Project Plan SP 2016-068

South West Threatened Fauna Recovery Project: Southern Jarrah Forest

Animal Science

Project Core Team

Supervising Scientist	Adrian Wayne
Data Custodian	Adrian Wayne
Site Custodian	

Project status as of Jan. 29, 2019, 8:11 a.m.

Approved and active

Document endorsements and approvals as of Jan. 29, 2019, 8:11 a.m.

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

South West Threatened Fauna Recovery Project: Southern Jarrah Forest

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	Adrian Wayne	0.5
Technical Officer	Marika Maxwell	0.9
Technical Officer	Colin Ward	0.9

Related Science Projects

other SWTFRP projects

Proposed period of the project

Feb. 1, 2016 – Dec. 31, 2018

Relevance and Outcomes

Background

Over the last 200 years, 50 per cent of the world's mammal extinctions have occurred in Australia (Short and Smith 1994). In Western Australia alone, 12 mammals and two birds have become extinct and at 30 June 2015, 39 terrestrial mammals and 23 terrestrial birds native to the State were classified as being threatened with extinction. Of these, three mammals and two birds are ranked as critically endangered. In mammals, most extinctions and declines have occurred in medium size species, in the so called 'critical weight range' of 35g to 5500g (Burbidge and McKenzie 1989).

Predation by feral cats and foxes is a key threatening process in the decline of many, if not all, these species. Foxes have been successfully controlled for many years in a range of locations across Western Australia using dried meat sausage baits containing 1080 poison. Over a decade of research by Parks and Wildlife scientists has led to the development of the *Eradicat®* feral cat bait, a moister meat bait, also containing 1080, that is more palatable to feral cats. *Eradicat®* was registered for operational use in Western Australia in December 2014, providing the opportunity to integrate broadscale feral cat control with existing fox baiting programs and other actions, such as translocation, that are implemented to improve the recovery of threatened native animals.

On 16 July 2015, the Minister for Environment, Hon Albert Jacob MLA, and the Commonwealth Minister for the Environment, Hon Greg Hunt MP, announced $1.7 million in funding for the Department of Parks and Wildlife to assist threatened animal recovery. The funding will be used to integrate the new *Eradicat®* feral cat bait with current fox baiting in four different Western Australian environments. Sites have been specifically selected to direct the funding to improving conservation of species identified in the Commonwealth's Threatened Species Strategy, and to align with fauna recovery programs already underway or planned by Parks and Wildlife in the south-west of WA.

This project fits within a broader suite of actions delivered by Parks and Wildlife to reduce the impacts of feral cats and foxes on threatened species in Western Australia. This includes *Western Shield*, the Integrated Fauna Recovery Project on the south coast, Rangelands Restoration at Matuwa and many other smaller scale projects.

The primary goal of the project is to contribute to the recovery of key threatened mammal and bird species found at each of these sites, through integrating feral cat baiting with existing fox baiting to reduce the impact of introduced predators, and undertaking translocations to establish new, secure populations, where necessary.

While the *Eradicat®* feral cat bait is a key tool in achieving effective feral cat control, other methods, such as shooting and/or trapping, may also be employed. For example, some individual cats appear to be reluctant to take baits or local climatic conditions may reduce the effectiveness of baiting alone. Some flexibility is built into the project plan to allow this suite of control options to be employed, as necessary.

The project is funded for three years over the 2015-16, 2016-17 and 2017-18 financial years. A project agreement has been signed with the Commonwealth Government outlining funding to be provided in each financial year and key deliverables.

Aims

To sustainably recover the wild populations of woylies and numbats in the Upper Warren region, through:

(a) developing protocols to allow the effective integration of feral cat control with existing fox control in the southern jarrah forest; and

(b) effective neighbour engagement.

Expected outcome

Integration of feral cat control with the current fox control program, including developing standard protocols for delivery of *Eradicat®* to maximise its effectiveness and the use of other introduced predator control techniques designed to minimise the impact of introduced predators on native fauna;

- Identification of the efficacy of Eradicat® baiting according to current operational delivery methods aerial and ground) and time of year.
- Quantification of the risk to potentially vulnerable non-target native mammals in the southern jarrah forest to operational use of Eradicat®
- Understand the effect of integrated fox and cat control on i) introduced predators, ii) non-target native mammals potentially at risk from management actions (i.e. chuditch, brush-tailed phascogale, quenda), and iii) numbats, woylies and other native species vulnerable to introduced predators by means of monitoring.
- Community awareness and engagement to ensure understanding of and support for management actions.

Knowledge transfer

Western Shield

Managers of introduced predators

Managers of threatened fauna species threatened by introduced predators (e.g. critical weight range species)

Tasks and Milestones

Year 1- 2015/16

Task	Milestones	Outputs	Timeframe	Responsibility
Undertake research to inform the development of baiting prescriptions	Pilot trials to develop bait uptake trial methods	Protocols for use of remote sensor cameras	March – June 2016	Science – A. Wayne
Undertake Woylie monitoring	Trapping – Moopinup, Warrup, Boyicup	Abundance estimates	Feb-May 2016	RFMS
Undertake Numbat monitoring				RFMS

Undertake monitoring of Dasyurids	i) Trapping (chuditch) & Nestbox transect (phascogales) – Moopinup, Warrup, Boyicup ii) Nestbox grid (K4, K5, K6, Stretch)	i) Abundance estimates ii) abundance estimates and infrastructure condition assessment	Feb-May 2016	RFMS

Year 2- 2016/17

Task	Milestones	Outputs	Timeframe	Responsibility
Optimising Eradicat® baiting protocols	Eradicat® bait uptake trials	i) trial site selection and set up ii) trials conducted to identify the most effective time and delivery method for Eradicat® bait deployment	i) Aug - Sept 2016 ii) Sept 2016 – Oct 2017	i & ii) Science – A. Wayne
Undertake cat/fox monitoring	GPS collars on cats to understand spatial ecology	Identify how cats use the landscape (i.e. where best to target baiting)	Mar- Nov 2017	Science – A. Wayne
Undertake Woylie monitoring	Woylie monitored by trapping	Woylie abundance estimate	Oct-Nov 2016, Mar-Apr 2017	RFMS
Undertake Numbat monitoring	Numbat monitoring by RS cameras	Numbat index of abundance	Sept 2016 - April 2017	RSFM & Science
Undertake monitoring of Dasyurids	i) Phascogale nest boxes monitored ii) Chuditch monitored by trapping	i) Phascogale index of abundance ii) chuditch abundance estimate	i) Feb & June 2017 ii) Oct-Nov 2016, Mar-Apr 2017	RFMS
Review and adapt monitoring	Report and review monitoring program	Monitoring plan beyond June 2017 for Stage 2	June 2017	RFMS
Undertake neighbour engagement	Public information on introduced predator control	Increased awareness	June 2017	RFMS
Undertake media /awareness				PICA
Reporting	Progress report	Progress report	June 2017	RFMS & Science

Year 3 – 2017/18

Task	Milestones	Outputs	Timeframe	Responsibility
Undertake operational feral cat baiting	Operational scale deployment of Eradicat® baits	Cat baiting in the optimum conditions to maximise efficacy with low risk to non-targets	TBC based on earlier work that identifies best timing (nominally Feb 2018)	RFMS
Undertake cat/fox monitoring	Camera monitoring Radio-collars on cats	Effect of Eradicat® baiting event on introduced predator abundance and survivorship (i.e. efficacy quantified)	TBC dependent on the optimal timing of baiting, which will be identified in stage 1 of this project	Science – A. Wayne
Undertake Woylie monitoring	Woylie monitored by trapping	Effect of Eradicat® baiting event on Woylie abundance	As above	RFMS
Undertake Numbat monitoring	Numbat monitoring by RS cameras	Effect of Eradicat® baiting event on Numbat abundance	As above	RSFM & Science
Undertake monitoring of Dasyurids	i) Phascogale nest boxes monitored ii) Chuditch monitored by trapping iii) Chuditch survivorship monitoring by radio-telemetry (funding dependent)	Effect of Eradicat® baiting event on Dasyurid abundance and survivorship (i.e. risk to potentially vulnerable non-targets quantified)	As above	RFMS
Review and adapt monitoring	Report and review monitoring program	Monitoring plan beyond Stage 2	June 2018	RFMS
Undertake neighbour engagement	Public information on introduced predator control	Increased awareness	June 2017	RFMS
Undertake media /awareness				PICA
Reporting	Final project report	Final project report	Dec 2018	RFMS & Science

References

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Study design

Methodology

0.1 Project summary

GOAL: To sustainably recover wild populations of woylies and numbats in the Upper Warren region through effective integration of feral cat control with existing fox control.

OBJECTIVE: Develop an effective cat and fox control program using Eradicat® and Probait baits that reduces the impact of introduced predators sufficiently to support sustainable populations of vulnerable threatened native fauna in the southern jarrah forests.

Stage 1 – Optimising Eradicat®baiting protocols

Specific objective: Determine when, how and where to deploy Eradicat® baits using the current operational protocols for aerial and ground deployment (Feral Cat Baiting Prescription; Forest and Ecosystem Management Division, 2015) that maximises the number/proportion of cats killed by baits and minimises the potential risks to non-target native species within the southern jarrah forest bioregion.

Strategies: i) use bait uptake trials (using remote sensor cameras) and ii) understand the spatial ecology (using GPS collars and radio-telemetry) of a sample of feral cats to identify when, how and where Eradicat® baits may maximise their impact on cats and minimise their possible risk to non-target native species.

Stage 2 – Operational deployment of Eradicat®

Specific objectives: Quantify the effects of an optimised operational use of Eradicat® baits (informed by stage 1) at the individual and population levels of i) feral cats and foxes, ii) potentially vulnerable non-target native species, and iii) priority native species threatened by introduced predators (Numbats, Woylies, etc) within the Upper Warren region.

Strategy: Conduct an Eradicat® baiting program within a limited area of the Upper Warren (e.g. 225-400 km^2), within a comparative / experimental framework, to assess the effectiveness on target species (cats and foxes) and effects on non-target species (with a focus on potentially vulnerable and priority beneficiaries).

Subsequent stages beyond the scope of the current project

Stage 3 Objective: Operationally integrate Eradicat® and Probait into the introduced predator control and monitoring program across the Upper Warren region (Western Shield's Manjimup baiting cell).

Stage 4 Objective: Consider the merits of rolling out the improved introduced predator control and monitoring program across other forested landscapes in south-western Australia.

0.2 Project area

Stage 1 (optimising baiting protocols) will be conducted in the southern jarrah forest ecosystems managed by Parks and Wildlife (predominantly in the Southern Jarrah Forest (JAF02) IBRA subregion), where standard fox baiting is currently applied and where feral cat control is a priority.

Stages 2 & 3 (larger scale operational baiting trial) will be conducted in the Upper Warren region given that it is a priority area for threatened mammal conservation.

0.3 Stage 1 - Optimising Eradicat® baiting protocols

Proposed program overview:

1. a) Pilot trial and method development
2. b) Eradicat® bait uptake trials to determine when, how and where the best time to bait is
3. c) Bait condition trials to determine how the application of Coopex and environmental conditions affect Eradicat® bait characteristics [dependent on securing additional funds]
4. d) Spatial ecology of cats to determine where in the landscape to target baiting to maximise the chance of baits being encountered by cats [dependent on securing additional funds]

0.4

0.5 1a) Pilot trial and method development

Summary: Technical and methodological trials will be conducted to determine the most effective and efficient protocols for the use of remote sensor cameras (RSC) to detect the consumers of Eradicat® baits deployed in the southern jarrah forest.

Objectives:

1. Determine the longevity of Eradicat® baits in the southern jarrah forest (i.e. the duration until the bait is consumed/removed to ascertain how long RSCs need to be deployed to capture the consumption of baits during the subsequent bait uptake trials).
2. Identify the optimal set up of the RSCs to maximize the detection of fauna interacting with the Eradicat® bait (i.e. by means of a comparison of camera orientations and distances from the bait).

0.6 1b) Bait uptake trials

Summary: Bait uptake trials will be conducted over at least 12-14 months using covert remote sensor cameras to observe species/individuals consuming Eradicat® baits. This is the preferred method based on affordability, efficiency and return for effort, for directly informing when, how and where it is best to bait for cats and assessing the risk to potential vulnerable non-target species.

Key principles:

1. The Eradicat® bait trials should resemble operational conditions as closely as possible. E.g. - mimic the spatial pattern of bait deployment by aircraft and ground deployment (Note bait location will not be biased to open areas where cameras can detect animals and observe their interactions with the bait) - bait treatment and characteristics (e.g. sweating, coopex, age, toxicity, etc)
2. Observer effects should be minimised as much as practically possible E.g. - remote sensor cameras need to be as covert as practically possible - minimise disturbance to sites as much as practically possible (including anthropogenic cues such as smell, etc) - allow enough time for animals to become accustomed to cameras and other infrastructure - minimise the cues for bait deployment (e.g. dummy cameras to be in place for an extended period beforehand so animals do not learn that cameras mean food)

Other considerations:

- Spatial independence between sites is required to maximise the encounters of different cats and minimise the influence of earlier trials nearby (e.g. removal of cats by toxic baits, opportunities for learning by individuals) that in turn affect inferences, etc (i.e. trials need to be conducted across all or much of the southern jarrah forest).

- A balance is needed between having a design that is robust and that will provide adequate and appropriate data that can be used to confidently identify the most effective cat baiting regime in the southern jarrah forests, and having a design that is practical and affordable with the time and resources available.
- Trials conducted across larger spatial and temporal scales will provide better results - More replicate sites will provide more data and results that can better account for the variability between sites - Trials over multiple years will more confidently confirm when and under what circumstances baiting is likely to be most effective (but this is not currently planned and may not be practical).
- Repeat trials on the same sites should be avoided or minimised. Ideally sites should not be subject to repeat trials more than once every 12 months; to reduce issues associated with the effects of earlier trials influencing the results of subsequent trials (e.g. learning by animals, removal of individuals by toxic baits).
- Additional benefits from this project include information on the distribution and activity/occupancy/abundance of mammal fauna (e.g. numbats, quokka, woylies, ngwayir, wambenger, tammar, quenda, chuditch, koomal, western brush wallaby, introduced mammals, etc) in the southern jarrah forest.

Aerial and ground baiting trials:

- Both aerial and ground bait delivery protocols should be tested given differences in cat detection on and off track (e.g. Wayne*et al.* 2013); Aerial deployment = 50 baits km^{-2} scattered as 50 baits within a 200m x 40m area every 1 km along transect lines space 1 km apart Ground deployment = 100 m intervals along road/track access allowing for replacement during the “baiting window” but not exceeding 50 baits/linear km/year
- Ground baiting is likely to be more successful at baiting cats (i.e. adjacent to tracks) but operationally more limiting (i.e. higher operational costs over equivalent areas; patchy delivery given limitations to tracks that provide adequate forest access; and, potentially access limitations at some times of the year due to dieback hygiene constraints). During the bait uptake trials, camera security is likely to be substantially more problematic on- versus off-track.

Best pragmatic design for Eradicat® bait uptake trials

2 x deployment methods (aerial and ground)
2 x replicates
10 x trials
= 40 sites. (Table 1).

Table 1. The experimental design for the Eradicat®bait uptake trials, showing in which site (as indicated by its number) each trial will be conducted.

In each of 10 sessions four randomly assigned sites will have Eradicat® baits deployed in a similar spatial pattern to operational protocols for aerial or ground baiting, with two replicates for each deployment method. Sites (numbered 1-40 in the table matrix) are spatially independent (>10 km) and randomly selected grid cells (5 x 5 km) in southern jarrah forest ecosystem type.

Deployment protocol	Aerial	Aerial	Ground	Ground
Replicate	1	2	1	2
Session				
1	39	23	8	6
2	16	11	20	9
3	29	4	34	17
4	38	10	31	40
5	26	2	21	5
6	7	33	14	12
7	37	32	25	18

8	3	28	22	24
9	15	35	36	27
10	30	1	13	19

- Missing data will make analysis much more difficult. The orthogonal and balanced design is very important to maintain throughout the study.

- Having 40 sites provides some flexibility in the timing of trials but an incomplete picture throughout the calendar year (i.e. aerial and ground bait trials will only be active during 33% and 67% of the year, respectively). The times of year that are omitted can be regular (e.g. 2 weeks between each trial) or strategic (e.g. avoid periods when baiting effectiveness may otherwise be expected to be poor, such as the wettest times of the year when bait condition may be compromised).

Site selection for Eradicat® bait uptake trials:

The southern jarrah forest ecosystem will be subdivided into 5 x 5 km cells (i.e. 2,500 ha each; Figure 1). Criteria for candidate cells include;

- Study area: southern jarrah forest (SJF) ecosystem and other minor jarrah forest ecosystem types immediately adjacent to SJF (Jarrah - Unicup, woodland, and north east ecosystem types) within the IBRA subregion JAF02 and Warren IBRA bioregion (WAR)), i.e. ~197 cells between Nannup in the northwest, Tonebride in the north east, Rocky Gully and Nornalup in the south east and Peerabeelup in the southwest.
- >75% area having Conservation Commission land tenure and/or land managed by the Department of Parks and Wildlife.
- >75% currently subject to Western Shield fox control
- Practical access available and relatively close to Manjimup (i.e. to reduce costs)
- Candidate areas planned to be burned or timber-harvested during 2016/17 will need to be considered carefully to co-ordinate the trials where possible when/where they won't be adversely impacted

Cell selection from the pool of candidates will be stratified-random – i.e. the initial cell will be randomly selected and then subsequent cells will be selected based on having a spatial separation of at least 10 km from other selected cells. Each selected cell will be randomly assigned to the sequential order of when and how (aerial or a ground) the baits are deployed.

Figure 1. a) 5 x 5 km grid cells with predominantly southern jarrah forest ecosystems on lands managed by the Dept. of Parks and Wildlife. b) Indicative location of the 40 Stage 1b sites to determine how, when, where best to bait using Eradicat®.

Site layout for Eradicat® bait uptake trials

Aerial bait treatment sites will be;

- located as close to the centre of the cell as possible (to maximise spatial separation from other selected treatment sites)
- > 100 m from trafficable tracks and >200 m from main public roads (for site security)
- Each site will have 50 bait stations roughly evenly spaced in an approximate grid layout (4 x 13 rows at 13 m x 16 m intervals) within an area of about 200 m x 40 m – to resemble operational protocols for aerial cat baiting as closely as possible (Algar et al. 2013; "Feral Cat Baiting Prescription", Forest and Ecosystem Management Division 2015).
- Note: the spatial separations between aerial bait sites will be much greater than the operational deployment of 50 baits km^{-1} – this will affect how the results can be interpreted (e.g. the likelihood of detecting a bait consumption by an introduced predator during the trials may be higher than if the baits were deployed at

operational densities (conversely the proportion of cats removed will be lower); similarly, the lower than operational density of baits at the landscape level during the trials will the lower the risk to chuditch but not quantify the risk to individuals that may encounter multiple bait clusters deployed at operational densities).

Ground bait deployment treatments sites will be;

- 5 km transects positioned as centrally as possible within the cell and maximising the distance from other selected cells nearby
- Forest tracks frequently used by vehicles will be avoided to minimise the disruption cause by temporary road closures.
- The roads will be closed to unauthorised access along the baiting transect during the baiting trial on that site (i.e. 4-8 weeks) by means of signs and flagging tape. This is to reduce the baiting risk to humans and their animal companions and to reduce the risk of interference or theft of cameras.
- Baits will be at 100 m intervals along the 5 km road/track transect. The bait stations will be 5-10 m off the track with the cameras positioned to conceal them from the track as much as practically possible.

Bait stations for both aerial and ground treatments:

Each bait station will have a dummy remote sensor camera deployed for at least 4 weeks prior to the start of the bait trials. A real remote sensor camera (a randomly allocated Reconyx HC 600 or PC900 model) with a toxic Eradicat® bait at the centre of the field of view will be deployed at the beginning of the bait trials at each site.

The camera will be as concealed as practically possible to reduce detection (i.e. within or adjacent to existing natural structures such as vegetation, logs or debris) but adjacent to and focussed on an open area in which the bait can be placed and monitored by the camera.

Some minimal modification of the vegetation in front of the camera and around the bait location may be required (e.g. selective light pruning) to improve camera surveillance of the bait and the animals around the bait.

The dummy cameras are necessary to reduce the cues and learning by animals of baits being available and to reduce the aversion of some animals to new and artificial objects in their environment (i.e. minimise behavioural responses of animals to the trials – i.e. observer effect).

Camera set-up protocols for Eradicat® bait uptake trials:

- Cameras to face between SE and SW (ideally S)
- Distance to bait 1.5 m
- Cameras to be at height 20-30 cm above ground
- Camera settings: 10 images per trigger (HC600 models) or more (PC900 models). No delay between triggers. High sensitivity, motion sensor on.
- Security measures: code lock activated, cameras labelled indicating security code protected and engraved,
- no flagging tape or any other visible indications of the location of the site or camera/bait stations. GPS co-ordinates of each camera to be recorded.

Bait preparation for Eradicat® bait uptake trials

Bait characteristics will be identical to those used operationally including, manufacturing process, toxicity, age and preparation. Eradicat® bait preparation will be done in accordance with the “Feral Cat Baiting Prescription” (Forest and Ecosystem Management Division, 2015). Prior to deployment;

- Sweat on racks under sunny conditions to allow the oils and lipid-soluble digest material to exude from the surface of the bait.
- All baits are sprayed on all sides, during the sweating process, with an ant deterrent compound (Coopex) at a concentration of 12.5 g l^{-1} as per the manufacturer’s instructions.

Timing of Eradicat® bait uptake trials

- Four trials (sites) will run simultaneously within a session; 2 replicates of each of two treatments (aerial and ground baiting) (Table 1, Appendix 3).
- The length of each trial will include 2-4 weeks with dummy cameras then 2 and 4 weeks for the aerial and ground bait trials, respectively, using real cameras and Eradicat® baits.
- The bait uptake trials will be conducted predominantly in the warmer-drier periods of the year (October – April) and opportunistically during the forecast drier spells (i.e. 6-7 days with <5-10 mm total rainfall forecast) in the cooler-wetter months between May and September inclusive (i.e. >50 mm average per month). This is in general accordance with the baiting prescriptions designed to avoid moist conditions in which the bait quality may be reduced (Forest and Ecosystem Management Division 2015). While specifics are not provided, a general operational guideline is to aim for 5mm of rainfall on the day of baiting and a minimum of 5 days post baiting (Gareth Watkins pers comm.). But we consider temperature, humidity and evaporation rates also to be important factors that affect the duration and magnitudes of ambient moisture levels and there is currently insufficient detail available on how environmental conditions affect bait quality or palatability. This may be examined as part of this study (see part 1c details below). Note that Western Shield protocols for the use of 1080 poison grain baits and dried meat baits is for deployment in conditions when < 6 mm and <40- 50 mm rainfall is forecast , respectively (Parks and Wildlife 2012).
- The timing of trials within the group of four sites within a session will be staggered (i.e. start on four successive days, as they are set up) so long as rainfall and extreme weather events are avoided during the four successive setup days and the 3-4 initial days post bait deployment (i.e. similar starting conditions for the four sites). The order of staggered entry within a group will be randomised. Some flexibility in the timing of the start of the trials will be needed to accommodate weather forecasts. If poor weather is forecast, the alternative is to have a staggered setup and simultaneous trial start (i.e. set up cameras over successive days then deploy the baits simultaneously at all four sites when the weather is clear - note this requires more resources / visits to the field sites). Note at least 2 days (3-4 people) are required to set up the 50 camera/bait stations at a site and another full day to deploy and activate the cameras.
- Aerial baiting treatments will only have one deployment of 50 baits per trial. The ground baiting treatments will have baits replenished on multiple occasions (< 5 baits per station) within the four week trial period at each site, in accordance with the protocols ("... Baits can be replaced during the "baiting window" if taken or spoiled but should not exceed 50 baits in total/linear km/year...", Forest and Ecosystem Management Division, 2015). i.e. up to 250 baits per trial

Research questions and analysis approach for Eradicat® bait uptake trials

General theme: Eradicat®bait consumption differences in relation to when, how and where baits are deployed and other factors (i.e. bait effectiveness)

Common response variable(s):

- Number or proportion of baits consumed by species '*x*' per site/trial
- Number of individuals of species '*x*' that consumed 1 or more baits per site/trial

Note: data may be sparse (lots of zeros) for bait consumption by cats, which will have implications for analysis

Q1: Does Eradicat®bait consumption by the target (feral cat) and non-target species vary according to time of year?

Plot: Average number and proportion of baits consumed by species '*x*' per trial within each session (y-axis) by start date of each session (x-axis)

Analysis: possibly just descriptive graphics given temporal factors will be examined in more detail in subsequent questions

Results: Identifies generally when bait consumption by cats and other species is greatest but does not consider differences or interactions due to other factors such as deployment method, habitat and landscape factors, etc.

Q2: Does Eradicat®bait consumption by the target (feral cat) and non-target species vary according to season, within season (session), and deployment method?

Analysis options:

- Multifactor ANOVA or mixed effects model. The appropriate approach will depend on whether all factors are fixed or whether the time factors represent random effects (session dates probably do).
- Log rank tests to examine differences between deployment method.

Response variable = number of baits consumed by each species / number of baits deployed or number of trials (i.e. the former takes into account bait replenishment during ground baiting, the latter compares the deployment methods).

Q3: Are there environmental factors (e.g. weather, proximity to agriculture, landscape position) or biological factors (e.g. competitors, food availability and breeding seasons) that relate to changes in Eradicat®bait consumption by i) target and ii) non-target species?

Analysis:

- Potential covariates include landscape attributes, site attributes, animal attributes, detectability of the bait, bait condition, and environmental attributes - see Appendix 4 for details
- Multivariate analyses would be needed to relate differences in bait consumption or 'survival' to other factors such as time of year, spatial factors, bait uptake by other species, environmental and biological factors, etc.
- With only 40 sites the number of covariates in the analysis will be limited (e.g. ~4-6 covariates). Therefore a process of culling covariates will be necessary (e.g. autocorrelation, step-wise approaches, etc)
- The use of the information theoretic approach to model selection may be appropriate with this data.

General theme: Nature of Eradicat®bait consumption

Q4: How long do Eradicat®baits last until they are consumed or removed (i.e. bait longevity)?

Analysis:

- Bait longevity can be described as a range (min-max), mean (+SE) and/or median number of days until 50%, 95% or 100% of baits were removed
- Plot of mean number of baits (+SE) remaining per day
- If there is a high level of variance in the mean number of baits remaining per day and/or the time taken for 95-100% of baits to be removed, then further analyses could seek to account for these differences – e.g. landscape position, subregion, season, etc. . .
- Bait survival or Bait consumption by a particular species (i.e. the primary response variable) can be measured using a survival analysis approach (i.e. consumption by other species and camera failures are censored). Pollock's staggered entry model or Kaplan-Meir survival analysis approaches may be appropriate.

General theme: Animal behaviour in relation to baits (i.e. to understand how to improve bait effectiveness)

Q5: How do target and non-target species interact with the baits? Specifically, Do targets and non-targets detect baits? And. once a bait has been detected, do targets and non-targets consume baits?

Once a bait has been detected, do targets and non-targets consume baits?

This will focus on information that provides some indications how to improve target and non-target consumption rates.

General descriptive metrics will include;

- Absolute number of baits consumed by each species
- Absolute number of individuals of focal species (e.g. cat, fox, chuditch) that consumed at least one bait
- Proportion of individuals of focal species detected that consumed at least one bait

Detailed metrics for focal species will include;

- Detection rate = # bait detection events / # events animals are within close proximity of the bait (i.e. within field of view of the camera)
- Investigation (approach) rate = # baits investigated/ # bait detection events
- Contact rate = # baits contacted (i.e. close investigation or physical contact)/ # bait detection events
- Consumption rate = # consumed/# bait detection events

Other possible metrics include;

- Frequency or proportion of partial v whole consumption (i.e. what is the risk of sublethal bait consumption by target species?)
- Frequency or proportion of baits consumed in situ or removed (i.e. are removed baits likely to be consumed or cached elsewhere; is there a risk that removed baits remain available)
- Were solitary or multiple individuals involved (i.e. potential for learning, sub-lethal doses, etc)?

General theme: Potential impact to individuals and populations of Eradicat®baiting on target and non-target species

Q6: Do individuals consume multiple baits in a day or within a baiting session?
i.e. what is the possible risk to vulnerable non-targets?

- Absolute number and proportion of detected individuals of species *x* that consumed multiple baits.

Q7: What is the potential and relative impact of Eradicat®baits on individuals and populations of feral cat, fox and potentially vulnerable non-target species?
i.e. how many and what proportion of individuals might have been killed by toxic baits? Does this change over space and time? Are there any patterns in the types of individuals that consumed the baits (e.g. size, age, gender)? Is this number or proportion of individuals that consumed baits likely to have a significant impact at the population level?

General theme: Recommended Eradicat®baiting protocol to maximise efficacy

Q8: When, how and where is it best to conduct Eradicat®baiting to maximise bait consumption by feral cats and minimise the risk to non-target species?
I.e. a synthesis of the results from the previous questions and an understanding of the biology and ecology of the target and non-target species to make an assessment of when, how and where Eradicat® bating is likely to be most efficient/effective.
Also consider what needs to be done to be informed how to make further improvements on the timing and location of the baits.

0.6.1 Other considerations

Low bait consumption rates by cats is a major risk for the bait uptake trials

- Low detection rates of cats and even lower bait uptake rates by cats is expected. A major challenge of this study will be to get sufficient data on cat interactions with baits to satisfactorily inform when, how and where to most effectively use Eradicat® to control cats and minimise risks to non-targets. Cat and fox densities are estimated to be about 1 each per 500 ha – 2000 ha (A. Wayne unpublished data). Therefore bait uptake is likely to be <1 cat and <1 fox per trial. This means that to get a routine and operationally realistic appreciation of when baits might be most effective to target cats, it is likely to require a lot of replicate trials to get sufficient data.
- It would be possible to estimate how many trials might be required but the estimates would be very rough, particularly since bait consumption rates are dependent on the probability a cat or fox comes within close proximity with a bait and guesswork as to what proportion might then actually detect, investigate and consume the bait.

- Conversely, based on the proposed experimental design with 40 trials, it might be possible to estimate what consumption rate of baits might be required to get sufficient data to identify significant differences in bait consumption by cats in relation to when, how and where the baits are deployed.
- Having trials of the ground baiting protocols are likely to be very important in getting enough data on target species interactions with baits because; 1) introduced predators are detected more frequently on track than off track (Wayne et al. 2013) and replenishment of the ground-deployed baits during the trials increases the opportunities for cats to encounter baits
- Data from the uptake trials will be regularly analysed to ensure sufficient data is being generated by the trials. If there is insufficient data then an increase in the number of concurrent trials may be required (e.g. greater than 4 concurrent trials across additional sites, requiring additional cameras and/or the period of the trials may need to be extended).
- Note that under the operational conditions of an aerial baiting event with introduced predator densities at these levels, 1 bait consumed by a cat (or fox) for every 250 – 1000 baits deployed at 50 baits/km^2 (i.e. within a 500 ha – 2000 ha area) would result in a 100% target removal - this is very low (i.e. 99.2% - 99.8% non-target uptake of baits could indicate a successful baiting program for both cats and foxes).
- Need to think what else could be done to improve detection and bait consumption rates – by cats (i.e. more data) e.g. target areas with high cat densities.

Repeat trials and confounding between learning by animals and time of year

Repeat trials on the same sites runs the risk of animals learning and changing their behaviour in relation to the baits (e.g. increased bait attraction or aversion), which is confounded with time of year. This could have a major effect on the study being able to identify when the best time to bait is (e.g. increased non-target uptake by possums or corvids could substantially reduce bait availability to targets over time). Therefore, the number of repeat trials should be minimised and the intervals between repeat trials should be maximised or avoided altogether if possible.

Note: The extent of learning within and between trials might be possible to quantify to some extent if individuals can be confidently identified. But this will be difficult for some problem species such as brush tail possums and corvids.

Toxic or non-toxic baits?

These trials could be done with toxic or non-toxic Eradicat® baits. It is recommended that toxic baits are used.

Using toxic baits:
Advantages

- Trials closer to real operational conditions
- Some cat removal may be a direct outcome of the trial (but it will make negligible difference at a population level given the density of trial sites relative to cat densities)

Disadvantages

- Necessitates greater/complete spatial independence between sites (i.e. <10 km separation) the consequences of which include a larger study area, higher logistic costs (e.g. vehicle running and travel time), greater variance in the results due to greater variation between sites over a larger area.
- There is some risk to non-target native individuals (e.g. chuditch, phascogale, etc) but given the large spatial separation between sites there should be negligible impact at the population level)
- There is some risk to domestic cats and dogs that visit the trial sites and nearby if some baits are relocated by wildlife (a risk assessment would be required as part of the baiting approval process)
- It will complicate the stage 2 comparative operational trials by potentially removing some cats across all treatments and potentially having some surviving individuals with a prior experience with Eradicat® baits, albeit at very low densities (i.e. 50 baits per 100 km^2). Therefore the first application of Eradicat® at an operational scale will not be to an entirely naïve population (i.e. the scale of impact of the initial operational deployment of Eradicat® baits may be very slightly less than what might have been achieved had the population been absolutely naïve).

Using non-toxic baits:
Advantages

- No risk to non-target individuals
- Spatial independence between trial sites is not as critical (because cats from earlier trials will not have been removed from the opportunity to encounter baits in subsequent trials nearby)
- The bait uptake trials will not influence cat densities for the subsequent Stage 2 comparative trials of the effectiveness of an operational-scale baiting program

Disadvantages

- Not identical to operational baits, therefore some additional assumptions as to how the results relate to operational conditions would need to be made
- No removal of any cats
- Uptake rates of both targets and non-targets (because of multiple consumptions by the same individual) may be greater than with toxic baits. This might be partially accountable if individuals are distinguishable but this may not be possible for some species such as koomal.

Camera security
Camera management and location will be important for security from theft and damage (e.g. from fire)

- Covert as possible for reducing detectability (also beneficial to the study if it reduces detectability by fauna – i.e. reduced observer effects) – based on location (next to/within/under natural vegetation and structures), camouflage (shape, shine, silhouette, surface, shadow, smell), etc
- Aerial deployment trials should be relatively low risk - located >100 m from any trafficable vehicle tracks and >200 m from frequently used public roads.
- Vehicle access to tracks near the cameras should be temporarily closed during the trials wherever possible. This will also reduce human-related risks of using toxic baits. Departmentally-managed roads can be closed under existing authority provisions available to the department. The roads could be closed with signage, danger tape, official 1080 signs and potentially have a covert camera for incursion surveillance. Signs can be produced cheaply on corflute boards and could be used for other departmental activities such as pig control. The text could state something like,

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DANGER - DO NOT ENTER.
Road Temporarily Closed. **No unauthorised access.**
Pest control operations for conservation currently underway.
1080 Poison baits & firearms may be in use.
For more information contact the local Parks and Wildlife office Ph: 97761207
Planned date of completion: ___ / ___ / _____

- All cameras to be code locked activated, cameras labelled indicating security code protected and engraved
- No flagging tape or any other visible indications of the location of the site or camera/bait stations

- Consider additional dedicated surveillance cameras to record human visits to trial sites
- Consider insurance policy in case of theft.
- Avoid areas imminently planned to be burned during the trial period. Have all sites registered with local district operations and fire management staff so they are aware of their location and can notify the project in case of imminent wildfire risks and other disturbance activities. Having the forest tracks closed with signage will also make workers in the area aware and thereby reduce the risk of damage due to planned burns or wildfire.

0.7 1c) Bait condition trials in relation to Coopex treatment and environmental conditions

Subject to additional funds being secured: experimental bait condition trials may be conducted concurrently to the bait uptake trials to;

1. Determine the effectiveness of different Coopex application methods to baits aimed at reducing invertebrate impact on Eradicat® bait characteristics
2. Determine how environmental conditions influence Eradicat® bait characteristics, including spatio-temporal factors, the weather and ambient conditions, invertebrate interference, etc.

Note: This would make an excellent honours or masters student project; Year 1 – data and sample collection (with or without the student), Year 2 - sample analysis and write up.

Testing the effectiveness of Coopex applications

Design:
3 bait treatments – sprayed, dipped, no Coopex
3 replicates of each treatment per site
5 sites per trial - each of the 4 bait uptake trial sites and a reference site (i.e. the 4 bait uptake trial sites will vary between trials (total of 40 sites) and the reference site (in jarrah forest near Manjimup) will remain the same throughout the successive trials (i.e. 41 sites in total).
10 trials conducted over a year

Method:

- The bait condition trial sites will be 1-3 km from the bait uptake trial sites for independence (i.e. to reduce the influence of one trial on the results of the other). Note that independence will not be absolute (because some vertebrates may encounter both trials) but environmental conditions should be comparable between the paired trials sites.
- Experimental unit / Bait station = 1 Eradicat® bait placed in contact with the ground within a 5-sided wire cage cube securely pegged to the ground (i.e. to allow invertebrate access but not vertebrates. Note the size of the cube and the mesh needs to overcome interference from possums and canids that might dig).
- Each bait station will be at least 100 m from other bait stations (based on estimated Australian meat ant (*Iridomyrmex purureus*) territory sizes being <5900 m^2 (Thomas *et al.* 1999; Note that *Iridomyrmex conifer* is likely to be the most problematic species in the forest)
- The trials will be conducted concurrently to the bait up-take trials and run for two weeks.
- Bait condition (photographed, weighed, visual assessment), soil moisture and invertebrate activity will be recorded at the beginning or the trials, at least once during the trials (day 4-10; for the trials associated with the ground baiting and reference sites only) and at the end of the trial (day 14 for aerial deployment trials). At the end of the trials the baits will be retained and frozen for later, more detailed, assessment if required.
- Environmental data to be collected at each trial site will include ambient conditions (temperature, relative humidity, rainfall, and soil moisture by means of data loggers and rainfall gauges; evaporation rates).

- Invertebrate species will be sampled i) that are found on the baits when they are checked during the trials, and ii) by means of a pair of delta traps with replaceable sticky bases (one in each pair being baited with 4 cm^3 piece of non-toxic Eradicat® bait), located ~10 m from each Eradicat® bait station.

Note: Being able to explain the factors affecting the rates and differences in the degradation of Eradicat® baits is important to being able to understand the scale of the problem and to identify solutions, and when and where they may be needed.

0.8 1d) Spatial ecology of cats

Subject to additional funds being secured. Summary: Radio-telemetry using GPS collars on up to 10 cats will be used to get spatio-temporal data within the Upper Warren region to provide a general understanding of;

- home range size, area covered per night and other information on movement patterns (e.g. useful to help estimate density, probability of encounter of potential bait locations, etc)
- how they use the landscape (e.g. habitat preferences/selection – landscape position, proximity to agriculture, use of roads and tracks, etc).
- try to identify when/where cats are more likely to eat baits, such as feeding areas as distinct from other activities such as shelter, territorial maintenance, breeding, social interaction, etc.
- This work is currently unfunded except for the procurement of the GPS collars.

Cat selection:
Cats for collaring would preferentially be selected in the area(s) within the Upper Warren region anticipated to be involved in Stage 2 of the project – i.e. the treatment and comparative reference areas for the operational-scale deployment of baits. This is to maximise efficiency and information return from investment (e.g. the same cats and collars could be subsequently used to track comparative survivorship of cats during operational baiting).

- Sources: farm shed strays/ferals from properties within or adjacent to expansive forest areas may be easier targets, but at least some individuals should be sourced from forest areas
- Capture methods will include cage and leg holds and opportunistic captures from wildlife monitoring. Catching cats is the greatest challenge for this project component. Assistance and support from expertise in cat trapping will be critical to its success.
- Landholder engagement and support will be important in finding source animals (i.e. an opportunity to integrate this with the community elements of this project).
- Reconnaissance using cat sightings, sign and remote sensor cameras will be needed to identify areas and individuals to target for capture and collaring
- Given the small sample size it may be difficult to derive clear gender differences in behaviour and movement. Consider only collaring individuals of one gender (Sarah Comer pers. comm.)

GPS Collars:

- About 20 fixes per day (hourly between 1600 and 0800 hrs and at 1000, 1200 and 1400 hrs)
- Approximate battery life of 150 days per collar
- Remote download every month

0.9

0.10 Complementary approaches that could help identify when, how and where to bait for effective cat control for fauna conservation

- Biologically informed – cat biology/ecology, native prey biology/ecology, predator prey interactions, spatial ecology, etc e.g. risk to chuditch may be reduced if the timing of baiting avoids the period when young emerge from the den and start feeding themselves
- Modelling

0.11 Stage 2 - Operational deployment of Eradicat®

Specific objectives: Quantify the effects of an optimised operational use of Eradicat® baits (informed by stage 1) at the individual and population levels of i) feral cats and foxes, ii) potentially vulnerable non-target native species (e.g. dasyurids), and iii) priority native species threatened by introduced predators (Numbats, Woylies, etc) within the Upper Warren region.

Strategy: Conduct an Eradicat® baiting program within a limited area of the Upper Warren (e.g. 225-400 km^2), within a comparative / experimental framework, to assess the effectiveness on target species (cats and foxes) and effects on non-target species (with a focus on potentially vulnerable and priority beneficiaries).

- Comparative treatments will include; 1) Eradicat® baiting treatment area, 2) Standard quarterly fox baiting area, 3) Monthly fox baiting area (Perup core, since 2010), 4) An unbaited (Probait and Eradicat®) area
- The effectiveness of the Eradicat® baiting event will be examined using a BACI design (before, after, control, impact); considered the most powerful means of making this assessment
- Responses of target and priority non-target fauna will be measured at the individual and population levels because each level provides important insights that the other cannot.
- Monitoring methods before and after the Eradicat® baiting will include (Table 2); - Radio-telemetry (target, and possibly vulnerable non-target species if additional funds can be secured - Remote sensor cameras (all species, especially cats, foxes, numbats, quenda) - Trapping (especially woylies also other native mammals) - Spotlighting (especially western ringtail possums, also phascogales and macropods) - Nestboxes (phascogales)
- The monitoring program will use and build on the existing monitoring infrastructure in the Upper Warren to provide best use of historical data and minimise costs of monitoring during this project (Figure 2). New monitoring infrastructure will include 3 nestbox grids, and a trapping and spotlight transect in Talling forest block in the Eradicat® baiting area (southern Perup) (Table 3).
- Potentially vulnerable non-target native species in the Upper Warren are presented in Table 4. Wambenger (brush-tailed phascogale), bush rat, chuditch and quenda are considered potentially the most vulnerable mammals based on a theoretical worst-case scenario assessment. All four species need to consume less than one or two Eradicat® baits to potentially receive a lethal dose of 1080. Relative to their body mass all four are capable of consuming their respective quantities of bait within 24 hrs (i.e. <9% of their body mass). Consumption rates of dried meat baits (DMB) of <9% body mass have been repeatedly observed being consumed by dasyurids in laboratory trials (Martin et al. 2002 and references within). Because the amount of bait consumed is inversely proportional to the hardness of the food, it is reasonable to assume that these species can eat more Eradicat® bait (which is softer) than DMBs. Most small dasyurids consume about 20-30% of their body mass each day (see Martin et al. 2002).
- Bush rats will not be assessed as part of this study because none have been detected in the Upper Warren region since 2005, having been abundant in places in the 1970s (Per Christensen pers comm.) but having declined since at least 1994 (Wayne et al. in review).
- The varanid lizards (*Varanus gouldii*and *V. rosenbergi*) and some birds (e.g. Australian raven, Australia magpie, some raptors) may also be potentially vulnerable (Table 4), however there is currently insufficient information to more accurately quantify the risks. These species will not be monitored, given the limited resources available. While some traps captures of *Varanus rosenbergi*are expected during other planned monitoring activities it is not likely that there will be sufficient data to assess population changes without a greater, more targeted monitoring program.
- The timing of the operational use of Eradicat® will be determined by Stage 1. This in turn will affect the timing of monitoring before and after the baiting operation (Table 5).

Design and analysis

BACI design with ANOVA

Response variables:

Individual level – survivorship of radio-collared (cats, ideally also foxes, chuditch and phascogales) or trapped animals (chuditch)

Population level – detection rate (Remote sensor camera, spotlight), abundance estimate (trapping) or occupancy rate (nest boxes) of each species

Figure 2. Map of the Upper Warren region with existing monitoring infrastructure and indicative treatment areas for the comparative operational deployment of Eradicat® baits

Table 2. Monitoring methods to be used for species of interest before and after the Stage 2 operational Eradicat® baiting. 1= most appropriate, 2=reasonable method, 3 = possibly useful.

Individual
Population responses
Category
Species
Radio-telemetry
RS Cameras
Cage Trap
Spot-light
Nest-box
Target
Cat
1
1
-
3
-

Fox
Ideally
1
-
3
-
Vulnerable natives
Wambenger
Ideally
3
-
3
1

Bush rat
-
3
1
-
-

Chuditch
Ideally
2
1
-
-

Quenda
Ideally
1
2

3
-

Varanus
Ideally
3
1
-
-
Priority natives
Woylie
-
2
1
3
-

Ngwayir
-
3
-
1
-

Numbat
-
1
-
-
-
Other native beneficiaries
e.g. Brushtail possum
-
2
1
2-3
-
Non-native beneficiaries
e.g. rabbits
-
1
-
2-3
-

Table 3. Monitoring infrastructure to be used for species of interest before and after the Stage 2 operational Eradicat® baiting.

Treatment area	Forest block	RS Cameras	Cage Trap	Spotlight	Nest-box grid	Nest-box transect
Perup Core	Moopinup		Existing	Existing	Existing - Stretch Rd	Existing
	Balban	Existing	Existing	Existing	New	

Std. W/S	Warrup		Existing	Existing		Existing
	Winnejup		Existing			
	Kingston			Existing	2 x Existing	
	Warrup East	Existing				
Eradicat®	Boyicup	Existing	Existing	Existing	New	Existing
	Talling		New	New	New	

Table 4.A worst case scenario theoretical assessment of the potentially vulnerable non-target native animals in the Southern Jarrah Forest based on published estimates of approximate lethal dose (ALD) for 1080 poison and the minimum recorded adult body masses. The degree of vulnerability is expressed in relation to the minimum number of Eradicat® and Probait baits required to consume an ALD (assuming 1080 is evenly distributed throughout the bait) and in relation to the amount of bait consumed proportionate to body mass. i.e. species that need to consume less than 1 or 2 baits and/or <20% of their adult body mass to receive an ALD are considered vulnerable. No information on the Australian raven or Australian magpie tolerances to 1080 could be found – the Little crow is presented as a surrogate.

* Source: Martin et al. (2002); ˆ Source: van Dyck and Strahan (2008); # ALD unknown, LD_{50} = 50, 235 and 12.8 mg 1080 kg^{-1} for *V. gouldii, V. rosenbergi*and Little crow *(Corvus bennetti)* respectively, (Dept. of Agriculture 2002); adult body mass estimates are also rough (for Varanus 500g is used as an interim minimum adult body mass, for the Little crow 380 g is the mean adult body mass)

Species	***Approx. Lethal Dose (mg 1080 kg^{-1})**	**ˆAdult Body mass (g)**	**Approx min. # of Eradicat®baits (4.5 mg 1080) for ALD**	**Amount of Eradicat®bait consumed to reach ALD proportionate to body mass**	**Approx min. # Probaits (3 mg 1080) for ALD**	**Amount of Probait consumed to reach ALD proportionate to body mass**
Wambenger	6	106-212 F, 175-234 M	0.14	1.9%	0.21	9.0%
Bush rat	27.6	40-225	0.25	8.9%	0.37	41.4%
Chuditch	7.5	615-1130 F; 710-2185 M	1.03	2.4%	1.54	11.3%
Little crow	#12.8	*380	1.08	4.1%	1.62	19.2%
Quenda	14.1	400-1200 F, 500-1850 M	1.25	4.5%	1.88	21.2%
Brown falcon	20	*400-480	1.81	6.6%	2.72	30.6%
Varanus	#50	<1000 F <1900 M	5.56	16.1%	8.33	75.0%
Woylie	105.8	750-1500 F, 980-1850 M	17.63	34.1%	26.45	158.7%
Koomal	92	1200-3500 F, 1300-4500 M	24.53	29.6%	36.80	138.0%

Table 5. Indicative timeline for the Southern Jarrah Forest component of the South West Threatened Fauna Recovery Project. Principle responsibility Green = Science, Blue = RFMS, Orange = Western Shield/RFMS

Jan-16
Feb-16
Mar-16
Apr-16
May-16
Jun-16
Jul-16
Aug-16
Sep-16
Oct-16
Nov-16
Dec-16
Jan-17
Feb-17
Mar-17
Apr-17
May-17
Jun-17
Jul-17
Aug-17
Sep-17
Oct-17
Nov-17
Dec-17
Jan-18
Feb-18
Mar-18
Apr-18
May-18
Jun-18
Jul-18
Aug-18
Sep-18
Oct-18
Nov-18
Dec-18

Stage 1: Bait protocol optimisation

Pilot trial

Site selection and set up

Bait uptake trials

Camera data management

Analysis

Cat spatial ecology

Stage 2: Integrated fox and cat control

Eradicat bait - 1 or 2 sessions per year, 50baits/km x 300 km2 = 15,000 baits

Stage 2: Fauna Monitoring

Camera monitoring (cats, numbats)

Radio-collaring cats

Radio-collaring chuditch

Radio-collar monitoring

Cage Trapping (chuditch, woylie, brushtail possum, quenda)

Spotlighting (western ringtail possums, tammar, western brush wallaby)

Nest boxes (phascogales)

Numbat monitoring

Note: the timing of the Operation Eradicat® baiting in Stage 2 is to be determined by the results of Stage 1. This in turn will affect the timing of the fauna monitoring before, during and after the baiting event

Figures provided for Varanus and Koomal are for larger adults than observed in UW, resulting in an overestimation of the min # baits required to reach ALD.

Biometrician's Endorsement

granted

Data management

No. specimens

Herbarium Curator's Endorsement

not required

Animal Ethics Committee's Endorsement

granted

Data management

Hard copies of data will be kept on file in the Manjimup Work Centre. A digital copy of the data will be maintained in Fauna File. Images will be stored and managed in CPW Photo Warehouse.

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			
Overheads			
Equipment			
Vehicle			
Travel			
Other			
Total			