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# THE CONSERVATION AND MANAGEMENT OF THE BILBY (MACROTIS LAGOTIS) IN THE PILBARA

This report summarises the work carried out on the conservation and management of the bilby (*Macrotis lagotis*) in the Pilbara during the period 2012 -2013.

Work undertaken in the period 2012-13 included:

1. Refinement of the Project Plan and Experimental Design
2. Employment of a Technical Officer
3. Population Viability Analysis – How much land is required to support a viable bilby population?
4. Collation of current and historic distributional data.
5. Modeling the distribution of bilbies in the Pilbara
6. Developing a fine-scale population monitoring technique
7. Developing a broad-scale survey technique

## 1. Refinement of the Project Plan and Experimental Design

The plan for the conservation and management of the bilby (*Macrotis lagotis*) in the Pilbara was extensively redesigned following literature review and incorporation of rigorous experimental design into components. Table 1 summarizes the new project plan.

The aim of this project is to improve our understanding of the distribution, and demographics of bilbies in the Pilbara, and provide information to environmental regulators and resource development companies that will allow appropriate management to ensure the persistence of this species in the Pilbara.

Specifically, the objectives of this project are to:

- Gather recent and historic records in order to understand and predict the distribution of bilbies in the Pilbara
- Develop and implement a broad-scale survey technique
- Develop a fine-scale population monitoring technique and implement long-term population monitoring
- Understand the effects on demographics of bilby populations in the Pilbara

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The anticipated project outcomes include:

- Improved understanding of the distribution and conservation status of bilbies in the Pilbara
- Information on which to base management decisions of populations in and around mining sites and other developments.
- Improvement to national impact guidelines being developed for bilbies.
- This project will provide a model for survey, monitoring and management of bilbies in other regions of WA.

The anticipated users of the knowledge to be gained include:

- DSEWPaC – provide guidance with bilby survey and monitoring protocols and the development of impact guidelines.
- Pilbara mining industry - provide information to resource development companies that will allow appropriate management of mining sites to ensure the persistence of bilby populations.
- Consultants – provide information and guidance relating to bilby monitoring and survey protocols.
- Other researchers – provide opportunities for more integrated and collaborative research projects to be undertaken, share knowledge with other participants.

**Table 1. Refined Project Plan.**

| Component | Milestones | Completion | Outputs |
|---|---|---|---|
| Collate current and historic distributional data | • Set up a database<br>• Complete search of all published and unpublished literature and interviews with landholders and managers<br>• Set up database as NatureMap theme and online user contributable input interface | Dec 2013 | • Accurate database of bilby records in the Pilbara<br>• NatureMap theme as portal to database with online user contributable interface to keep database current |
| Model distribution of bilbies in the Pilbara | • Habitat model of bilbies in Pilbara completed and written up for publication | Dec 2013 | • Publication in scientific journal |
| Develop broad-scale survey technique | • Select sites to trial survey techniques<br>• Compare survey techniques and select most efficient | 2014 | • Publication in scientific journal<br>• Survey protocols for DSEWPaC and DEC |
| Broad-scale survey of Pilbara | • Select areas to survey based on habitat modeling<br>• Selected areas surveyed<br>• Data imported into online database | 2015-ongoing | • Publication in scientific journal<br>• Dataset available online via NatureMap theme portal |
| Develop fine-scale population monitoring technique | • Select sites to trial monitoring techniques<br>• Develop and test DNA extraction and PCR with developed bilby microsat primers from fecal samples<br>• Compare monitoring techniques and select most efficient | 2014 | • Publication in scientific journal<br>• Population monitoring protocols for DSEWPaC and DEC |

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|---|---|---|---|
| Long-term population monitoring | • Select sites/functional populations for long-term monitoring<br>• Annual monitoring | 2015-ongoing | • Annual technical report<br>• Periodic publications in scientific journals of the status of bilbies in the Pilbara<br>• Information for the basis of development and management decisions |
| Understand effects on demographics | • Determine population genetic structure of bilbies in the Pilbara and elsewhere<br>• Investigate potential impacts of mining activities and development on populations | 2015+ | • Publication in scientific journals<br>• Information for the basis of development and management decisions<br>• Protocols for bilby management on mining and other development sites |

# 2. Employment of a Technical Officer

Fiona Carpenter was engaged from 2012 in a full time position as the Technical Officer for this project.

# 3. Population Viability Analysis – How much land is required to support a viable bilby population?

In 2012 it was noted that a need existed to know for offset conditions how much habitat is needed to support a viable bilby population. Using mortality and demographic data available from the literature, population viability analysis (PVA) was performed to determine a suitably sized area that would support self-sustaining populations of bilbies (*Macrotis lagotis*) without intervention or artificial management of the population.

This analysis indicated that a minimum area of approximately 50,000 ha of suitable bilby habitat is required to be able to support a viable population with a low probability (<0.1) of extinction over 100 years (Figure 1). In this area and under the lowest mortality rate scenario, if 15 bilbies were used as founder stock, a population of approximately 120 could be sustained after 30 years. If 50 bilbies were used as founder stock, 200 bilbies could be sustained after 20 years. A 1,000 ha area is considered unsustainable in the long term as it provides home range space for only six bilbies which the PVA predicts would persist for less than five years. This study is currently being drafted for publication.

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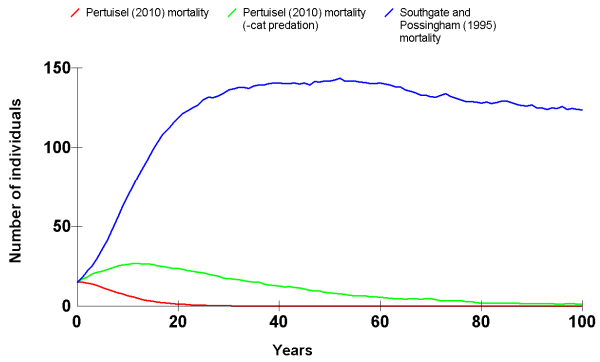
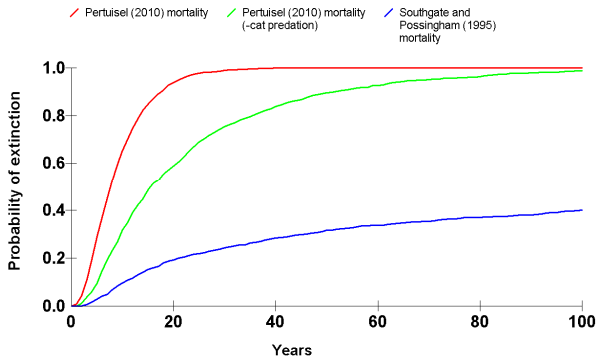
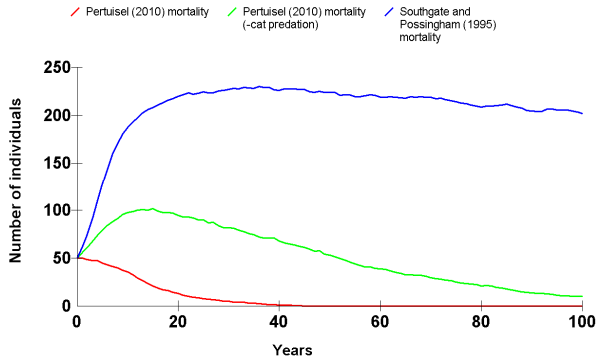


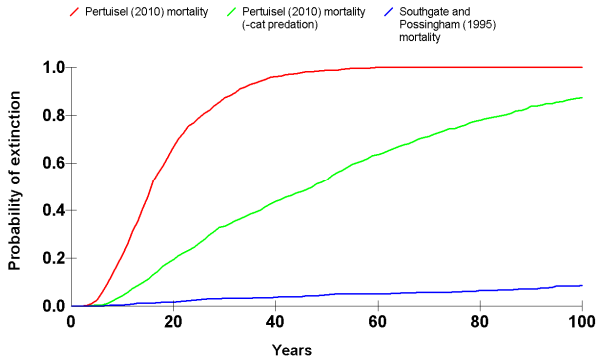

Number of individuals. Initial population = 15 individuals




Probability of extinction. Initial population = 15 individuals




Number of individuals. Initial population = 50 individuals




Probability of extinction. Initial population = 50 individuals

**Figure 1. Population viability of bilbies in 50,100 ha of habitat.**

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# 4. Collation of current and historic distributional data.

Current and historic records of bilbies in the Pilbara have been accessed from the following sources:

- Published literature
- "Grey" literature (including consultant and DEC reports)
- WA DEC, WAM and other national databases
- Liaison with DEC staff, ecologists, consultants and land holders/users
- Field trips to the Pilbara region

An online portal through DPaW's NatureMap webpage has been designed and set up to access the database of bilby records. This has been developed as an internal collaboration with DPaW Science Applications. An online user-contributable data entry site has also be developed to provide the ability to maintain the database and keep it current with the addition of new records. This has been developed using the open source Atlas of Living Australia Biological Data Recording System (ALA, 2013) in collaboration with Gaia Resources and DPaW Science Applications. The Pilbara Threatened Fauna is now online at: http://naturemap.dec.wa.gov.au/default.aspx under the dropdown menu: "Themes" (Figure 2).

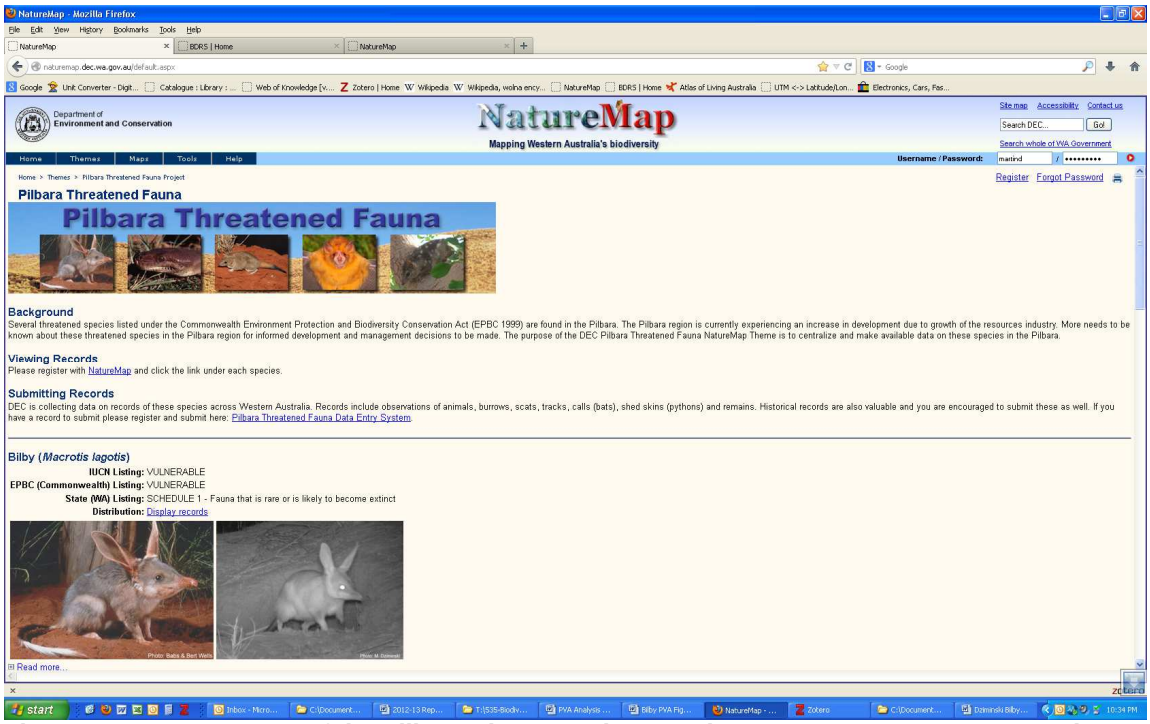


**Figure 2. Screen capture of the Pilbara Threatened Fauna theme on DPaW's NatureMap site.**

The online user-contributable data entry site (Figure 3) is still being finalized and will be fully functional shortly. A preview can be accessed here: http://core.gaiaresources.com.au/bdrs-core/dtf/home.htm

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**Figure 3. Screen capture of the Pilbara Threatened Fauna online user-contributable data entry site.**

# 5. Modeling the distribution of bilbies in the Pilbara

The distributional data collected in Section 4 above will be used in conjunction with GIS layers to create a model of predicted distribution of bilbies in the Pilbara. Modelling will be completed using various software packages and will be drafted for publication.

# 6. Developing a fine-scale population monitoring technique

Since no reliable method of estimating bilby densities exists, and bilbies are not suitable for efficient mark-release-recapture studies, the combination of using distance sampling (Buckland *et al.*, 2001, 2004) and molecular markers is being investigated. Reliable techniques exist for the extraction of DNA from bilby scats (Smith *et al.*, 2009), and polymorphic microsatellite markers have been developed for bilbies (Moritz *et al.*, 1997; Smith *et al.*, 2009) that are useful for identifying individuals.

A pilot study incorporating distance sampling and molecular markers has been undertaken at Lorna Glen where a reintroduced population of bilbies exists. Nine 1 km transects were sampled for bilby scats in a 10,000 ha area. Twenty-three scat samples were collected. We have managed to extract DNA and successfully genotype individuals from scats. The analysis and refinement of this pilot study is progressing with the expectation of expanding the survey area at Lorna Glen, and implementing pilot monitoring sites in the Pilbara.

# 7. Developing a broad-scale survey technique

Remote sensing techniques may have the potential of detecting bilby burrows in the landscape. LiDAR (Light Detection and Ranging) has recently been used to measure the height, shape and density of termite mounds across a landscape (Levick *et al.*, 2010) and detect old gold mine shaft entrances across a landscape (Utting *et al.*, 2010). This technique has the potential to be able to detect bilby burrow entrances across a landscape, through vegetation.

Another potential technique, SfM (Structure from Motion; Il-Kyun Jung & Lacroix, 2003; Kanade *et al.*, 2004) is being investigated. A collaboration with Dr James Kellner (Brown University) has been initiated to trial the use of LiDAR and SfM in detecting burrows from a UAV. Furthermore, the use of this technique extends beyond bilby burrows (eg rabbit burrows, boodie warrens) and has the potential to become an important land and pest management tool that land managers can benefit from.

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Funding opportunities for this work are currently being pursued with the goal of deploying these instruments at several pilot sites in the Pilbara and at Lorna Glen.

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