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Evaluating the status of species using Indigenous knowledge: Novel evidence for major native mammal declines in northern Australia

M.R. Ziembicki [a,b,*], J.C.Z. Woinarski [a,c,1], B. Mackey [b,2]

[a] Northern Territory, Department of Natural Resources, Environment, The Arts and Sport, PO Box 496, Palmerston, Northern Territory 0831, Australia
[b] Fenner School of Environment and Society, Australian National University, Canberra, Australian Capital Territory 0200, Australia
[c] National Environment Research Program North Australian Hub, Research Institute of Environment and Livelihoods, Charles Darwin University, Darwin, Northern Territory 0909, Australia

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ABSTRACT

A small series of recent monitoring studies has reported major declines for many native mammal species in localised regions in northern Australia. However, the broader spatial context of these studies is uncertain. This study aims to assess the extent and timing of change in mammal status across a broad area of northern Australia (the monsoonal tropics of the Northern Territory). Indigenous information about terrestrial native mammal fauna (excluding bats) was compiled from a large series of interviews conducted across Indigenous communities. A collection of mammal skins was used to help facilitate discussions and verify identifications. The resulting information was analysed with non-parametric statistics to test for changes in mammal status across different time periods, between different regions, and between different groups of mammal species. Declines were reported as extending from the earliest memory of Indigenous participants, but the rate of decline has increased recently. These changes were reported across all five regions within the broad study area and were greater for "critical weight range" species than for other species. Indigenous participants suggested several factors were associated with the changing status of species. The study's results reveal a pattern of widespread decline in the mammal fauna of the monsoonal tropics of northern Australia, thereby corroborating the conclusions of recent more local wildlife monitoring studies. The study also demonstrates the value and capability of Indigenous ecological knowledge to complement and corroborate more intensive and local scientific studies. The results reinforce concern for the conservation status of the mammal fauna of northern Australia.

1. Introduction

Since European colonisation, Australia has suffered a catastrophic loss of native mammals, with the extinction of at least 22 species, and a further eight species persisting only as residual populations on offshore islands. The extinctions have been non-random, being more likely in larger rodents, larger dasyurids (quolls and phascogales), smaller macropods and bandicoots (species characterised as "Critical Weight Range" (CWR): (Burbidge and McKenzie, 1989; Chisholm and Taylor, 2007). A feature of the declines and extinctions is that they are not so much in regions characterised by intensive development and land clearing (the driving force of biodiversity decline across much of the world), but rather in relatively natural arid and semi-arid areas, such as central Australia (McKenzie et al., 2007). Further, the declines and extinctions are not some now closed and regrettable episode of past colonial history, but rather an ongoing pattern, with continuing decline for many species. Even some of the extinctions have been relatively recent: for example the last known records of the central hare-wallaby (*Lagorchestes asomatus*) and the desert bandicoot (*Perameles eremiana*) were reported by Aboriginal informants to Burbidge et al. (1988) to be around 1960 and around 1970 respectively.

Recent evidence indicates a major decline in components of the mammal fauna of parts of monsoonal northern Australia, a region previously considered relatively secure (Burbidge and McKenzie, 1989). Evidence for that decline derives from monitoring programs (Russell-Smith et al., 2009a; Woinarski et al., 2010, 2004a, 2001) and comparisons of recent surveys with historical accounts or – in a few cases only – subfossil material (Braithwaite and Griffiths, 1994; Cramb and Hocknull, 2010; Dahl, 1897; Kitchener, 1978; Kutt et al., 2005; McKenzie, 1981; Short and Calaby, 2001; Start

* Corresponding author. Present address: School of Marine and Tropical Biology & Centre for Tropical Environmental and Sustainability Science, James Cook University, P.O. Box 6811, Cairns, Queensland 4870, Australia. Tel.: +61 7 40421714; fax: +61 7 40421319.
E-mail addresses: mark.ziembicki@jcu.edu.au (M.R. Ziembicki), john.woinarski@cdu.edu.au (J.C.Z. Woinarski), b.mackey@griffith.edu.au (B. Mackey).
[1] Present address: PO Box 148, Christmas Island 6798, Australia.
[2] Present address: Griffith Climate Change Response Program, Griffith University, Gold Coast, Queensland 4222, Australia.

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et al., 2011; Winter and Allison, 1980). However, this evidence base is sparse and localised and there are examples of inconsistency with the predominant trends of decline, most notably in the higher rainfall and most rugged areas of the north Kimberley, where the mammal fauna remains relatively stable (Start et al., 2011, 2007). The limited number of monitoring programs, their relatively brief temporal span, and the sparse historical record all serve to constrain extrapolations or interpretations of coherent spatial and temporal patterns of change, and hence of the causal factors contributing to such change (Woinarski et al., 2011a).

To attempt to overcome these limitations, we sought to document Indigenous knowledge of the changing status of the native terrestrial mammal fauna in a systematic assessment across a large component of northern Australia, the monsoonal tropics of the Northern Territory. We focussed especially on areas that were under-represented in scientific surveys such as Aboriginal lands. The use of local and/or Indigenous knowledge is increasingly recognised for its value to contemporary natural resource management and biodiversity conservation (Berkes et al., 2000; Huntington, 2000; Shen et al., 2012), and has been applied to help assess species status and distribution and to aid ecological monitoring (Anadon et al., 2009; Ferguson et al., 1998; López-Arévalo et al., 2011; Mallory et al., 2003; Moller et al., 2004; Ramstad et al., 2007; van der Hoeven et al., 2004; Ziembicki and Woinarski, 2007). The present study is based on and complements a comprehensive review of Indigenous knowledge of the changing status of the mammal fauna of central Australia (Burbidge et al., 1988), which provided a historical depth and continuity, and geographic breadth, far surpassing the information base derived from non-Indigenous sources.

As with all ethno-ecological studies, there are constraints in the approach and its interpretation. Particularly in more traditional communities, there may be linguistic and interpretational challenges; scientific taxonomy may poorly match Indigenous classification systems (e.g., Bradley et al., 2006; Davis, 1981; Waddy, 1988), particularly for some small mammal groups that have little cultural importance; some Indigenous knowledge may be culturally sensitive and considered not appropriate for public sharing; chronology may be imprecise; without the context of live animals behaving naturally in the wild, identification from pictures or specimens may be artificial, challenging or ambiguous; most Indigenous people have moved from permanently living on their clan estates to more centralised living in larger towns; in many communities, lifestyles have changed such that far fewer people are still involved in regular and traditional bush activities leading to 'shifting baselines' and the loss of knowledge between generations (Turvey et al., 2010); information from an individual source may be difficult to corroborate; validation and integration of Indigenous and scientific knowledge systems may be challenging (Gratani et al., 2011); across most communities in this study area, decades of involvement with pastoralism may have overlaid the tenets of traditional management; it may be difficult to contextualise highly localised expertise (Wohling, 2009); and lamentable health standards in most Indigenous communities have resulted in the survival of few individuals with long connection to their lands. At least some of these characteristics were more pronounced for this study than they were for the study of Burbidge et al. (1988) in central Australia more than 20 years previously. Where possible, we attempted to design our approach to accommodate these constraints or minimise their impacts, and our results are interpreted with regard to these factors.

The principal objective of this study was to document Indigenous knowledge of changes in the status of the native mammal fauna of the monsoonal tropics of the Northern Territory over a period of the last 50 or so years, the memory span of older Aboriginal people. More detailed information collated in this study concerning ecological knowledge of mammal species, uses made of those species, and language names will be documented separately.

We sought to assess the extent to which changes in status were consistent across different regions, whether any change in the status of native mammals was considered to be associated with a potentially causal factor, and the extent to which Indigenous information was consistent with the current scientific record. Where possible, we complement or corroborate the information derived in this study with some previous local ethno-biological accounts (Bradley et al., 2006; Dixon and Huxley, 1985; Jones et al., 2010; Liddy et al., 2006; Raymond et al., 1999; Waddy, 1988; Widijburru et al., 2010) although noting that these latter typically take the form of language dictionaries rather than documentation of conservation status.

This study has a particular focus inspired by concern about the conservation of native wildlife in northern Australia. But this study also seeks to illustrate the valuable and different environmental perspective of Indigenous people. There is only limited documentation of such information in contemporary Australian ecological literature, perhaps to the detriment of our ability to manage our natural environments.

2. Methods

2.1. Study region

The study area comprised the monsoonal tropics of the Northern Territory, extending south to about 19°S, approximately the northern border of the area considered in the analogous previous study by Burbidge et al. (1988) (Fig. 1). Except where indicated, our study was restricted to mainland areas. The study region is characterised by marked seasonality with distinctive wet and dry seasons, with rainfall declining steeply from the northern coast to the inland south (Hobbs et al., 1998).

There is relatively little topographic variation across this area, although the rugged terrain of the western Arnhem Land escarpment and plateau is notable in providing some microclimatic and fire refuge to many plant, and some animal, species (Woinarski et al., 2006, 2009). Eucalypt open forests and savanna woodlands comprise the most extensive vegetation types, with smaller areas of tussock grasslands, hummock grasslands, *Acacia* woodlands, *Melaleuca* forests and woodlands, mangroves and other coastal communities, *Terminalia* woodlands and monsoon rainforests. In contrast to savannas in other parts of the world, Australia's tropical savannas are relatively intact (Woinarski et al., 2007a), with less than 2% of the region's native vegetation cleared (Woinarski and Dawson, 2002). Pastoralism is the most widespread and dominant land use, extending over 46% of the study area (Hosking, 2002), with other main land types comprising Indigenous lands (see below), mining, military training, and conservation reserves.

Approximately one third of the study region's population is Indigenous and a similar proportion of land is under Aboriginal control. Relative to some other parts of Australia, Aboriginal culture in the study area is relatively robust, particularly in Arnhem Land, one of the country's largest Aboriginal reserves. At the time of European settlement there were an estimated 48 Indigenous languages spoken across the region, with much of that diversity found along the coast (Horton, 1994). However, largely as a consequence of historical events and past government policies (for example, the aggregation of Aboriginal people from their lands to centralised settlements), there has been a significant diminution in traditional Aboriginal practices and an associated erosion of traditional ecological knowledge and loss of Aboriginal languages (AIATSIS, 2005; Nettle and Romaine, 2000).

In terms of knowledge specific to wildlife, a fundamental change in familiarity and use was associated with the transition