Project Plan SP 2017-060

Thermal, physical and prey requirements for northern quoll denning habitat

Animal Science

Project Core Team

Supervising Scientist	Judy Dunlop
Data Custodian	Judy Dunlop
Site Custodian	

Project status as of May 25, 2020, 1:24 p.m.

Closure pending approval of closure form

Document endorsements and approvals as of May 25, 2020, 1:24 p.m.

Project Team	granted
Program Leader	granted
Directorate	granted
Biometrician	granted
Herbarium Curator	not required
Animal Ethics Committee	granted

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Biodiversity and Conservation Science Program

Animal Science

Departmental Service

Service 6: Conserving Habitats, Species and Communities

Project Staff

Role	Person	Time allocation (FTE)
Supervising Scientist	Judy Dunlop	0.0

Related Science Projects

STP2017-076
SP2011-005

Proposed period of the project

June 4, 2018 – July 31, 2019

Relevance and Outcomes

Background

The northern quoll (*Dasyurus hallucatus*) is Australia's smallest species of quoll and exhibits a semelparous life history with males rarely living longer than 12 months (Oakwood, 2000; Schmitt et al., 1989). Northern quoll habitat once extended right across the northern third of the Australia, with a 75% reduction in distribution this century alone (Braithwaite & Griffiths, 1994). For the persisting population, topographically rugged habitat, essentially rocky outcrops, are thought to be critical habitat for protection against predators, fire and extreme weather, as well as providing denning opportunities (Begg, 1981).

The Pilbara bioregion of Western Australia has been identified as a last remaining stronghold for the northern quoll (Cramer et al., 2016), primarily due to the absence of cane toads, widely regarded as among the northern quolls greatest threats. However, the mesas and ranges that make up the preferred habitat of Pilbara northern quolls are increasingly subject to destruction by companies due to their suitability for iron-ore extraction, along with granite outcrops which are used in the construction of roads as well as railway beddings (Amir Abdul Nasir et al., 2018; Ramanaidou & Morris, 2010). In cases where known quoll habitat is disturbed due to mining development, the creation of artificial habitat may be used mitigate direct impacts on resident quoll populations.

To create artificial quoll habitat, rehabilitation managers must have a good understanding of key characteristics associated with suitable natural denning sites. This information is currently limited within the literature. However, it can be assumed that breeding dens will likely be structured such that internal temperature and humidity is kept somewhat stable in comparison to the external Pilbara climate, and that the den opening is small enough to exclude potential predators such as feral cats, wild dogs and larger varanids (Hernandez-Santin, Goldizen, & Fisher, 2016; O'Connell & Keppel, 2016).

Quantifying both the internal conditions as well as external features of occupied natural northern quoll dens, will facilitate the development of guidelines for future construction of northern quoll artificial habitat.

Aims

The primary aim of this study will be to quantify characteristics of northern quoll natural denning habitat (thermal properties, size, aspect and prey availability) in order to elucidate necessary conditions to be replicated as part of future artificial habitat creation.

In achieving this aim, the objectives are to;

1. Determine the thermal and physical properties of natural dens used by females and compare these to natural 'non-denning sites' which were available but not selected by denning females, presumably because they do not possess required characteristics.
2. Compare the thermal and physical properties of occupied dens to artificial dens.
3. Compare prey availability at occupied dens to non-denning sites and artificial sites.
4. Compare visitation rates of predators (feral cats, dingoes) at denning sites, non-denning sites and artificial sites.
5. Examine how female quolls use natural denning habitat and close surroundings.
6. Summarise information and data gathered to create guidelines for artificial den and habitat construction.

Expected outcome

We expect that this project will provide insights into the denning requirements for northern quolls in natural and artificial settings. Understanding the physical and thermal properties of these refugia will allow for the creation of artificial habitat and for better identifying habitat that is critical to the survival of northern quolls on a fine scale.

Knowledge transfer

Information gained from this project will be useful to State and Federal government agencies for guiding decision making, and to Industry partners for reducing impacts on threatened species. Information will be made available through an Honours thesis, reports and publications.

Tasks and Milestones

Permits, Risk assessment and Literature review by Sept 2018
Fieldwork completed by March 2019
Writeup and Data analysis by April 2019
Honours Thesis submission by June 2019

References

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Study design

Methodology

To locate occupied dens, we will use the following techniques;

1. Live trapping and radiotelemetry to track quolls back to occupied dens, as well as to observe behaviour and habitat use, including how far quolls venture from their dens and where they spend the most time.
2. Spool and line tracking will give us a different method to achieve similar observations as radiotelemetry on a smaller scale.
3. Fluorescent pigment tracking of quolls themselves using fluorescent pigment and portable ultraviolet lights is a similar way to obtain occupied den locations, as well as placing pigment at entrances of presumed dens to obtain presence/absence of quolls and which category the den will fall under (Proulx et al., 1995).
4. Live trapping and VHF tracking of quolls back to occupied dens.
5. Camera trapping at den sites where fluorescent powder has been disturbed, as well as other opportunistic sites using scat and refuse detection.

To measure thermal properties of occupied dens, non-denning sites and artificial dens we will use temperature and humidity iButtons placed inside dens as well as outside. iButtons are small data loggers used in most studies to measure ambient temperature and humidity of external and internal areas like quoll dens, hollows or nests (Roznik & Alford, 2012). iButtons will allow us to compare thermal differences between occupied dens, unoccupied dens and artificial dens, as well as outside air temperatures. (O'Connell & Keppel, 2016; Rowland, Briscoe, & Handasyde, 2017).

Mounted HC600 Reconyx covert cameras will allow us to observe times that quolls are entering and leaving dens, as well as predator visitation.

Invertebrate prey availability (ex. Coleoptera) will be studied using a combination of shallow and ramp pitfall trapping (Pearce, Schuurman, Barber, & Larrivée, 2005).

Downward facing HC600 Reconyx covert cameras will be used for vertebrate prey observation and baited with a contained universal bait of peanut butter and oats (ex. *Pseudomys*).

Belt transects for vegetation will be undertaken at denning, non-denning and artificial sites to observe ground cover as well as abundance of plants known to be part of quoll diet (ex. *Ficus*).

Predator visitation at all sites will recorded using unbaited HC600 Reconyx camera traps as to not lure predators to quoll dens or obtain biased visitation rates.

Natural habitat properties will be measured at denning and non-denning sites, including size, aspect, geomorphology and elevation.

Data analysis will be undertaken using R Studio using a combination of linear regression models comparing den treatments (occupied natural, unoccupied natural and artificial) alongside their co-variants;

- Elevation, aspect, den size and entrance size.

- Temperature and humidity inside and outside dens throughout the day.
- Quoll denning times versus active times.
- Dietary plant abundance.
- Invertebrate and mammal prey abundance.
- Predator visitation.

Biometrician's Endorsement

granted

Data management

No. specimens

Herbarium Curator's Endorsement

not required

Animal Ethics Committee's Endorsement

granted

Data management

Data will be lodged into NatureMap, and with the Departmental Library upon completion of the thesis.

Budget

Consolidated Funds

Source	Year 1	Year 2	Year 3
FTE Scientist			
FTE Technical			
Equipment			
Vehicle			
Travel			
Other			
Total			

External Funds

Source	Year 1	Year 2	Year 3
Salaries, Wages, Overtime	In-kind (DBCA/Roy Hill)		
Overheads			
Equipment	$5000 Roy Hill funding$		
Vehicle	In-kind (DBCA/Roy Hill)		
Travel	In-kind (DBCA/Roy Hill)		
Other			
Total			