The Old School, Brewhouse Hill, Wheathampstead,
Hertfordshire AL4 8AN, UK
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A report of capture myopathy in the Tasmanian pademelon (Thylogale billardierii)

CR McMahon[†], NL Wiggins[*‡§], V French[†], HI McCallum[‡#] and DMJS Bowman[‡]

[†] School for Environmental Research, Charles Darwin University, Darwin, Australia
[‡] School of Plant Science, University of Tasmania, Private Bag 55, Hobart, Australia
[§] School of Zoology, University of Tasmania, Hobart, Australia
[#] Griffith School of Environment, Griffith University, Nathan, Australia
* Contact for correspondence and requests for reprints: wigginsn@utas.edu.au

Abstract

*In Tasmania, a small island state of Australia, wildlife is under increasing pressure from anthropogenic activities. Multiple species of native herbivores compete directly for resources with humans, such that wildlife populations are regularly managed to reduce their impact on agricultural and forestry landscapes. There is an increasing need to quantify the impacts of such wildlife management strategies on localised populations of Tasmania's iconic fauna. Gathering this information often requires capture and restraint of animals, but due to a paucity of published information on responses of wildlife to such techniques, regulatory bodies overseeing research do not always have complete information upon which to base decisions. In our study, the regulatory body designated manual restraint over chemical immobilisation as the preferred method, but current prescribed techniques can result in capture-related injuries including myopathy. To encourage dialogue on this welfare issue, we present observations on capture and restraint of the endemic Tasmanian pademelon (*Thylogale billardierii*). Three of 19 animals that were trapped as part of a research study exhibited symptoms consistent with capture myopathy. Results suggest that techniques involved with capture and manual restraint can be problematic for pademelons, and we present recommendations for preventative measures, including chemical immobilisation, to limit myopathy-related deaths.*

Keywords: *animal welfare, capture myopathy, chemical immobilisation, macropod, Tasmanian pademelon, wildlife*

Introduction

Currently, the world is experiencing a human-induced loss of biodiversity known as the sixth great extinction, driven primarily by habitat modification, climate change and invasive species introductions. Tasmania (Australia) is one example of a place where human activities are affecting wildlife. This island hosts a unique and diverse fauna which is under increasing stress from anthropogenic activities. Humans and the endemic Tasmanian pademelon (*Thylogale billardierii*) are in direct conflict, such that pademelon numbers are regularly managed through methods of lethal and non-lethal control (eg Coleman *et al* 1997; Wiggins *et al* 2010) to reduce their impact on agricultural and forestry landscapes. Managing interactions between humans and animals requires an in-depth understanding of animal biology and environmental use. Studying wild animals often relies upon capture and restraint to obtain information on diet, physiology and habitat use. Capture and restraint are not without their difficulties and researchers have a responsibility to take into account the welfare of captured individuals. This includes minimising negative impacts of capture-related injuries, including capture myopathy, a common problem in small prey species such as pademelons (Holz 2007). However, given the risk of capture-related injuries to pademelons, little has been published on the impacts of capture/restraint methods.

Capture myopathy is a potentially fatal disorder which may occur in captured and restrained wildlife as a result of physiological imbalances related to over-exertion and stress (Chalmers & Barrett 1982; Spraker 1993; Williams & Thorne 1996; Vogelnest & Portas 2008). Cases of myopathy vary in severity yet treatment and/or cures remain poorly understood in a number of species. Although work exists on related species and instances of capture myopathy in several species of macropods (eg Vogelnest & Portas 2008), there is a paucity of accessible information on capture myopathy in the endemic Tasmanian pademelon. As a result, regulatory bodies overseeing research activities do not have a complete background upon which to base decisions.

We present findings on the capture and restraint of 19 wild-caught pademelons in Tasmania. The pademelons were caught and restrained to fit GPS collars in a study of habitat use (Wiggins *et al* 2010). We monitored the incidence of capture myopathy in order to provide some recommendations to regulators and researchers, intended to lower myopathy rates.

Materials and methods

Research was undertaken in north-east Tasmania, Australia (41° 06' S; 147° 35' E) at two agricultural properties (Wiggins *et al* 2010). Approval for research was granted by the University of Tasmania Animal Ethics Committee (Permit A9895), the Tasmanian Parks and Wildlife Service (Permit FA8122) and research followed ASM guidelines (Gannon & Sikes 2007).

Standard procedures to capture animals were adhered to throughout trapping periods. Traps used were similar to those described by Pollock and Montague (1991), made with canvas for soft-sided walls (110 × 75 × 75 cm; length × width × height). Traps were set at night in secure, dry positions protected from rain, baited with grain and carrots and checked every 3–4 h (prior to and at sunrise). A quick assessment was performed on trapped animals, noting flight response upon approach (strong response versus passive response), breathing patterns and body size. Animals deemed flighty or too small for collaring were immediately released. Individuals suitable for collaring were transferred into a net, quickly weighed, sexed and manually restrained for collar attachment, with restraint times generally under 10 min.

A total of 19 pademelons, average weight range 5–10 kg, were captured and assessed as described above, with a total of 13 pademelons (four females, nine males) being fitted with a Televilt Tellus Basic™ 3H2A GPS collar equipped with a Tellus RC-DropOff mechanism (Followit, Lindesberg AB, Sweden). Individuals fitted with GPS collars were tracked for 24 weeks after which time collars were removed and animals released (Wiggins *et al* 2010).

The necropsy was undertaken by the Tasmania Animal Health Laboratory, Hobart, Tasmania, Australia.

Results

During this study, three instances of death accompanied by clinical signs consistent with capture myopathy occurred. The first instance of myopathy occurred with a 9-kg male. After transferral from trap to net, irregular noisy breathing was noted. The animal was immediately removed from the net to monitor condition and released. The animal attempted to stand on multiple occasions post-release; during this time breathing became heavier and strained. The animal did not regain use of his legs and died within 2–3 min of release.

The necropsy findings revealed acute bruising seen grossly, and skeletal and cardiac myopathy (including areas of fibres with loss of fine sarcoplasmal cross striation and some fragmentation) resulting in high muscle enzyme (creatinine kinase and aspartate transaminase) concentrations in ocular fluid consistent with struggling, stress, and capture myopathy. There was severe congestion and possible haemorrhage of adrenal cortex consistent with stress and congestion of other viscera consistent with failing circulation and blood pooling. Although there were high antibody levels to toxoplasma there was no tissue evidence of an active infection and the titres were considered to reflect a past active infection. The conclusion was that trap-associated struggling and stress-induced cardiac and skeletal muscle damage resulted in the animal's collapse and death.

The second instance of suspected myopathy, similar to the one described, occurred the following day with an 8-kg male. Collar fitting had just occurred when noisy, strained breathing was noted. The collar was removed, however the animal died within 5 min of release.

The third instance of suspected myopathy occurred with a 5-kg female. This individual was successfully trapped, collared and released. When tracked one week post-release the individual was found deceased 500 m from site of capture. This individual was too autolysed for necropsy but it was possible (although not conclusive) this pademelon suffered from myopathy post-capture/restraint.

Rates of mortality due to capture myopathy are difficult to measure, largely due to small sample sizes prohibiting statistical analysis. Therefore, we report that three of 19 animals that were trapped as part of a research study exhibited symptoms consistent with capture myopathy.

Discussion

During capture and restraint of Tasmanian pademelons we observed three mortalities, with clinical signs including irregular, strained breathing and an inability to balance, typical and consistent with acute myopathy (Vogelnest & Portas 2008). The occurrence of myopathy was confirmed by necropsy in one of the three animals, with the conclusion that trap-associated struggling and stress induced animal death. From direct observations, it appears that current manual capture and restraint techniques advised by our regulatory body is probably not the most appropriate method for pademelons, and efforts to reduce the risk of myopathy need to be considered in the future. The difficulty in developing appropriate methods is that the prevention and treatment of myopathy in Tasmanian pademelons is poorly understood. However, there may exist some, albeit difficult to quantify, preventative measures that can be taken which we recommend below.

Trapping and manual restraint

There exists a wealth of literature describing techniques to minimise the onset and occurrence of myopathy during trapping and restraint of animals, including recommended trap properties (soft-sided, size-relevant to animal), trapping conditions (suitable environmental conditions, reduced trapping periods) and handling techniques (experienced handlers, short processing times) (Chalmers & Barrett 1982; Booth 1994). Literature also details underlying body conditions which may influence the onset and/or severity of myopathy, including toxoplasmosis, nutritional status and trap trauma (Chalmers & Barrett 1982). However, from our direct observations in the field and strict adherence to required codes of conduct, we believe that only minimal modifications to our manual trapping techniques could be made (ie trialling smaller trap sizes) in an attempt to reduce the incidence of myopathy in Tasmanian pademelons. Additional efforts to reduce the risk of myopathy, such as chemical restraint, need to be considered in the future.

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Chemical immobilisation and prophylaxis

As prevention and treatment of capture myopathy in Tasmanian pademelons is currently poorly understood, we recommend the trialling of additional preventative measures, including chemical immobilisation, as has been demonstrated with ungulates prone to capture myopathy (eg Spraker 1993; McMahon & Bradshaw 2008) and in macropods (eg Blyde 1999; Volgnest & Portas 2008).

One option to reduce the risks of capture myopathy developing is to administer a short-term sedative to animals at time of capture. The ideal sedative would include analgesic and amnesic components (eg Diazepam [Generic Valium®, an anxiolytic-sedative drug]). Zoletil® (zolazepam/tiletamine) is commonly used for sedating macropods. It can be administered intra-muscularly (eg King *et al* 2011) and could be considered for use in sedating wild-caught pademelons. We believe trialling such a standard practice may be prudent when capturing wild animals prone to developing capture myopathy. Providing long-acting antibiotics and multivitamin supplements may further reduce side-effects of myopathy, although this remains a fertile field of study to be pursued.

Another option to reduce the risks of post-capture disease, following the methods of McMahon and Bradshaw (2008), is to inject pademelons with a combination of prophylactic antibiotics and multivitamins, including 3.45–7.64 mg kg^{-1} penicillin (Benacillin®) intra-muscularly (IM), 0.05 mg kg^{-1} selenium-vitamin E mixture (Selvite E®) IM and 0.05 ml kg^{-1} ivermectin (Ivomec®) subcutaneously (SQ) (Staker 2006). Benacillin® is a long-acting penicillin-based product for parenteral infection treatment; Selvite E® is a mixture of selenium and vitamin E (tocopherol) proposed to counteract adverse effects of myopathy (Chalmers & Barrett 1982); and Ivomec® is an anti-parasitic preparation effective against common parasites which may reduce the risk of infection in a stressed and immunosuppressed animal.

The role of researchers and regulatory bodies

To ensure animal safety and reduce the risk of capture injury to wild animals, it is important that researchers and regulatory bodies, which dictate the techniques wildlife researchers, are allowed to use have the most current information at hand upon which to base decisions. This is only possible if information is freely available (eg published mainstream literature). It is our hope that the information we present here will contribute to informing research and regulatory communities on the effects of manual restraint of Tasmanian pademelons, and that our experiences serve as a basis for improving capture methods. We hope that through the development, trialling and reporting of techniques that reduce the incidence of myopathy in the Tasmanian pademelon, we are able to improve upon research techniques that may impact the welfare of the study species.

Conclusion

We observed mortality in three Tasmanian pademelons when animals were equipped with GPS collars, most likely in response to manual capture and restraint techniques. The clinical signs observed appeared consistent with capture myopathy, which was confirmed by necropsy of one individual animal. In an attempt to reduce the incidence of myopathy in wild-caught pademelons, we recommend chemical immobilisation be trialled in future studies, hopefully in close liaison with regulatory bodies concerned. By documenting these negative results we hope that our data and experiences act as a baseline from which to develop safer capture and restraint techniques for Tasmanian pademelons, in particular, but also more generally, for other species prone to developing capture myopathy, in order to reduce the risks of welfare problems following capture and re-release.

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