little or no pattern and a comparatively short snout. *Egernia s. badia* is reddish-brown in colour with a strong pattern of blotches or irregular bands of white or cream on the dorsal surface. The colouration of Shark Bay, Edel Land and Dirk Hartog Island individuals is similar (B. Maryan, pers. comm. 2008).

A “melanic” population occupying granite outcrops and occasionally lateritic breakaways in the Cue-Yalgoo- Mt Magnet area in the upper Murchison catchment is glossy black with no patterning and possesses a less spinose tail than other *E. stokesii* which is tapered and agile (Hamilton, 2003). Hereafter it is referred to as the “black form” of *E. stokesii*.

1.3 Taxonomic status

Egernia is an endemic Australian skink genus of around 30 species which occur across the continent and in habitats ranging from rainforest to deserts (Gardner *et al.,* 2008). They vary in size from small (30 mm snout-vent length, < 10g) to large (700 mm SVL, < 1kg) species. Within the genus, there is considerable variation in ecology; while most species are diurnal, others are crepuscular or nocturnal. Some live solitary lives, while many larger species live in complex

social groups (Greer, 1989; Cogger, 1992; Gardner *et al.,* 2001; Gardner *et al.,* 2002; Gardner *et al.,* 2007).

Three subspecies of *Egernia stokesii* are formally recognised as occurring in Western Australia (Storr, 1978), although Aplin and Smith (2001) did not consider *E.s. aethiops* as a distinct taxon based on morphology and synonomised it with *E. s. stokesii*. The latter work has not been reflected in legislation; *E. s. aethiops* is still listed under State, Federal and IUCN threatened species listings.

A variety of factors have been responsible for the geographic and genetic separation of populations of *E. stokesii* in Western Australia. Several island populations have been isolated from the mainland during sea level changes in the late Pleistocene (Main, 1961). Populations in the Abrolhos appear to have become isolated from mainland populations around 1.2 million years ago before major sea level changes. Deep channels between island groups in the Abrolhos archipelago may have prevented or restricted gene flow between Abrolhos skinks (Hamilton, 2003).

Climate change with increasing aridity in the late Tertiary and subsequent cycles of aridity have led to the fragmentation of woodland habitats. The populations living on Murchison granite outcrops may have become isolated around 2 million years ago perhaps due to fire, increasing aridity and the disappearance of suitable habitat (Hamilton, 2003).

Hamilton (2003) examined Western Australian populations of *E. stokesii* using morphometrics (measurements), meristics (scale characters/counts) and the sequencing of the ND4 gene in the mitochondrial genome. She found that morphometrics produced five distinct geographical groupings of *E. stokesii*; Baudin Island, Shark Bay area, the wheatbelt, the Abrolhos and those in granite outcrops in the Murchison River catchment near Cue (hereafter the “black form”).

The Abrolhos grouping could be further subdivided into “northern” and “southern” forms (Hamilton, 2003).

These divisions were not entirely supported by genetic results. The “black form” and Abrolhos populations proved to be distinct from other *E.stokesii* on both morphometric and genetic criteria. However, the Shark Bay, wheatbelt and Baudin Island skinks form a single clade, suggesting considerable phenotypic plasticity with the species (Hamilton, 2003).

Given the contradictory nature of morphological and genetic results in separating taxa within the *E. stokesii* complex, this Plan adopts a conservative position and recognises the following six distinct populations or management units for the purpose of developing conservation actions:

1. *E. stokesii stokesii* “northern Abrolhos” population present on Tattler, Seagull, Oystercatcher, Pigeon, East and West Wallabi Islands in the Wallabi Island group.
2. *E. stokesii stokesii* “southern Abrolhos” population present on Murray and Middle Island in the Pelsaert Island group.
3. *E. stokesii aethiops* occurring just on Baudin Island in Freycinet Estuary.
4. *E. stokesii badia* consisting of those populations in the northern and central wheatbelt from Kellerberrin north to Mullewa and east as far as Mukinbudin and Perenjori (Storr *et al*., 1999).
5. *E. stokesii* “Shark Bay” populations comprising those skinks from Peron Peninsula, Edel Land, Dirk Hartog Island and Callagiddy and Woodleigh Stations.
6. A distinct black form known from granite outcrops and lateritic breakaways in the upper Murchison catchment.

The population that formerly occurred on Rat Island in the Abrolhos (in the Easter Group between the Wallabi and Pelsaert Groups) is of unknown taxonomic status, as no specimens are available for morphometric or genetic analyses.

1.4 Distribution and habitat

The *Egernia stokesii* species-group has a widespread (though disjunct) distribution across semi-arid Australia, from far west New South Wales to the south-western interior of Western Australia. Populations of *Egernia stokesii* covered in this Plan all occur in the south-western portion of WA. *Egernia s. stokesii* occurs on several arid islands in the Abrolhos Archipelago, 40 km off the WA town of Geraldton (Figure 1). In the Wallabi Group, it is present on East and West Wallabi Islands and Pigeon, Seagull, Oystercatcher and Tattler Islands. In the Pelsaert Group, it occurs on Middle and Murray Islands. It formerly occurred on Rat Island in the Easter Group, but was exterminated sometime between 1899 and 1913 (Alexander, 1922). On these islands, *E. s. stokesii* shelters under loose sheets and boulders of limestone and in crevices formed by solution erosion of caprock.

Egernia stokesii aethiops only occurs on the tiny Baudin Island (~15 ha) in Freycinet Harbour in the Shark Bay region. It is very abundant under sheets on limestone and in solution crevices in caprock. The vegetation of the island is arid low heath with areas of *Spinifex longifolius* (Storr and Harold, 1990).

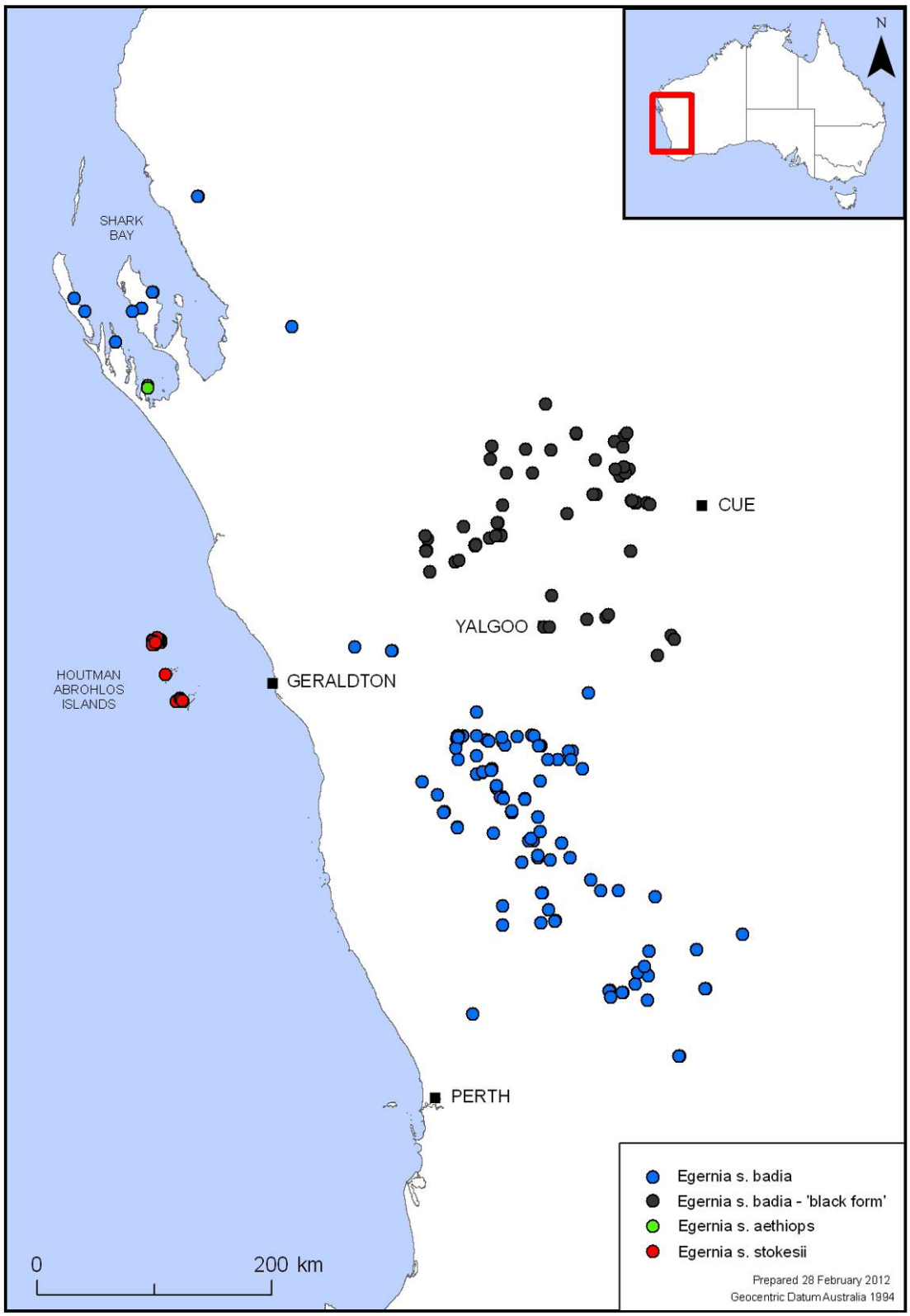

Figure 1: The distribution of records for the *Egernia stokesii* species complex showing the distribution of the three accepted sub-species and the “black form”.

Egernia stokesii badia has the largest distribution of the WA taxa of *E. stokesii*. It was widely distributed up until the 1960s through semi-arid areas of south-western WA from Minnivale (150 km ENE of Perth) north to Mullewa and east to Perenjori and south of the Yalgoo, but excluding coastal areas (all known localities are east of the Brand Highway). Clearing for agriculture has removed most of its potential habitat through this region and the population has consequently declined as a result of isolation through fragmentation (Kitchener *et al*., 1979; How *et al*., 1999).

In the WA wheatbelt, *E. s. badia* occurred in woodlands of York Gum (*Eucalyptus loxophleba*), Gimlet (*E. salubris*) and Salmon Gum (*E. salmonophloia*) that were distributed on heavier (clayey) soils predominantly within the Avon Wheatbelt IBRA bio-region (Cogger *et al*.,1993; How *et al*., 1999; Thackway and Cresswell, 1995). These soils were amongst the best for agriculture so most of the woodlands were cleared in the decades up to 1960. The WA Museum has specimens from 28 localities in the central and northern wheatbelt with declining accessions in the last four decades (How *et al*., 1999; How *et al*., 2003).

A survey by How *et al.* (1999) found that most recorded locations for *E. s. badia* occurred on private land holdings. It was known from a few reserves including Buntine and Bowgada Nature Reserves; Caron Siding Water Reserve and Rothsay State Forest. Survey work in January 1998 failed to find any recent sign of the species at Caron Siding Water Reserve, but did detect the species at other sites (How *et al.,* 1999). Populations were discovered in the Perenjori township and recent faecal piles were found near hollow logs at ten other woodland sites as far east as Kalannie. The smallest remnant where *E. s. badia* was found to persist was just 1 ha in size, but many other small (< 5 ha) patches of suitable woodland showed no evidence of their presence. How *et al.* (1999) also detected the taxon further east than previously documented in the Yalgoo bio-region with the discovery of a mummified individual under a log east of Morawa.

Subsequent searches have uncovered populations in the Blue Hills area on the former Karara Pastoral Lease, now managed by DEC. A survey in 2008 also located the Western Spiny-tailed Skink at Mount Gibson Sanctuary, some 70 km from its nearest known population (AWC 2010).

The primary shelter sites used by *E. s. badia* are fallen logs, but they may also use tree stumps and human-created habitats such as abandoned buildings, piles of corrugated iron, building rubble and piles of railway sleepers (How *et al.,* 1999). They are also known to occupy farm houses, living in cupboards or occupying woodpiles (in which case, individuals may have been brought from elsewhere in loads of firewood).

The importance of logs was emphasised by How *et al.* (1999), noting that "in all of the woodland sites surveyed the species occurred only where there were considerable numbers of large fallen logs. Preferences appeared to be for log piles with several overlapping hollow logs …(providing)…numerous openings as well as cover." They also speculated that the dispersal of young between log piles might be disrupted by the presence of cattle or sheep, so that "long-term survival of populations in grazed woodlands may not be assured" (How *et al.,* 1999).

Other populations of *E. stokesii* which occur around Shark Bay and on Dirk Hartog Island are typically placed with *E. s. badia*, although they appear to be geographically isolated from populations in the wheatbelt. There are comparatively few recorded locations in this region; Peron Peninsula (4 WAM specimens), Useless Loop (2), Dirk Hartog Island (2), Callagiddy Station (1) and Woodleigh Station (1). There have been no specific regional surveys for the skinks, but people working on Peron Peninsula have reported them to be caught occasionally in cage traps set for mammals (K. Himbeck, pers. comm. 2008) or observed by remote cameras (Linda Reinhold, pers. comm. 2011).

The Peron Peninsula skinks have been found in the base of fallen *Acacia ramulosa* trunks in open low (< 3 m) shrublands and in a kitchen cupboard at the Peron Homestead (D. Pearson, pers. obs. 2003). Information on the collection locations of other skinks is not available, but the general area is vegetated by arid low shrublands. The specimen from Woodleigh Station was recovered from a rubbish tip. Dirk Hartog Island is vegetated by low shrubland and skinks have been found sheltering under sheets of tin at the homestead, at the rubbish dump and in a limestone crevice (B. Maryan, pers. comm. 2008).

The black form was originally known from a limited number of sites on Austin Downs Station, east of Cue (e.g. Walga, Wurrah and Woolgerong Rocks). They were restricted to massive granite exposures ("whalebacks") with a variable cover of loose boulders and pockets of soil and low shrubland vegetation. These outcrops are separated by open low woodland and shrubland. The skinks live in narrow crevices and boulders and are observed most readily when they bask close to their refugia. Surveys between 2006 and 2009 identified over 70 new locations in the Murchison region (ecologia Environmental 2010).

1.5 Life history and ecology

Comparatively little is known about the ecology of populations of Western Australian *E. stokesii*. In contrast, *E. s. zeelingi* populations in South Australia have been well studied and some general features of the biology may be inferred from this work (Main and Bull, 1996; Bull *et al*., 2000).

Social organization

Like other large members of the genus *Egernia*, *E. stokesii* is probably long-lived, with a life expectancy in excess of 10 years (How *et al.,* 1999). Swan (1990) reported captive individuals (subspecies not specified) living for over 25 years. Captive individuals of *E. s. zeelingi* are known to live at least 12 years (Zimmerman, 1985 in Greer, 1989).

Skinks in the genus *Egernia* are among the most social of all squamate reptiles (Chapple, 2003). *Egernia stokesii* typically live in stable, small groups of related individuals; often parents are found sheltering with their young in refugia and occasionally larger groups of several adults and juveniles are encountered (Alexander, 1922; Main and Bull, 1996; Bull *et al.,* 2000; pers. observations). These family groups may number up to 17 and their aggregations last for over five years. Multiple groups may co-exist in an outcrop, each with a small home range; for instance Duffield and Bull (2002) reported 17 family groups in a 1.5 ha rock outcrop near Hawker in SA.

Sub-adult skinks are known to stay with their family group for at least three years (Duffield, pers. comm. in Bull *et al.,* 2000). Some of these lizards may occupy crevices on the edges of family territory and were termed “floaters” by Duffield and Bull (2002).

Main and Bull (1996) undertook experimental trials to examine mother-offspring recognition, by separating young from their mothers soon after birth and then testing subsequent exposure to related and unrelated skinks. They found that mothers were able to distinguish their own progeny, and in reciprocal experiments that juveniles were able to identify their mothers. Main and Bull (1996) concluded that olfactory cues were probably important for this recognition and that mother-offspring recognition was an important foundation for the family groups. In subsequent experiments, Bull *et al.* (2000) tested olfactory stimuli from the skin and cloaca between related and unrelated juvenile and sub-adult skinks.

Trial skinks showed a stronger response (based on the number of tongue flicks) to stimuli from unrelated skinks, than to stimuli collected from themselves and related skinks. This suggests that skinks may learn to recognise and discriminate members of their group on the basis of pheromones rather than some genetic signal or imprinting soon after birth.

Egernia stokesii use a communal toilet area ("scat piling") outside their refuges. In a related species, *Egernia striolata*, Bull *et al.* (1999a & b) suggested that scat piling probably evolved to mark territories with the skinks using pheromone signals in the scats to identify their refuges.

Reproduction

Like all other members of the genus, *E. stokesii* is viviparous (bearing live young). In captivity, females captured near Hawker SA, produced an average of around 5 young per litter (range 1-8) during the months of February and March (Duffield and Bull, 1996). Nankivell (1976) reported a lone birth in August from a WA wheatbelt population, but this was an injured animal kept in captivity and is not likely to be typical. *Egernia stokesii* in WA probably follow a similar seasonal pattern of reproduction to other live-bearing reptiles in south-west WA. Mating tends to occur in late September to early November and young are born in February to March (R. How, pers. comm. 2008).

In captivity, Duffield and Bull (1996) found that young were born over a period of one to several days (average 2.8 days), head-first. The mother consumes the yolk sac and birth membrane of offspring and assist them out of the embryonic sac. There has been an observation of infanticide with a female in captivity consuming one newly-born neonate in a clutch of eight. The reason behind this infanticide and its possible frequency in the wild is unknown (Lanham and Bull, 2000).

Smaller females tend to produce smaller litters and larger litters generally resulted in smaller young based on snout-vent length (SVL) and mass. Neonates range in size from 5.8-10.5 g and 65-95 mm in SVL (Duffield and Bull, 1996). Mating was not observed by Duffield and Bull (1996), but they concluded that it probably coincides with the maximum activity period in spring (October to November), suggesting that gestation would take 3-4 months. It is likely that females do not reproduce every year based on the observation of Duffield and Bull (1996) that 26% of females collected from the field in December 1994 were not gravid. Reproductive behaviour, timing and litter sizes are likely to vary between geographically separated populations, in tune with different environmental conditions and habitats.

Diet

Little information is available on the diet of Western Australian populations of *E. stokesii*. Storr (1978) stated that they were partly vegetarian. Cursory examination of faecal pellets collected in the Shark Bay area and in the Abrolhos indicated that the diet includes plant and arthropod material. On West Wallabi Island, *E. s. stokesii* has been observed eating fruits from *Nitraria* shrubs and the seeds are common in faecal pellets (D. Pearson, pers. obs. 2008)

General literature about the species suggests that it may be partly herbivorous based on the diets of similarly-sized *Egernia* species (Swan, 1990); or else have primarily an insectivorous diet (Cogger, 1992). Swan (1990) listed grasshoppers, grubs, moths, beetles, spiders and plants as the main dietary items.

Duffield and Bull (1998) reported on the diet of *E. s. zeelingi* in the Warrawarldunha Range in South Australia based on the examination of faecal pellets. While unable to identify much of the plant tissue in the pellets, a number of seeds could be identified including ruby saltbush, *Enchylaena tomentosa* (it has a fleshy red mericarp) and introduced species including the succulent *Portulaca oleracea*, *Carrichtera annua, Medicago minima* and *Lycium*

ferocissium. The pellets also contained parts of beetles and grasshoppers. In captivity, *E. s. zeelingi* readily eats mealworms and chopped fruit and vegetables (Duffield and Bull, 1998).

Juveniles appear to have a more insectivorous diet than adults based on the field research of Duffield and Bull (1998). They found that small faecal pellets appearing in communal latrines following the birth of young in late summer had less plant material and a greater frequency of insect remains than the larger pellets of adults. This observation was supported by their captive trials. Juveniles tended to eat more insects relative to body mass than adults, and pellet size was found to be related to body size.

The diet of adult skinks in the Warruwarldunha Range changed over the mid to late summer period. Plant material increased (with a concomitant decrease in insects) and although food availability may have been the cause, Duffield and Bull (1998) also speculated that the adults may be foraging at different sites or times, or responding to competitive pressure from the juveniles.

Activity patterns

Egernia stokesii is a diurnal species. In some populations it is known to overtly bask either alongside crevices (black form, Abrolhos) or close to its hollow (Peron Peninsula) in morning sunshine, but otherwise it is rarely observed active. This suggests it is very wary and is likely to either forage for short periods away from its refuge, or use an ambush strategy and dart out to grab invertebrate prey.

Groups of *E. s. zellingi* in the Flinders Ranges of South Australia have small home ranges and dispersal has been rarely recorded. However, Duffield and Bull (2002) detailed an instance where a male “floater” travelled at least 350 m and was inadvertently transported to Adelaide in a researcher’s vehicle, living for a time on grasshoppers killed on the radiator. When returned to his home outcrop

after a winter in detention, he had moved to another outcrop 300 m away a month later (Duffield and Bull, 2002).

Predators

Skink populations elsewhere in Australia have declined due to predation by domestic cats, and Dickman (1996) demonstrated that lizards are a significant component of the cat diet. Domestic cats have been recorded capturing *E. stokesii*. One farmer in Koorda WA reported that every March his cat would bring in juvenile skinks (T. Lee-Steere, pers. comm. 2008). Pearson and Shine (2002) reported finding the scales of *E. s. stokesii* in the faecal pellets of south-western carpet pythons (*Morelia spilota imbricata*). On several occasions during fieldwork on West Wallabi Island, carpet pythons were found in ambush positions over the entrance of crevices where skinks were located suggesting they are an important dietary item for sub-adult female and male pythons (Pearson, unpublished data).

It is highly likely that the Woma Python (*Aspidites ramsayi*) and some elapid snakes, especially the Mulga Snake (*Pseudechis australis;* a well-known predator of other reptiles), would eat *E. stokesii.* Goannas (*Varanus* spp.) and birds-of-prey are also probable predators.

2. THREATS

While some threats are clearly apparent, the relative importance of others is unknown or unclear. Clearing of habitat was the major cause of fragmentation and decline of *E. s. badia* populations living in wheatbelt woodlands of WA in the decades leading up to 1960. Vast areas of York Gum and other woodlands on alluvial soils were extensively cleared for agriculture. The fragmented native vegetation left behind was confined to private property, water reserves, railway and road reserves and a few small nature reserves. Continuing clearing of woodland remnants over subsequent years has exacerbated the situation. Loss of further habitat and fragmentation of the regional population has likely restricted its genetic exchange and the ability to repopulate former habitat (vacated due to fire, drought or other disturbances). Such factors may also have the effect of reducing some groups of skinks to sizes that prevent reproduction and effective recruitment.

2.1 Modified landscapes

In those woodlands that have survived large scale clearing operations, there are other processes which have prevented or limited the recruitment of trees (and hence the long-term creation of logs). These include rising water tables and increasing salinity; changes to fire regimes (usually the long-term exclusion of fire which may inhibit germination of some plant species*, Yates et* al., 1994), weed encroachment and grazing by sheep, cattle and rabbits and related ground compaction. Grazing removes a large proportion of biomass under the tree canopy and presumably restricts the range of plant and invertebrate species that are available for *E. s. badia*.

Cutting of trees for fence-posts, firewood, the construction of yards and other farm purposes have had significant impacts on remnant woodlands. The removal of log piles for firewood and to “clean up” woodlots for improved access by grazing animals removes important micro-habitat and cover for *Egernia* spp and may result in increased predation.

Direct and obvious habitat destruction is less of an apparent threat for other WA populations of *E. stokesii*, where anthropogenic activity is less intense. Nonetheless, portions of the Shark Bay population occur on pastoral stations where the vegetation is degraded due to the activities of domestic livestock, large herds of feral goats, and elevated macropod numbers and rabbits. The role that such combined grazing has on the function of these arid woodlands and shrublands is unclear, but it is highly probable that the removal of significant amounts of plant biomass limits the availability of some plant foods (typically soft fruits such as *Nitraria*), reduces the density and diversity of invertebrate prey, and largely prevents wildfires that regenerate some shrubland dominants. For instance, on Peron Peninsula many of the larger hollow *Acacia ramulosa* stumps lying on the ground have charcoal traces around their base, suggesting that fire killed the original shrub, and so in time, provided suitable refuges for *E. stokesii* (D. Pearson, pers. obs. 2008).

The long-term exclusion of fire may inhibit the processes responsible for the creation of hollow logs. Further work on the role of fire in creating and maintaining an ongoing supply of hollow logs is required (Manning *et al*., 2011). In the summer of 2011/12 extensive wildfires started by lightning occurred over large areas of the Murchison and Gascoyne regions as a result of continuous fuels (due to growth after a period of exceptional rainfall). Such fires are a rare occurrence but may have profound impacts on *Egernia* populations, the extent of which is currently unknown (A. Desmond, pers. comm. 2012).

2.2 Grazing

Feral goat activity seems to be a particularly important threat for the black form populations. The vegetation on three granite outcrops east of Cue has been seriously degraded by goat grazing and trampling, to the point that on Woolgerong and Walga Rocks, perennial plants are being killed and skeletal soils on the outcrop are starting to erode away (Hussey, 2003; D. Pearson, pers.

obs. 2008). This probably leads to a loss of food resources for the skinks, but also potentially, the silting up of crevices used for shelter. Other populations of the black form on pastoral lands are probably similarly threatened. Sheep and feral goats were previously present in their thousands on Dirk Hartog Island and had a major impact on the structure and floristics of local shrubland communities. Destocking and ongoing goat control should result in the recovery of the vegetation.

2.3 Loss of modified habitat

Perversely, farmers and other landholders cleaning up junk (especially sheets of corrugated iron), removing abandoned farmhouses and other infrastructure or disposing of piles of old wooden railway sleepers may threaten local populations of skinks. These materials and structures provide refuges that have become important for the persistence of skinks in areas where woodlands have been largely cleared so that there are few alternative refuges (such as logs) available.

2.4 Predation

Foxes and cats have been identified as a probable conservation threat to *E. stokesii* (Desmond and Chant, 2001). Both foxes and cats take small lizards as prey, so it is likely that some *E. stokesii* are eaten. Determining the role of foxes and cats in causing or exacerbating population declines would be difficult as diet studies in isolation (i.e. using the presence of skink material in predator scats) typically do not provide an indication of the intensity and impact of predation. However, young, dispersing skinks are likely to be particularly vulnerable.

Insular populations of *E. stokesii* are at potential risk from introduced predators, including introduced rats. The extinction of *E. stokesii* on Rat Island in the Abrolhos (probably linked to the introduction of rats and cats) indicates the likely impact of an introduction of exotic mammals. In other parts of the world, rats and feral cats have had serious impacts on insular lizard fauna (Dickman, 1996).

2.5 Illegal taking

Illegal collecting for the illicit pet-trade is a possible and potential threat for some populations, especially distinct geographically restricted taxa such as the black form skinks or *E.s. aethiops*. While illegal collection has traditionally been more of a problem for the conservation of snakes (Webb *et al*., 2002), increasing interest in herpetoculture may see a shift to other reptiles including such bizarre-looking social skinks with spiny tails. The removal of numerous individuals from local populations could influence the persistence of populations.

2.6 Mining activities

Mining and associated infrastructure (e.g. roads and railway lines) has impacted individual populations due to the removal of habitat and some individual *E.s. badia* have been translocated as a result in the Yalgoo Bioregion. Similar activities may threaten populations of the black form of *E. stokesii.* Further work is required to understand the likely impacts of such activities and the success of translocations.

2.7 Climate change

The effect of climate change on *E. stokesii* is difficult to discern given we know comparatively little about its ecology in WA. Changes in climate that lead to degradation of woodland habitat in the wheatbelt would obviously negatively impact upon the skinks. Elsewhere, declining rainfall could place remnant populations under increased risk of localised extinction during drought events or long-term failure to recruit new woodland plant species. The specific impacts of climate change to the narrow band of country occupied by *E. stokesii* in WA needs to be further investigated.

2.8 Summary of threats

To summarise, the main threats known to WA populations of *E. stokesii* are:

- the clearance of habitat for mining and mining infrastructure and farming (particularly remnant woodlands in the wheatbelt)
- degradation of existing habitat due to rising water tables and salinisation, grazing by rabbits, feral goats and domestic stock

- discontinuation or modification of natural processes (such as fire) that generate logs and regenerate woodlands
- firewood collecting that removes logs and hollow trees
- removal of alternative refugia such as rubbish piles, abandoned farm houses and infrastructure
- climate change

The main potential threats include:

- Introduction of exotic predators, including rats, onto islands occupied by *E. stokesii*
- Illegal collection for pets

3. PREVIOUS MANAGEMENT ACTIONS

Some generalised management actions for areas occupied by *E. stokesii* have probably incidentally benefited the species. For example, ongoing fox, feral cat and feral goat control on Peron Peninsula may have reduced some predation pressure and reduced damage to vegetation communities. The change in tenure of Dirk Hartog Island from a pastoral lease to National Park has resulted in destocking of sheep and substantial removal of feral goats and some control of feral cats. No other reserves with *E. stokesii* are subject to routine feral animal baiting programs or have feral goat control activities where this pest species is present.

Fire suppression that has occurred in small woodland remnants may have benefits in the short term (such as avoiding the loss of existing logs), but in the longer term may interrupt renewal processes for woodland plant species and the production of logs. The protection of habitat in designated reserves is likely to have prevented or restricted the removal of timber from these sites for construction or firewood purposes.

Surveys have been undertaken to determine the distribution, conservation status and possible threats to the conservation of *E. stokesii*. Such surveys have been undertaken by a number of organisations including DEC, WA Museum, non-government organisations (e.g. AWC) and environmental consulting companies commissioned by mining and exploration companies (e.g. ecologia Environmental, 2010). In addition, specimens have been collected by the public. Examples of such surveys include:

- Joint CALM (now DEC) and WA Museum expeditions to the Abrolhos Island in October 1998, October 1999 and April 2003 collected specimens and genetic material and found the species to be very common on East and West Wallabi and Tattler Islands (How *et al.,* 2004).
- In August 2003, a CALM biologist, amateur herpetologists and an Honours student visited various populations to collect genetic material for a morphological and genetic study (Hamilton, 2003). Animals were collected from Peron Peninsula, Wurrah Rock and Caron in the wheatbelt and observations made on the habitat occupied in these areas.
- In May 2008, under state Natural Resource Management (NRM) funding for threatened species ("Back from the Brink" and "Back from the Edge"), public reported sightings of *E. stokesii* populations in the Northern Agricultural Zone and the Avon Catchment areas of the wheatbelt were collated and investigated (R. Hartley, T. Lee-Steere, pers comm. 2008).
- Fauna surveys undertaken as part of environmental review documents failed to locate *E. stokesii* in the Mt Gibson area (ATA Environmental, 2006) however the Australian Wildlife Conservancy confirmed the species to exist on Mt Gibson Sanctuary in 2009 (M. Page, pers. comm. 2011).
- Two populations were found near a proposed iron ore mine near Koolanooka, approximately 21 km east of Morawa. The populations were found in rubbish piles of tin and car bodies in degraded areas alongside farm houses. Large trees and abundant woody material lay on the ground in these areas (ATA Environmental, 2004).

- Surveys between 2006 and 2010 were commissioned by Oakajee Port and Rail Pty Ltd and undertaken by ecologica Environmental (2010) included helicopter surveys to identify suitable habitat within the project area and targeted surveys for the species. These resulted in over 70 new records in the Murchison Region.

Identification and mapping of suitable habitat has been undertaken as part of an NRM project ("Hidden Treasures") aimed to identify remnant bushland areas in the wheatbelt with high diversity of vegetation associations. It mapped vegetation remnants and overlaid this information on digitised and revised vegetation association maps (originally prepared by J. Beard). The base datasets from this project are valuable to establish other areas of suitable habitat in the wheatbelt which should be surveyed to determine where *E. stokesii* persists (J. Scott, pers. comm. 2008).

A relocation of nine *Egernia stokesii badia* was carried out in April 2008 following their discovery on a property in the Perenjori townsite. The land-owner was proposing to clear up waste materials and an emergency translocation moved the skinks to nearby West Perenjori Nature Reserve, 5 km away, where the skinks were known to exist (R. Hartley, pers. comm. 2008). The skinks were captured and held in plastic containers in their original family groups and transported to the nature reserve along with some of the materials under which they had been sheltering. Additional logs and sticks collected from throughout the reserve were combined with the moved materials to add to the complexity of their new habitat. Fifteen days later, the translocation site was inspected and at four of the five constructed woodpiles, fresh scats were found. Two of the piles were dismantled to check on the physical condition of the skinks. Some movement of the skinks between piles was discovered and three of four individuals examined had increased in weight since release (R. Hartley, pers. comm. 2008).

4. IMPORTANT POPULATIONS

Western Australia

All populations of *Egernia stokesii* in Western Australia are considered important. Each of the six identified management units (included within three subspecies) is restricted in its distribution. *Egernia stokesii stokesii* is only known from eight islands and at least 2 genetic groupings exist within this taxon ("northern" Abrolhos (5 islands) and "southern" Abrolhos (3 islands); see p. 11). *Egernia stokesii badia* is only found on the mainland in fragmented populations between the northern and central wheatbelt and the upper Mid West region ("Shark Bay" populations including Dirk Hartog Island).

Many populations of *E. s. badia* appear to be under significant threat. In the wheatbelt region, several known and isolated populations occur on small and degraded woodland remnants, or have tenuous existence living in abandoned houses or piles of rubbish. It is highly likely that there are other populations in similar circumstances, but the most important populations for the persistence of the subspecies have not yet been determined.

All the black form populations are important due to their overall small geographic range, ongoing degradation of habitat from uncontrolled grazing by feral goats and also perhaps illegal collection. Baudin Island is the only known location for *E. s. aethiops* and so it is essential for this taxon.

5. MANAGEMENT PRACTICES

Programs and other documents that complement the Recovery Plan and can further protect the species are listed below.

- Avon Catchment Council (now Wheatbelt NRM) projects such as '*Ecoscapes*', '*Our Patch*' and '*Fire Management*' that aimed to address landscape scale threats, develop bushland conservation guidelines and management plans, and deliver on ground management..
- WWF's '*Woodland Watch*' (now '*Healthy Bushland*') aimed to protect remaining areas of tall eucalypt woodlands in the wheatbelt and to work with landholders, community groups and local government to improve their management, raise awareness and implement long-term conservation measures.
- Greening Australia's '*Living Landscapes*' project encourages farmers to rehabilitate their local landscape while maintaining sustainable agricultural systems.
- BushBank is a fund to buy private blocks of high conservation value, that are then protected by a conservation covenant and the land on-sold to a sympathetic purchaser.
- Bush Brokers supports the protection and management of private bush remnants through information and informing the real estate industry about the conservation value and marketing of bush blocks.
- Private, non government organisations such as the Australian Wildlife Conservancy and Bush Heritage Australia have purchased property with suitable habitat and aim to manage these properties for conservation purposes.

Other relevant management plans and policies include:
Western Spiney-tailed Skink (Egernia stokesii badia) conservation plan 2008-2013 (Lee-Steere, 2008)

- Shark Bay Terrestrial Reserves Management Plan 2000-2009 No. 45, Department of Environment and Conservation (Hancock *et al.,* 2000)
- Shark Bay World Heritage Property Strategic Plan 2008-2020, Department of Environment and Conservation
- Fisheries Sustainable Tourism Plan for the Houtman Abrolhos Islands 2001 Fisheries Management Paper No. 146, Fisheries Western Australia
- Policy Statement No. 29 *Translocation of Threatened Flora and Fauna* (CALM, 1995)
- Policy Statement No. 33 *Conservation of endangered and specially protected fauna in the wild* (CALM 1991)
- *Minimising Disease Risk in Wildlife Management*. 2nd Edition. Department of Conservation and Land Management, Perth, Western Australia. (Chapman *et al*., 2008)

6. GUIDANCE FOR DECISION MAKERS

Loss of habitat caused by development and on-ground works (e.g. firebreaks, road works, burning, mining etc.) may significantly affect the species and may therefore require environmental impact assessment under the Western Australian *Environmental Protection Act 1986* and/or the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999.* A proposed action, or any person proposing to undertake actions, which may have a significant impact on any listed threatened species or ecological community should refer the action to the Commonwealth Minister for the Environment. The Minister will determine whether the action requires EPBC Act assessment and approval. Further advice on the EPBC Act is available on the Department of Sustainability, Environment, Water, Population and Communities website (SEWPaC, 2012).

Activities that could result in any of the following may result in a significant impact on *Egernia stokesii*:

- introduction of vertebrate predators, including rats, onto islands where *E. stokesii* occurs
- the removal of available refugia, or the destruction or degradation of habitat or potential habitat
- decrease in the connectivity of woodland remnants
- removal of timber from woodland habitats
- increased grazing, compaction or salinity within identified or potential habitat
- prescribed fire or arson in woodland remnants.

7. RECOVERY PROGRAM

7.1 Recovery Objective

To improve the conservation status and ensure the long-term survival of the three identified taxa (and the six genetic management groups) in the *E. stokesii* complex through increased knowledge and understanding of the taxa, the protection of habitat and the abatement of threats.

7.2 Performance criteria

Criteria for success over the life of the plan (five years):

- Maintain or increase in the number of populations or habitat occupied by all taxa.
- Habitat occupied by *E.s. badia* and the black form of the species plus potentially suitable habitat has been identified and mapped.
- At least 50% of known remnant woodland populations are being managed for conservation (e.g. through voluntary management agreements).
- All incursions of exotic vertebrate predators and rats are prevented from establishing on islands where populations of *E. stokesii* occur.

- At least 75% of all attempted translocations result establishing viable populations.

Criteria for failure:

- Any taxa have decreased in terms of number of populations or apparent abundance.
- Habitat and potential habitat for any taxa of the species remains unclear and not mapped.
- Less than 30% of known remnant woodland populations are being managed for conservation.
- Less than 50% of all attempted translocations result in establishing viable populations.
- Exotic vertebrate predators and/or rats establish on islands where populations of *E. stokesii* occur.

8. RECOVERY ACTIONS

8.1 Determine the essential habitat requirements of mainland WA populations.

Tasks:

- Describe and identify all potential habitat
- Model and map habitat effectively, especially within the WA wheatbelt
- Identify potential sites for translocation
- Identify opportunities to link habitat through land purchases, rehabilitation of vegetation or land management agreements

Stakeholders:

DEC, NRM groups, catchment groups and farmers/graziers, exploration and mining companies.

Budget:

Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Total
50,000	55,000				105,000

8.2 Clarify the distribution and conservation status of the various taxa of *E. stokesii*, their population trends and threats.

Tasks:

- Undertake targeted surveys as informed by the information from action 1
- Monitor populations annually in the wheatbelt for population dynamics and response to management actions
- Complete genetic analyses (mtDNA, microsatellite, allozyme)
- Resolve the taxonomic and conservation status of WA taxa within the *E. stokesii* complex

Stakeholders:

DEC, WA Museum, DoF (Abrolhos), NRM groups, catchment groups and farmers/graziers.

Budget:

Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Total
50,000	50,000	20,000	20,000	20,000	160,000

8.3 Identify threatening processes and techniques to mitigate their impact.

Tasks:

- Investigate goat exclusion/control zones around populations on pastoral leases
- Evaluate the impact of proposed mining and infrastructure activities and develop ways to minimise impacts on populations and habitat
- Develop ways to minimise timber/firewood collection around populations
- Analyse the activities and diets of predators around populations and assess whether fox/feral cat control is required
- Investigate relationships between habitat complexity and predation

Stakeholders:

DEC, NRM groups, catchment groups, farmers/graziers and mining companies.

Budget:

Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Total
50,000	50,000	50,000			150,000

8.4 Manage known populations in remnant woodland areas.

Tasks:

- Identify threats specific to the taxa occupying woodland habitats
- Develop specific management actions for each known population of *E. s. badia*

Stakeholders:

DEC, NRM groups, catchment groups and farmers/graziers.

Budget:

Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Total
20,000	40,000	40,000	20,000	20,000	140,000

8.5 Protect habitat remnants and create new habitat where required for populations to persist.

Tasks:

- Trial artificial refugia (as described by Arida and Bull 2008; Mensforth and Bull, 2008) in areas where logs have been largely removed
- Protect habitat remnants where possible through planning processes, land management agreements and consultation with land holders
- Review available literature and undertake research to determine the processes involved in log formation in woodland remnants

Budget:

Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Total
20,000	20,000	20,000			60,000

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8.6 Prevent the introduction of exotic vertebrate predators and rats onto islands occupied by *E. stokesii*

Tasks:

- Consult with DoF regarding the planning and management of the Albrolhos Islands
- Develop an island biosecurity strategy to protect *E. stokesii* populations
- Implement an education program for government employees, tourism operators and commercial fishermen using the islands
- Develop a rapid response quarantine strategy to reduce the risk of any incursions of exotic species

Stakeholders:

DEC, DoF, professional fishermen in the Abrolhos, and Abrolhos dive, fishing and tourism operators.

Budget:

Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Total
2,000	2,000	2,000	3,000	3,000	12,000

8.7 Prevent illegal collection.

Tasks:

- Develop a network to report suspicious or illegal behaviour using pastoralists, Fisheries officers, Customs, DEC staff, NRM staff and community members
- Develop DNA profiles of all populations for future identification
- Educate wildlife enforcement officers about the species
- Enforce compliance breaches under the *Wildlife Conservation Act 1950* and the *Wildlife Conservation (Reptiles and Amphibians) Regulations 2002*

Stakeholders:

DoF, DEC, NRM groups, graziers and farmers, tourism operators and pet dealers.

Budget:

Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Total
2,000	2,000	2,000	2,000	2,000	10,000

8.8 Engage landholders and local communities to make them aware of the existence of the species and its conservation requirements.

Tasks:

- Produce informative brochures targeted at landholders (and other stakeholders) to summarise the ecology and conservation issues facing *E. stokesii* with suggestions for sympathetic land management (include disposal of rubbish piles and railway sleepers)
- Insert articles in local papers and organise interviews on local radio to outline conservation efforts and request assistance in locating and managing populations
- Work with existing programs (e.g. WWF's Healthy Bushland Project) to help raise appreciation of the importance of remnant wheatbelt woodland for threatened fauna

Stakeholders:

NRM groups, WWF, Westrail, catchment groups, local communities, farmers/graziers, DEC.

Budget:

Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Total
5,000	5,000	5,000	5,000	5,000	25,000

8.9 Encourage landholders to remove or minimise the impact of stock and introduced herbivores on habitat, especially remnant woodlands.

Tasks:

- Undertake specific liaison with landholders who have *E. stokesii* populations on their land to explain their conservation importance and to seek their assistance with management
- Provide resources (such as fencing materials and labour) to fence off woodland patches and rock outcrops containing *E. stokesii* populations
- Develop land management agreements to reduce stock rates or intensity of land use on remnant woodland patches
- Work with DAFWA extension officers to improve management of fragmented landscapes in combination with improving farm productivity and sustainability

Stakeholders:

DEC, NRM groups, DAFWA, farmers in the northern and central wheatbelt and graziers in the Shark Bay to Cue area

Budget:

Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Total
5,000	5,000	5,000	5,000	5,000	25,000

8.10 Develop and implement conservation agreements with landholders and mining companies to retain habitat and link remnant woodland patches as identified in Action 1.

Tasks:

- Develop a standardised land management agreement that can be modified as required to engage landholders in managing and linking *E. stokesii* habitat
- Based on information collected under Actions 1 and 2, develop recommendations for appropriate land management practices and strategies on different land tenures to link habitat

- Identify landholders with populations of skinks on land under their control and co-operatively formulate suitable land management strategies

Stakeholders:

DEC, NRM groups, farmers in the northern and central wheatbelt, mining companies, graziers on Callagiddy and Woodleigh Stations and presumably other stations in the area, and mining proponents e.g. Oakajee Port and Rail Project and Karara Mining Ltd.

Budget:

Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Total
5,000	5,000	5,000	5,000	5,000	25,000

8.11 Manage ongoing recovery process to ensure actions are delivered and monitored effectively.

Tasks:

- Consult with other stakeholders to identify the most effective format for a recovery team, either a species-specific team or perhaps one to cover a range of threatened, DEC priority-listed or specially protected reptiles in the Midwest and Wheatbelt Regions (e.g. Woma Python (*Aspidites ramsayi*), Carpet Python (*Morelia spilota imbricata*), the legless lizards (*Aclys concinna major, Aprasia haroldi* and *Pletholax gracilis edelensis*)).
- Hold regular meetings of recovery team to plan, revise and implement actions

Stakeholders:

DEC, NRM groups, Brookfield Rail, catchment groups, DoF, professional fishermen, Shire Councils and farmers/graziers.

Budget:

Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Total

500	500	500	500	500	2,500

8.12 Develop a strategy to translocate at-risk populations to secure sites when needed.

Translocations should conform to DEC's translocation protocols (Policy Statement 29: CALM 1995) and animal ethics requirements. There is provision for emergency translocation in Policy Statement 29. Given that the species maintains discreet family groups and home ranges, it is desirable to place translocated family groups of lizards in suitable but vacant habitat. Wherever possible translocations should be conducted to nearby bushland and the success of the translocation monitored to determine its success or otherwise and so guide any future attempts. Actions 1 and 2 would identify suitable sites for translocations should populations in high risk locations (abandoned buildings, rubbish piles) be under direct threat.

Tasks:

- Identify habitat likely to be threatened where skinks may require translocation
- Develop translocation protocols, risk management procedures and monitoring requirements
- Evaluate the potential of captive breeding for release to the wild to facilitate increased capacity to augment existing populations, to establish new populations and to re-establish locally extinct populations

Stakeholders:

DEC, Brookfield Rail, Department of Water, exploration and mining companies.

*Budget**:

Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Total
2,000	2,000				4,000

*No specific funding has been included for captive breeding and translocation as it is not currently required, but may be within the life of the Plan. It would need to be determined on a case-by-case basis. Captive breeding (e.g. at Perth Zoo) would cost in the order of $70-80,000 in the first year to set up and $50-60,000 per year to maintain. The selection of suitable translocation sites, predator control, a translocation of 30 captive animals and monitoring in the northern wheatbelt / Murchison would cost in the order of $70,000 p.a.

9. IMPLEMENTATION AND EVALUATION OF RECOVERY PLAN

This Recovery Plan guides the recovery actions for *E. stokesii* and will be implemented and managed primarily by DEC, with the support of other relevant agencies, non-government organisations, educational institutions, regional natural resource management authorities and community groups as appropriate. Technical, scientific, habitat management or education components of the Recovery Plan may be referred to specialist groups as required. Contact will be maintained between Government agencies and key stakeholders on recovery issues concerning the species. The plan will run for a maximum of five years from the date of its adoption under the EPBC Act, or until replaced. The Recovery Team (or similar see section 8.11) will produce an annual report of achievements against the actions. The Plan will be reviewed by DEC, in consultation with the Recovery Team within five years of the date of its adoptions, or sooner if necessary.

Table 1 presents a summary of the recovery actions, their priority, and estimated costing over a five year period.

Table 1: Summary of recovery actions, priority and costs over five years.

Action No.	Action title	Priority	Year 1	Year 2	Year 3	Year 4	Year 5	Total
1	Identification of critical habitat requirements	High	50,000	55,000				105,000
2	Clarify the distribution and conservation status of all taxa of *E. stokesii*, their population trends and threats	High	50,000	50,000	20,000	20,000	20,000	160,000
3	Identification of threatening processes and techniques to mitigate their impact	High	50,000	50,000	50,000			150,000
4	Manage known populations in remnant woodland areas	High	20,000	40,000	40,000	20,000	20,000	140,000
5	Protect habitat remnants and create new habitat	Medium	20,000	20,000	20,000			60,000
6	Prevent the introduction of exotic vertebrate predators and rats onto islands occupied by *E. stokesii*	Medium	2,000	2,000	2,000	3,000	3,000	12,000
7	Prevention of illegal collection	Medium	2,000	2,000	2,000	2,000	2,000	10,000
8	Engage landholders and local communities to make them aware of the existence of the species and its conservation requirements	Medium	5,000	5,000	5,000	5,000	5,000	25,000
9	Encourage landholders to remove or minimise the impact of stock and introduced herbivores	Medium	5,000	5,000	5,000	5,000	5,000	25,000
10	Develop and implement conservation agreements with landholders and mining companies	Medium	5,000	5,000	5,000	5,000	5,000	25,000
11	Manage the on-going recovery process	Medium	500	500	500	500	500	2,500
12	Translocation strategies and protocols for monitoring	High	2,000	2,000	0*	0*	0*	4,000
Total	Annual cost of recovery program		211,500	236,500	149,500	60,500	60,500	**718,500**

*** To be determined on a needs basis (case-by-case)**

10. AFFECTED INTERESTS

Private landholders

The full implementation of recovery actions outlined in this Plan may affect how some private landholders manage parts of their properties containing patches of remnant woodland. In some cases, fencing of woodland remnants or granite outcrops may be a desirable option and this will reduce the amount of grazing or cropping land available. The Plan does recommend that no further areas of woodland known to contain *E. stokesii* or potential habitat are cleared or used for timber production or firewood collection. Such actions inevitably will have some impact on private landholders.

The Department of Fisheries (DoF)

At present, the activities of fishermen on the Abrolhos Islands are subject to control by the DoF. This agency limits structures that can be built and maintained on each island. Any quarantine protocols designed to reduce the chance of introducing exotic vertebrates or plants may have some impacts on the way that fishermen conduct their operations and manage their camps. However, given the high conservation value of these islands, actions to prevent the introduction of exotic species underlies sound land management. Proposals to develop tourism ventures, including accommodation on Abrolhos islands, need to be carefully scrutinized and licensed to ensure that quarantine protocols are rigorous and carefully monitored. Damage to *E. stokesii* habitat should be avoided wherever possible.

Mining interests

Mining and associated infrastructure interests in the Morawa-Yalgoo-Cue area may be affected if populations are found in areas of mineral prospectivity or along proposed corridors for roads or railways. On such occasions, companies may need to alter the location or intensity of some of their activities or with the necessary approvals, translocate skinks.

11. INDIGENOUS INTERESTS

Spiny-tailed skinks are known as ‘gidgee’ skinks throughout Australia because of the skinks’ association with gidgee plants (*Acacia* spp.) (Yokose, 2001). Local people in the Shark Bay area use the name “migurda” for this skink (D. Capewell, Wula Guda Nyinda Aboriginal Eco Adventures, pers. comm. 2011). The distribution of *E. stokesii* covers lands of multiple indigenous language groups. There are currently registered native title applications over areas where *E. stokesii* including the “Malgana Shark Bay Peoples” (WC98/17), “Wajarri Yamatji” (WC04/10), “Mullewa Wadjari” (WC96/93), “Widi Mob” (WC97/72) and “Badimia People” (WC96/98) (National Native Title Tribunal 2011). These groups and others will need to be consulted about future survey work and management actions across the known range of this species. Participation in recovery actions including survey work on the species is anticipated and existing partnerships will be fostered in the recovery planning process. The Aboriginal Sites Register maintained by the Department of Indigenous Affairs lists significant sites and will be searched prior to the implementation of any recovery actions that could impact on these sites. Traditional owners will be consulted and actions taken to minimise disturbance of sites listed on the Register as well as unlisted sites.

12. SOCIAL AND ECONOMIC IMPACTS

Implementation of the proposed actions of the Recovery Plan is considered to have limited social and economic impacts. At present, there are only a small number of *E. stokesii* known to occur in areas of intensive development such as mineral deposits or major infrastructure. Nonetheless, further surveys may reveal hitherto unknown populations that are threatened by large resource projects, especially in the Yalgoo and Cue areas.

Other processes that are causing the ongoing decline of *E. stokesii* occur across vast tracts of landscape. At the individual farm level, the fencing of woodlands to

protect habitat may reduce area available for grazing, but may have other benefits for farmers (windbreaks, prevention of elevated water tables and salinity, etc.). Land and infrastructure involved in railway lines which transport cereal crops may be of considerable importance to *E. stokesii*. The linear corridors of bushland retained along railway lines, piles of old sleepers and even piles of tin and rubbish in railway reserves provide habitat and it may be necessary for railway line operators to undertake some actions to minimise the impact of their operations on populations of resident skinks.

The involvement of local communities in projects which identify threatened species and consider the management of their habitats will have positive social benefits in encouraging communication between landholders and neighbours. In addition, it draws into focus the biological diversity of the local bushland for residents and so makes people more aware and appreciative of the natural values of their surroundings.

13. BENEFITS TO OTHER SPECIES OR COMMUNITIES

Numerous wheatbelt fauna species, including several threatened species would benefit from the Actions proposed in this Plan. Woodlands in the wheatbelt are important habitat for a range of threatened fauna including Carnaby's cockatoo (*Calyptorhynchus latirostris*) and malleefowl (*Leipoa ocellata*) (both listed under the Wildlife Conservation Act and EPBC Act), carpet python (*Morelia spilota imbricata*) and the woma python (*Aspidites ramsayi*), (listed as Other Specially Protected Fauna under the Wildlife Conservation Act).

Several threatened and priority fauna species are found on the Houtman Abrolhos Islands along with *Egernia stokesii stokesii*, these include Abrolhos painted button-quail (*Turnix varia scintillans*), tammar wallabies (*Macropus eugenii*), brush bronzewing pigeons (*Phaps elegans*), Abrolhos dwarf bearded dragons (*Pogona minor minima*) and numerous seabirds. These species would benefit from management strategies that protect island habitats and prevent the

introduction of predators, weeds or disease to the islands. Similarly, fauna species in Shark Bay (some translocated there) and its islands would benefit from recovery actions in this plan and include Shark Bay mammals such as the Shark Bay mouse (*Pseudomys fieldi*), Greater stick-nest rat (*Leporillus conditor),* Western Barred bandicoot (*Perameles bougainville*), Burrowing bettong (*Bettongia lesueur*),and Banded-hare wallaby (*Lagostrophus fasciatus*).

In the Mid-West region reptiles that would benefit from recovery actions for *E. stokesii* include other *Egernia* species such as *Egernia depressa* that live in similar habitat such as hollow logs, as well as many other species.

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