



Options for updating large wild mammal distributions and relative abundances in New Zealand

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Manaaki Whenua

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A. David M. Latham

Landcare Research

Prepared for:

Environment Southland

Private Bag 90116
Invercargill 9840

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Landcare Research, Gerald Street, PO Box 69040, Lincoln 7640, New Zealand, Ph +64 3 321 9999, Fax +64 3 321 9998, www.landcareresearch.co.nz

Reviewed by:

Approved for release by:

Graham Nugent
Programme Leader
Landcare Research

Andrea Byrom
Portfolio Leader
Managing Invasive Weeds, Pests & Diseases

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1 Introduction

Landcare Research investigated options for updating knowledge about the distributions and relative abundances of large wild mammals in New Zealand, with emphasis on options for an updateable, interactive website suitable for use by government agencies, researchers, and the public. This report was prepared for Environment Southland with funding from Envirolink Small Advice Grant 1517-ESRC158.

2 Background

In the mid-1990s, Fraser et al. (2000) determined the established ranges and new populations of 11 introduced wild ungulate species in New Zealand. They concluded that ‘the present established ranges are more widespread than previously documented and, with the exception of Himalayan tahr [*Hemitragus jemlahicus*], are all still being extended’. There has been no national-scale update of our knowledge of wild ungulate distribution ranges in the 20 years since Fraser et al.’s work. However, some recent local survey data and many anecdotal reports indicate substantial new populations have established and range expansions have occurred in recent years (e.g. Latham et al. 2012). Knowing where wild ungulates occur and how common they are is fundamental for managing the unwanted impacts that these animals can have on native biodiversity (e.g. Forsyth et al. 2010), their role in the transmission dynamics of some diseases (e.g. Nugent & Fraser 2005), and herds designated as being of special interest for hunting (Latham & Warburton 2014). It is therefore strongly suggested that up-to-date data are needed for these purposes.

In addition to ungulates, two species of wallabies, dama wallaby (*Macropus eugenii*) and Bennett’s wallaby (*M. rufogriseus*), occur on the New Zealand mainland (North Island and South Island, respectively). They can also have unwanted impacts on indigenous vegetation and, to a lesser extent, agriculture (Warburton 2005a, b). The distributions of Bennett’s wallabies were mapped in the South Canterbury area in 1916, 1956, and 1975 (Warburton & Sadleir 1990) and, in 2013–early 2014 (Warburton et al. 2014). The distribution of dama wallabies in the Bay of Plenty was assessed in 1994, 2000, and most recently in 2007 (Strickland 1994; D. Williams, Environment Bay of Plenty, pers. comm.). Although more recently updated than for wild ungulates, the revisions of wallaby distributions have not been exhaustive, so it seems appropriate to also include them in a nationwide update of knowledge about the distribution of large wild mammals.

Potential benefits or beneficiaries from such an update include:

- Evidence-based updating of regional pest-management plans (regional councils)
- Identifying new population threats posed by large wild mammals to native ecosystems (Department of Conservation (DOC) and community conservation groups)
- Managing bovine tuberculosis within long-lived hosts capable of long-distance dispersals (TBfree New Zealand)
- Assessing/managing threats from exotic diseases transmitted by wild mammals (Ministry for Primary Industries, lead biosecurity agency)

- Reducing production loss, disease risk and avoiding hunter management costs (forestry and agricultural industries)
- Delineating range boundaries and managing herds of special interest (hunting organisations).

This report identifies how such an update could be undertaken.

3 Objectives

- To determine the feasibility of updating knowledge about the distributions and relative abundances of large wild mammals in New Zealand, by expanding the methods used by Fraser et al. (2000) and by providing ideas for a publicly accessible, interactive website.

4 Defining a potential approach

I briefly review the methods used by Fraser et al. (2000) and then suggest a series of additions or refinements to their methods that would facilitate the creation of an updateable, interactive web-based approach.

4.1 Fraser et al. (2000) approach

Fraser et al.'s (2000) work provided a snapshot of the distributions and new populations of wild ungulates in the mid-1990s. They surveyed for information about 'new populations' from all DOC conservancies and regional or district councils, whereas only relevant DOC staff were asked about 'current species ranges' in each DOC conservancy. Species range areas (depicted as polygons) and point locations for new populations were then digitised using GIS, and the information was summarised in a peer-reviewed journal article. It was a relatively coarse-scale assessment, and it did not provide information about the relative abundance of these species within their ranges.

The simplest option for updating that research would replicate Fraser et al.'s (2000) approach and likewise produce a report or peer-reviewed journal article that updated the distributional work done in the mid-1990s. In addition to DOC and regional council biosecurity staff, information about large mammals could be expanded to include hunting groups, community conservation groups and other organisations/groups/individuals (but see Key considerations below). This replication of Fraser et al.'s method would be a lower cost option than creating an interactive website, as described under 4.2. However, distributional data would still need to be digitised to create the updated distributional maps, and this is one of the critical steps necessary for 4.2 below.

4.2 Updateable, interactive web-based approach

This approach is an extension of the Fraser et al. (2000) method. It would require collating and digitising the same data/information as above; however, rather than only summarising the work in a report or peer-reviewed journal article, it would make the information publicly available via a website. At its simplest, the website could be a static version that simply

reproduces coarse-resolution maps, but I consider that the utility of the information would be greatly enhanced by ‘building in’ a high level of interactivity, such as allowing website users to focus on certain species and, to ‘zoom into’ geographic regions of interest in order to assess distributions at a finer scale.

The methodology used in the *Atlas of Bird Distribution in New Zealand* (Robertson et al. 2007) may be a useful way of managing and presenting data. In this approach, a populatable grid system is overlaid on a GIS map of the country and each cell has a record in a table containing information about ‘presence/absence (or not detected or not reported)’ status for each species. In addition, a coarse measure of relative abundance (e.g. absent, occasional, low, moderate, or high) could be estimated and assigned to each grid cell. Entering and managing data on distribution and relative abundance using this type of approach would also provide a quantitative framework for routinely updating this type of information – noting that a grid-based system will also be cheaper and easier to update than having to re-digitise polygons.

5 Key considerations

5.1 Methodological issues

Where will data be sourced from and how will they be collected?

Fraser et al. (2000) collected data from DOC and regional councils to identify new populations of wild ungulates and estimate their distributions. Although these organisations are comparatively reliable sources, this approach excluded numerous other sources of data/information and, while alternative data will presumably be of more variable quality, some are likely to be of great value to this update. Should some organisations/individuals be preferentially contacted to provide data/information for this revision or should the net be cast more widely to include all those that are interested in contributing? In a similar vein, how will the information be collected – mail or telephone or online surveys, advertisements in appropriate magazines and newspapers, and so on – and will a consistent method be used for all organisations/groups/individuals, i.e. some sources will be forthcoming with information, whereas it may need to be solicited from others? Will users be able to upload records directly to a ‘data repository’ and, if so, what format will be best? Finally, once collected, how will records be vetted for accuracy and reliability?

How should data/information of variable quality be dealt with and weighted?

It is likely that available information will vary from empirical (or ancillary) data collected as part of DOC’s Tier 1 monitoring on public conservation land, to abundant observations reported by landowners/users of a particular species within a grid cell, to ‘unusual, one-off’ records of a species occurring within one or more grid cells outside (perhaps well outside) the recognised distribution for that species. While the first two sources provide comparatively robust information, the latter, if unable to be verified, does not. Despite this, unusual records outside of established ranges may provide useful

information about species' range extensions, if they can be objectively incorporated into the available 'records' (e.g. as 'possible' or 'probable' records).

What spatial resolution will be most appropriate?

Fraser et al. (2000) asked staff from each DOC conservancy to delineate the boundaries of the established ranges of wild ungulates within their areas on NZMS 242 series maps (1:500 000 scale). This 'rough' delineating of polygons for each species can be quite arbitrary, particularly if no natural boundaries such as rivers or mountain ranges exist to aid demarcation of the boundary of a species in a given area. An alternative and widely used approach is to populate grid cells overlaid on a map of New Zealand – particularly with the wealth of accurate locational information that may be available now that GPS units are widely used. Using this approach, each grid cell could be populated to depict presence/absence (not detected), as well as a coarse measure of relative abundance. The primary consideration associated with this method is what spatial resolution should be used for the grid system? For example, the *Atlas of Bird Distribution in New Zealand* used 10 × 10 km squares for the period 1999–2004 (Robertson et al. 2007); DOC's Tier 1 monitoring is based on 8 × 8 km squares; alternatively, it may be desirable to increase the spatial resolution to (for example) 5 × 5 km squares to provide more precise location information (although this may result in data more prone to bias, if uploaded records are not accurate).

How interactive should the website be and how should maps be depicted?

The website could be set up to have varying degrees of interactivity. For example, the site could allow users to select a species and zoom into the geographical location of interest. Additionally, users could 'click' the cursor onto a cell of interest to get details about what data/information was used to populate that particular cell and, potentially, to filter out unwanted records. Similar levels of complexity could be included in how maps are depicted/presented. Further, consideration will need to be given as to whether the data will be freely available for people to download onto their personal computers or whether they will only be able to interact with the site and search it for records on the Web. If it is made free to download, this may create problems relating to how accurately users project location data when it is downloaded, with a polygon-based system being more susceptible to this than a grid-based system. Finally, it is important to note that increasing levels of complexity are likely to be more costly (see 5.2 below).

5.2 Logistical/funding issues

How will a revision of wild mammal distribution be funded?

If this work proceeds, we (Landcare Research and Environment Southland) anticipate that it will be partially funded by an Envirolink large advice grant (which we anticipate applying for following the technical workshop discussed in Recommendations below), with some additional co-funding. The level of funding required will be dependent upon the preferred/chosen approach and levels of interactivity of the website, if the second

option is selected. Further, there will need to be agreement on and buy-in to a funding model for future revisions and database management, e.g. a consortium funding model.

Which organisation will host the website?

If an updateable, interactive web-based approach is chosen as the preferred option, the site is expected to receive regular visits. The number of visits may be influenced by which organisation hosts the site and how accessible and well-maintained it is.

6 Recommendations

- It is feasible to update wild ungulate distributions in New Zealand. In addition, I recommend including wallaby species located on both the North and South Island in this update. Consideration may also be given to including other species of wild mammals.
- Landcare Research (Dave Latham, Andrew Gormley, Cecilia Latham, Graham Nugent, and Bruce Warburton) should apply for another Envirolink small advice grant, led by Environment Southland, to further investigate updating knowledge of large wild mammal distribution and relative abundance in New Zealand.
- A small technical workshop should be convened (funded by the Envirolink small advice grant mentioned above) to determine which approach, data collection and weighting methods, and degree of interactivity will best suit the needs of stakeholders and end users.
- If an updateable, interactive web-based approach is chosen, the application for an Envirolink large advice grant should be agreed upon, additional co-funding/future funding requirements should be discussed, and a host organisation for the website should be agreed upon.

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