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News and Views

Response to 'Fauna-rescue programs highlight unresolved scientific, ethical and animal welfare issues' by Menkhorst *et al.*

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We often discuss the issues and questions raised by Menkhorst *et al.* (2016), as it concerns us that there is very little relevant research to guide the preparation and implementation of mitigation relocation plans for vertebrate fauna in areas to be impacted by vegetation clearing, particularly for habitats and species we normally work with in Western Australia.

There are multiple state government agencies that assess, control, regulate and apply approval conditions to vegetation clearing programs in Western Australia. In addition, local government is also able to apply conditions to vegetation clearing programs, and regularly does so. These approval conditions often require that a fauna management plan or fauna relocation strategy be prepared that mitigates or minimises impacts on vertebrate fauna as a consequence of vegetation clearing programs; this either implicitly or explicitly means that vertebrate fauna in a potential impact area are to be relocated. Most state and local government agencies that assess, control, regulate and apply approval conditions to vegetation clearing programs take the advice of the Western Australian Department of Parks and Wildlife (DPaW), and would implement policies or procedures that this agency publishes. We have on multiple occasions encouraged various staff in the DPaW to prepare and publish vertebrate fauna relocation guidelines, as their absence means that different agencies have differing views on what should occur (if anything at all). Amy Mutton (pers. comm.), a zoologist in the Species and Community Branch of the DPaW, has advised that fauna relocation guidelines are being prepared, an action that we strongly support.

In the absence of any guidelines, government agencies responsible for assessing, controlling, regulating and applying approval conditions to vegetation clearing programs will do what they consider is the 'right thing to do', and few of these people have the time to review the science to decide what is best practice or ecologically appropriate. Similarly, environmental consultants who have a responsibility to prepare fauna management plans and who are time poor, work to budgets that rarely stretch to include reading and keeping abreast of the literature, and who are expected to consider community expectations in the preparation of these plans, often include fauna relocation strategies in these mitigation plans without the approach being based on published research or considering ecological, ethical or animal welfare issues.

There are multiple publications about the success or otherwise of relocating single species and mostly threatened fauna (see some listed in Menkhorst *et al.* 2016), but we were unable to find any that discuss the success or otherwise of fauna relocation programs associated with vegetation clearing programs in Australia. There are, however, a few that report on fauna relocations for trenches associated with laying pipelines (e.g. Ayers and Wallace 1997; Doody *et al.* 2002; Swan and Wilson 2012), but none of these have assessed the success or otherwise of these relocations. Fauna found in trenches are typically caught and quickly relocated into adjacent areas, which is presumably similar habitat.

If a development site is going to be cleared of its vegetation, then vertebrate fauna present are either going to die (or be injured and then die) or they will be forced to relocate to adjacent habitat that may or may not be suitable. The following simple question faces government agencies responsible for assessing, controlling, regulating and applying approval conditions to vegetation clearing programs in the absence of the appropriate science to guide what action should be taken: Will some of the vertebrate fauna that are caught and relocated survive and subsequently breed and will this benefit outweigh any disadvantage associated with fauna at the relocation site? If the answer is 'yes', then a relocation program is justified as some vertebrate fauna will survive. We have some anecdotal evidence to indicate that relocated vertebrates survive:

- We caught and relocated *Cryptoblepharus buchananii* (Buchanan's snake-eyed skink) to a fence that had no others of that species and little opportunity for others to migrate to the site. These *C. buchananii* subsequently bred and there is now a larger population present in the relocation site.
- We caught and relocated *Isoodon obesulus fusciventer* (southern brown bandicoot) in September 2013, May 2014

and again in October 2014 to an area of 'suitable habitat' at a location prescribed by our licence and all relocated southern brown bandicoots had a particular ear marking as we had collected a tissue sample from each animal. In February–March 2016 we caught and relocated *I. o. fusciventer* from the relocation site as this area was now being cleared for a development. Seven *I. o. fusciventer* that we had relocated earlier were subsequently captured and all appeared healthy with many of the females showing signs they had recently had young.

- Ashleigh Wolfe (pers. comm.), as part of her Ph.D. project, relocated *Pseudonaja affini*s (dugite) and *Tiliqua rugosa* (bobtail) with radio-transmitters attached and indicated a high survival rate.

On the Swan Coastal Plain, vertebrate fauna typically caught before or during vegetation clearing include: *Isoodon obesulus fusciventer* (southern brown bandicoot), *Trichosurus vulpecula* (common brushtail possum), *Heleioporus eyrei* (moaning frog), *Acritoscincus trilineatum* (western three-lined skink), *Christinus marmoratus* (marbled gecko), *Ctenotus australis* (western limestone ctenotus), *Ctenotus fallens* (west-coast laterite ctenotus), *Menetia greyii* (common dwarf skink), *Pogona minor* (dwarf bearded dragon), *Tiliqua rugosa* (bobtail), *Varanus gouldii* (Gould's goanna), *Cryptoblepharus buchananii* (fence skink), *Morethia obscura* (pale-flecked morethia), *Hemiergis quadrilineatum* (two-toed mulch skink), *Limnodynastes dorsalis* (western banjo frog), *Pseudonaja affinis* (dugite), *Chelodina colliei* (western snake-necked turtle) and *Lialis burtonis* (Burton's legless). On the basis of these species' geographic distributions and the habitat types in which they are found on the Swan Coastal Plain, most species appear to have relatively plastic habitat requirements, and if relocated nearby and into habitat similar to that from which they came, and putting aside issues to do with predation and disruption of the receiving fauna assemblages and individuals' home ranges, it seems intuitive that these species would have a high chance of surviving the relocation.

It was not our intention, as Menkhorst *et al.* (2016) interpreted, to indicate that developments and a loss of native vegetation can proceed with minimal 'cost' to biodiversity because the resident fauna can be relocated, which can also lead to a justification for further and ongoing loss of habitat. It is our view that the clearing of native vegetation, even with the implementation of appropriate vertebrate fauna mitigation programs, does impact on the biodiversity of the area.

Defining and measuring success

We support the notion that success is measured by a proportion of the relocated animals surviving, establishing home ranges, persisting in the long term and successfully breeding. We would add to this, suggesting that the relocations have minimal impact on the receiving fauna environment and require a minimum readjustment by the resident fauna population. What proportion need to survive for the program to be deemed a success is a judgement, and, yes, monitoring and reporting of the outcomes are required. We have on multiple occasions discussed with the DPaW staff the need to monitor survival rates of relocated species, in particular *I. o. fusciventer* and *Macropus fuliginosus* (western grey kangaroos). We have, for example, sedated and relocated a large number of *M. fuliginosus* from a golf course, where there was plenty of grass, shelter, permanent fresh water, protection from predators and the relocated animals were habituated to the presence of golfers. These kangaroos were relocated to a marri/jarrah woodland with no grass, no permanent water and an unknown number of predators. The community felt good that the animals were relocated rather than euthanased, but as survival was not monitored it is not known how many survived, established a home range and subsequently went on to breed.

Suitability of release sites

When vertebrate fauna are relocated under licence in Western Australia, the DPaW determines the relocation site. Most often within the relocation site there is a choice of habitats into which animals can be released and zoologists undertaking the relocations are required to exercise judgement in the selection of a 'suitable release site'. We do not agree with Menkhorst *et al.* (2016) that the proportion of taxa for which we have an adequate understanding of suitable habitat is small and thus there is a high risk of indiscriminate or inadvertent placing of animals into suboptimal habitat. Putting aside the issue of the impact that relocated animals have on resident fauna, it is usually relatively easy to find adjacent or nearby habitat that has similar soils, relief, vegetation community, leaf litter, etc., for a release site. Issues associated with disorientation, a lack of knowledge of refuge sites and no established home range, which could increase predation, are, of course, unknown. We do not support the suggestion of Menkhorst *et al.* (2016) of doing nothing until more data are collected, as the fate of the vertebrate fauna in a development site where all of the vegetation will be cleared is most often death or injury followed by death. At least the relocation of animals provides the possibility of a better outcome until more is known.

Animal welfare issues

We agree that animals placed into a less than optimal habitat, or a habitat that already supports a population of their species, face an uncertain future; however, it is conjecture to say they are unlikely to thrive. Maybe the relocation forces animals to undertake long and risky movements and some will die from predation, starvation, exposure or misadventure; however, others may survive, flourish and go on to successfully reproduce. We simply do not know. However, the relocation option gives them a chance when they face death or injury followed by death at the development site. We think developers and government regulators do 'feel good' about relocation programs, but in the absence of adequate data on the fate of relocated fauna assemblages undertaken in our habitats by experienced zoologists, why not give the fauna an opportunity to survive and flourish, albeit at another location.

Failure to recognise the complexity and diversity of potential impacts

We believe some of the skilled and experienced zoologists in environmental consultancies that are managing fauna relocations are aware of the complexity and diversity of potential

impacts of relocating vertebrate fauna, but in an environment where we are data poor about outcomes of fauna assemblage relocations in habitats in which we regularly work (e.g. banksia woodlands, jarrah woodlands, sand plain heath on Quindalup, Spearwood or Bassendean dunes, Pinjarra Plains or the surrounds of wetlands), why not give the fauna an opportunity to survive and flourish, be it at another location.

Lack of clear aims, monitoring strategies and contingency planning

We believe the aims of vertebrate fauna relocations from a development site are clear, i.e. avoiding the certain death of fauna present in the development site and providing relocated species with an opportunity to survive and flourish, albeit at another location. Within the constraints imposed on us as licence conditions, we always endeavour to find habitat in relocation sites that match as closely as possible the habitat from which the animals came. We have repeatedly requested that the DPaW undertake, commission or fund monitoring programs of relocated fauna; however, it appears this work is not high enough priority to warrant the necessary financial commitment.

Creating unrealistic community expectations of a positive outcome

We take a different point of view to the comment of Menkhorst *et al.* (2016) on creating unrealistic community expectations. In the absence of adequate data to indicate that relocating vertebrate fauna assemblages for a development site where death or injury followed by death or a forced relocation into an adjacent area that may or may not be suitable, then why not give the fauna an opportunity to survive and flourish, be it at another location. Developing community interest and positive attitudes to the small vertebrate fauna that are likely to be killed in development sites is important if we are to get better outcomes for relocated fauna in the future. Research into these outcomes is only going to occur if the issue has a high enough profile in the community that the DPaW is prepared to allocate funds for the monitoring, as this type of research is unlikely to attract the necessary funds from the normal research-funding sources. One only needs to see the requirement for Ashleigh Wolfe to obtain crowd funding of her Ph.D. project on the success or otherwise of relocated vertebrate fauna to appreciate that this type of research is unlikely to attract funds from sources other than the DPaW, given its legislative responsibilities.

Giving injured animals, chicks and orphaned joeys to animal carers

Although not mentioned by Menkhorst *et al.* (2016), an issue that we have often mulled over is the benefits of giving injured animals, chicks and orphaned joeys to animal carers with the intention that they be held for a period to recuperate or grow before being released back into suitable habitat. We could find no relevant literature on this topic for species that we typically deal with, although an article by Cooper (2011) indicates that *I. o. fusciventer* were successfully released after being used in laboratory experiments. Occasionally an animal is injured during vegetation clearing and the zoologist deems that it could be rehabilitated and released, so it is given to a DPaW registered animal carer. When removing trees during clearing, nests occasionally contain chicks in a reasonably advanced stage, and these are occasionally given to a DPaW registered animal carer. When undertaking monitoring or relocating programs for *I. o. fusciventer*, occasionally pouched juveniles are 'ejected' as the female runs away. We have never seen the female return for her young, so if their eyes are open, then animal carers indicate that they have a high chance of surviving with appropriate care. Animal carers raise these joeys and release them into suitable habitat when they are deemed old enough to survive. In the process of sedating *M. fuliginosus* before relocation, joeys at foot can become separated from their mothers. It is very difficult to reunite a joey with its mother as she slowly comes out of sedation, which can take 30–240 min. As a consequence, joeys at foot are often given to animal carers to raise and release. We could find no relevant literature that would provide an indication on whether vertebrate animals given to animal carers in Western Australia survive when released, although there are numerous articles in the public and scientific literature of releasing threatened species after a period of care (e.g. black-cockatoos: see Groom *et al.* 2014) and there are multiple articles on the release of captive-bred threatened species (e.g. Moseby *et al.* 2011).

Conclusion

In conclusion, we reiterate the recommendation made in our earlier paper (Thompson and Thompson 2015) that government regulators require that the number of species and individuals likely to be lost during a vegetation-clearing program be reported in environmental impact assessments and when submitting Native Vegetation Clearing permit applications. These data could easily be collated and published annually to assess potential impacts on the vertebrate fauna for vegetation-clearing programs.

Industry and environmental consultants would benefit from clear guidelines that are based on good science for fauna rescue programs before and during vegetation-clearing programs. Of utmost importance, and as discussed by Menkhorst *et al.* (2016), it is important that the DPaW commission appropriate research to assess the success or otherwise of vertebrate fauna relocation programs associated with vegetation clearing to ensure that such programs are cost-effective and the data inform subsequent management practices.

The level of effort applied to a fauna relocation program before and during vegetation clearing is variable and it is unreasonable to prescribe an effort or methodology that fits every scenario; however, it is possible to indicate levels of effort required for varying circumstances. The exact procedures (i.e. type and duration of trapping, cherry pickers for hollow inspections, hand foraging, fauna rescue personal present, etc.) should be determined on the basis of advice from zoologists with expertise in the habitat being impacted and the type of species likely to be encountered and then documented in the fauna management plan. However, as an interim step and in the absence of guidelines, we offer the following suggestions for consideration for fauna rescue programs for non-threatened species:

- In areas that have high habitat value (i.e. closely resembles the vegetation complex and quality that would have existed in the area before any disturbance, has connectivity with other

habitats and is likely to contain a vertebrate fauna assemblage similar to that of undisturbed environments) a comprehensive fauna relocation program is recommended. This may include trapping, tree hollow inspections and fauna rescue personnel being deployed on site during the vegetation-clearing process.

- In areas that have a low–moderate habitat value (i.e. some indication of disturbance, may be partially fragmented or cleared, but generally retain many of the characteristics of the habitat if it had not been disturbed) then a moderately comprehensive fauna relocation program is recommended. This may include targeted trapping and fauna rescue personnel being deployed on-site during the vegetation-clearing process.
- In areas that have a highly degraded habitat limited intervention is required and the fauna relocation program may be concentrated on having fauna rescue personnel present when the trees, but not grasses, are cleared.
- In areas where the fauna habitat is considered rare or represents less than 10% of its original extent and is between a low and very high habitat quality, then implementation of a comprehensive trapping and relocation program is recommended and fauna rescue personnel should be deployed on site.
- In areas that support iconic species, or mammals and reptiles with a mass between 50 and 5000 g (critical mass range for mammals), then a targeted trapping and fauna rescue program should be implemented to capture and relocate these individuals.

If, after appropriate further research, vertebrate relocation programs are deemed successful providing that suitable relocation habitat is available, then they should be implemented more broadly; however, for projects where suitable relocation habitat is not available this should become a serious consideration for government regulators during the assessment process when determining the acceptability of the development action proceeding.

We disagree with the conclusion of Menkhorst *et al.* (2016) that mitigation translocations rarely produce the desired outcomes, as there are inadequate data for the species regularly being relocated in Western Australia to draw this conclusion. However, we do agree with their conclusion that mitigation relocations should not be used as a surrogate for habitat retention.

We would argue the reverse of the conclusion of Menkhorst *et al.* (2016), and advocate that appropriate levels of mass mitigation relocations should be more broadly applied to vegetation-clearing programs, and that guidelines for relocation programs should be developed on the basis of relevant research to determine the benefits or otherwise of these programs. Where the appropriate research is unavailable, then it is recommended that it be commissioned by the DPaW.

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