

# Science for Saving Species

## Research findings factsheet

### Project 3.1



National Environmental Science Programme

## Factsheet: A Threatened Mammal Index for Australia



### Research in brief

This project is developing a Threatened Species Index (TSX) for Australia which can assist policy-makers, conservation managers and the public to understand how some of the population trends across Australia's threatened species are changing over time. It will inform policy and investment decisions, and enable coherent and transparent reporting on relative changes in threatened species numbers at national, state and regional levels. Australia's TSX is based on the Living Planet Index ([www.livingplanetindex.org](http://www.livingplanetindex.org)), a method developed by World Wildlife Fund and the Zoological Society of London. The TSX has been designed to be a dynamic tool to which new monitoring data are added and examined annually.



### How can the index be used?

For the first time in Australia, an index has been developed that can provide reliable and rigorous measures of trends across Australia's threatened species, or at least a subset of them. In addition to communicating overall trends, the indices can be interrogated and the data downloaded via a web-app to allow trends for different taxonomic groups or regions to be explored and compared. So far, the index has been populated with data for some threatened and near-threatened birds and mammals, and monitoring data

for threatened plants are currently being assembled.

These indices will allow Australian governments, non-government organisations, stakeholders and the community to better understand and report on which groups of threatened species are in decline by bringing together monitoring data. It will potentially enable us to better understand the performance of high-level strategies and the return on investment in threatened species recovery, and inform our priorities for investment.

### A Threatened Species Index for mammals in Australia

Different taxonomic groups can be explored individually in the Threatened Species Index. Here, we present the national Threatened Mammal Index (TMX) for the first time (Figure 1A). In its first iteration, this index incorporates data from 57 threatened and near-threatened mammal taxa (Near Threatened, Vulnerable, Endangered or Critically Endangered under the EPBC Act and/or IUCN – see Table 1). This represents about 39% of Australia's threatened and near-threatened mammals (143 taxa, which counts both species and subspecies) and comprises 53 terrestrial (five volant and 48 non-volant) mammals, one bat, and four marine mammals (Table 1). We used information from the Australian Species

Profile and Threats Database and the international IUCN Red List as of July 2019 to make a decision about the currently listed taxa.

Data on these mammal taxa come from fixed sites where they have been repeatedly monitored in a systematic and standardised way. For some of the terrestrial sites, the data custodians provided information on whether they have been intensively managed and how. This information allowed us to look at the trend across all monitored sites, which is the overall Threatened Mammal Index (Figure 1), but also to drill down to look at the trends for:

1. Sites subject to any management (e.g., introduced predator-free havens/islands and other





## A Threatened Species Index for mammals in Australia (continued)

- dedicated conservation management) (Figure 2),
2. Sites without introduced predators (islands and fenced exclosures) (Figure 3), and
  3. Sites with no (known) targeted management (Figure 4).

The division of sites/populations has been made solely on information provided by the custodians. This separation into subindices based on the type of intensive management is important especially for mammals monitored after being reintroduced into fenced or predator-free island areas. These areas are often more intensively monitored than extant populations, have fewer threats, and have the potential to significantly bias the population trends in the overall

index. The reintroduced population trends may skew the overall result for a taxon and show the population as stable or increasing while in fact the extant population outside of the predator-free safe havens continues to decline, and thus need to be examined carefully.

The index itself shows the estimated yearly change in relative abundance of threatened and near-threatened mammal taxa in relation to a baseline year, for which 1995 was chosen, where the index is set to 1.0. This baseline year was chosen because very few of the ongoing monitoring programs originated before 1995. However, later baseline years are also available to support the specific needs of conservation managers and can be selected via the web-app.

Changes in the index are proportional – a value of 0.5 indicates the multi-taxon relative abundance is 50% below the baseline value; a value of 1.5 indicates 50% above baseline.

For the index on all sites where Australian threatened and near-threatened mammals were monitored, the TMX value in 2016 based on the current data is 0.62. This suggests that the relative abundance of threatened and near-threatened mammals for which we have information has decreased by 38% between 1995 and 2016. While the overall index value in 2016 is 0.62, individual taxa have TMX values between 0.34 (a 66% decrease) and 1.08 (a 8% increase) (Figure 1A). It is expected that more data (and taxa) will be added as they become available each year, allowing the index to grow.

## What should we know about the data?

This overall index on all monitored sites is based on 1186 time series (defined as sites where data on a taxon are recorded using the same methodology and a consistent monitoring effort though time) across these 57 taxa. Data quality was maximised by: 1) checking whether each dataset had been produced by standardised monitoring; and 2) by sending surveys on 127 eligible datasets to custodians and requesting them to assess the trends produced for their datasets. Feedback was received for 74% of the datasets. Only time series that had been produced by standardised monitoring and with a minimum length of two years, collected between 1995 and 2016 inclusive, were used for index calculation. Sub-trends of the overall trend (e.g., for marine mammals) can be calculated if data on at least three taxa are available.

The data underlying the national index mostly derive from monitoring programs in eastern Queensland, southern Victoria, coastal and inland South Australia, Western Australia,

and the northern part of the Northern Territory, but there is little or no representation yet of monitoring data from New South Wales and the Australian Capital Territory. There are limited taxon datasets for Tasmania and the arid zone (Figure 1B). The number of sites monitored that met the TMX criteria (Figure 1C) has substantially increased since around 1995, while the number of taxa monitored increased from 17 in 1995 to 50 in 2013 (Figure 1D). In combination, this has resulted in a large increase in the time series available: from 353 in 1995 to 806 in 2013.

The index containing data on sites that were subject to any management such as introduced predator-free havens/islands and other dedicated conservation management (i.e., sustained predator baiting and ecological fire management) has 155 time series with data on 29 mammal taxa. This index has a 2016 value of 1.46, which corresponds to an increase of 46% between 1995 and 2016 (Figure 2).

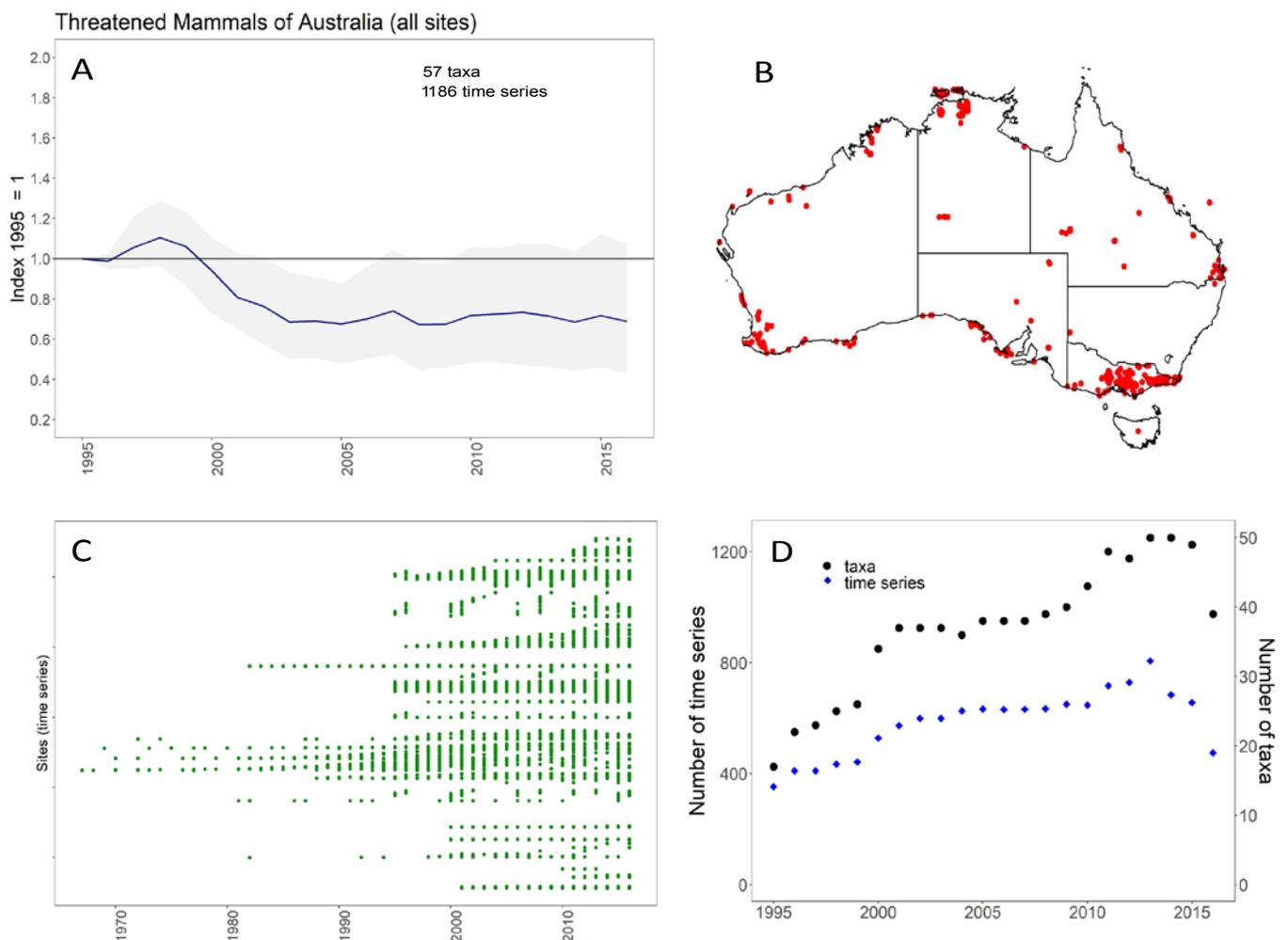
The index that includes only island and other predator-free sites is based on 23 time series and 15 mammal taxa. With a TMX value of 6.00, it shows an average increase of 500% between 2000 and 2016 (Figure 3).

The index corresponding to sites with no (known) targeted management contains the majority of data on sites and taxa. This index is based on 1031 time series and 32 mammal taxa. The TMX value in 2016 is 0.40 which indicates a 60% decrease on average in relative mammal abundance between 1995 and 2016 (Figure 4).

As more high-quality data become available they can be added, making the index more powerful, meaningful and representative. Increasing the number of taxa, regions and functional groups monitored would strengthen the value of the index. Ongoing long-term monitoring programs allow for continuing capability to track changes in the relative abundance of threatened and near-threatened mammal taxa.

## Interpretational issues and constraints

- This composite index only includes data for threatened and near-threatened mammal taxa provided by the custodians endeavouring to meet the TMX criteria supplied. Inspection of these data indicate they are biased to the coastal areas of most states and are sparse for the arid zone. The index can be useful for also identifying strategic monitoring opportunities to increase the comprehensiveness of representation of threatened and near-threatened mammal taxa (see Table 1).
- There were limited appropriate monitoring data for remote areas available for inclusion in the index to 2016.
- Some mammal subgroups, such as bats and rodents, are still underrepresented.
- The proportional representation of threatened and near-threatened mammal taxa, and spatial coverage, is low in comparison to data on threatened and near-threatened birds. (Threatened Bird Index).

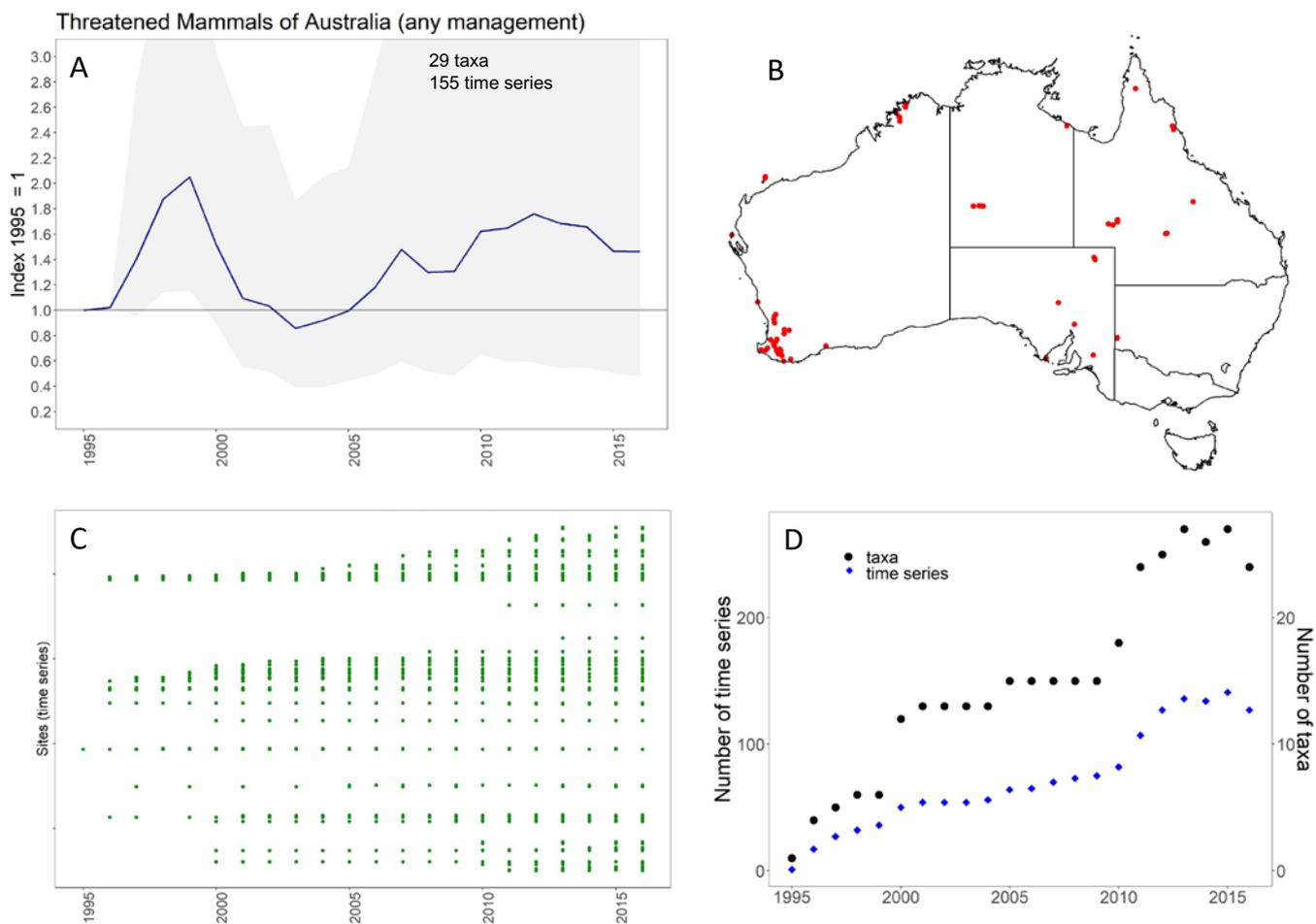


**Figure 1:** A) The Threatened Mammal Index (TMX) including data from all sites where threatened and near-threatened mammal taxa were provided. The blue line shows the change in mammal abundance relative to the baseline year of 1995, where the index is set to 1.0. The grey cloud shows the range of trends for the individual taxa that make up the overall multi-taxon index. It can be seen as the variability between single-taxon trends that contribute to the composite (i.e., it is not statistical confidence).

B) A map showing where threatened and near-threatened mammal data were recorded in Australia. The red dots indicate repeatedly monitored fixed sites.

C) This dot plot shows the particular years for which monitoring data were available to compile the index. Each row represents a time series where a taxon was monitored with a consistent method at a single site.

D) The number of taxa (in black circles) and number of time series (in blue diamonds) used to calculate the index for each year.



**Figure 2:** A) The Threatened Mammal Index (TMX), based only on data from managed sites (introduced predator-free havens/islands and other dedicated conservation management).

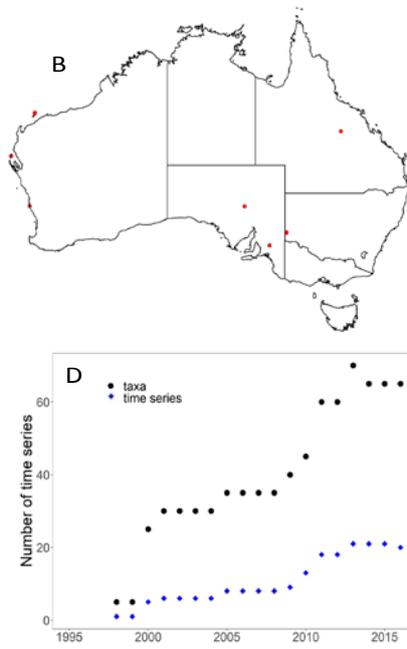
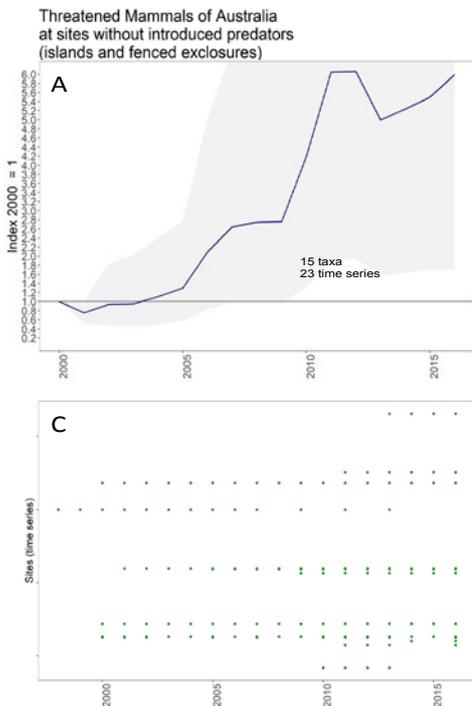
B) A map showing where threatened and near-threatened mammal data on sites subject to any conservation management were recorded.

C) This dot plot shows the particular years for which monitoring data were available to compile the index. Each row represents a time series where a taxon was monitored with a consistent method at a single site.

D) The number of taxa (in black circles) and number of time series (in blue diamonds) used to calculate the index for each year.

Australian sea lion. Image: Peter Southwood Wikimedia Commons CC BY-SA 3.0



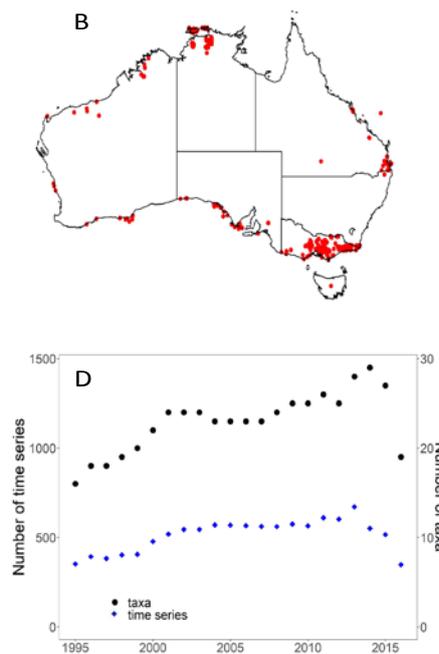
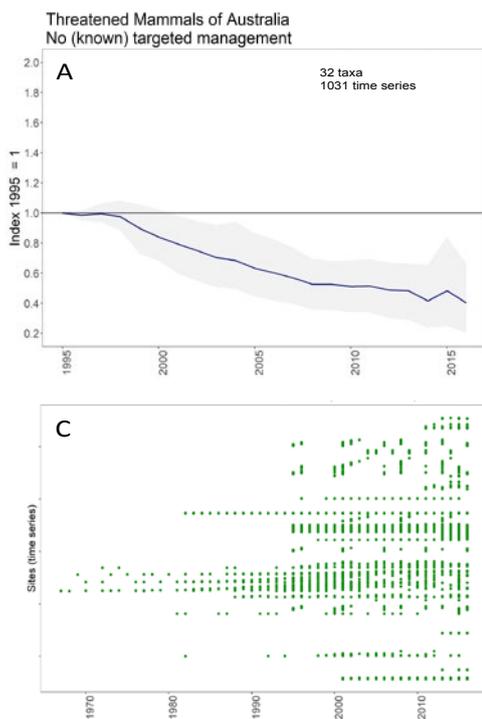


**Figure 3:** A) The subindex of the Threatened Mammal Index (TMX) that includes only data from feral predator-free islands and fenced sites. Note that where one of these species also occurs elsewhere, data from those sites (which are not feral predator-free) is not included in this subindex.

B) A map showing where threatened and near-threatened mammal data on island and other predator-free sites were recorded.

C) This dot plot shows the particular years for which monitoring data were available to compile the index. Each row represents a time series where a taxon was monitored with a consistent method at a single site.

D) The number of taxa (in black circles) and number of time series (in blue diamonds) used to calculate the index for each year.



**Figure 4:** A) The subindex of the Threatened Mammal Index (TMX) that includes monitoring data on sites without targeted management of threatened and near-threatened mammal taxa or for which no information on management was provided by the custodians.

B) A map showing where threatened and near-threatened mammal data with no (known) targeted management were recorded.

C) This dot plot shows the particular years for which monitoring data were available to compile the index. Each row represents a time series where a taxon was monitored with a consistent method at a single site.

D) The number of taxa (in black circles) and number of time series (in blue diamonds) used to calculate the index for each year.

**Table 1: Data on threatened and near-threatened mammal taxa included in the overall TMX for Australia.**

Times-series length (mean ± SD): 12.0 ± 7.9  
 Number of samples (year) per time series (mean ± SD): 6.5 ± 6.6  
 Number of data sources in index: 58  
 Number of data taxa in index: 57

Taxon common name	Taxon scientific name	Functional Group	IUCN Status	EPBC Status	# data sources	# time series	Mean time-series length
Arnhem rock-rat	<i>Zyomys maini</i>	Terrestrial:50-5000g	Vulnerable	Vulnerable	1	15	11.5
Australian sea-lion	<i>Neophoca cinerea</i>	Marine:>5000g	Endangered	Vulnerable	2	31	16.4
Banded hare-wallaby	<i>Lagostrophus fasciatus</i>	Terrestrial:50-5000g	Endangered		1	1	6.0
Bilby	<i>Macrotis lagotis</i>	Terrestrial:50-5000g	Vulnerable	Vulnerable	5	11	5.3
Black-flanked rock-wallaby	<i>Petrogale lateralis lateralis</i>	Terrestrial:50-5000g	Vulnerable	Endangered	1	1	4.0
Black-footed rock-wallaby	<i>Petrogale lateralis</i>	Terrestrial:50-5000g	Vulnerable		1	7	2.0
Black-footed tree-rat (Kimberley and mainland Northern Territory)	<i>Mesembriomys gouldii gouldii</i>	Terrestrial:Arboreal:50-5000g	Vulnerable	Endangered	1	20	16.8
Black-footed tree-rat (Melville Island)	<i>Mesembriomys gouldii melvillensis</i>	Terrestrial:Arboreal:50-5000g	Vulnerable	Vulnerable	1	40	16.0
Black-footed tree-rat (north Queensland)	<i>Mesembriomys gouldii rattooides</i>	Terrestrial:Arboreal:50-5000g	Vulnerable	Vulnerable	2	2	7.0
Black-tailed antechinus	<i>Antechinus arktos</i>	Terrestrial:50-5000g		Endangered	1	2	2.0
Boodie	<i>Bettongia lesueur</i>	Terrestrial:50-5000g	Near Threatened	Vulnerable	1	1	17.0
Boodie (Barrow Island)	<i>Bettongia lesueur (Barrow and Boodie Islands)</i>	Terrestrial:50-5000g	Near Threatened	Vulnerable	1	1	4.0
Boodie (Shark Bay)	<i>Bettongia lesueur lesueur</i>	Terrestrial:50-5000g	Near Threatened	Vulnerable	2	2	5.0
Bridled nailtail wallaby	<i>Onychogalea fraenata</i>	Terrestrial:50-5000g	Endangered	Endangered	2	2	14.5
Brush-tailed phascogale	<i>Phascogale tapoatafa</i>	Terrestrial:Arboreal:50-5000g	Near Threatened		1	73	7.8
Brush-tailed rabbit-rat	<i>Conilurus penicillatus</i>	Terrestrial:50-5000g	Vulnerable	Vulnerable	2	22	9.5
Brush-tailed rabbit-rat (Kimberley, Top End)	<i>Conilurus penicillatus penicillatus</i>	Terrestrial:50-5000g	Vulnerable		1	10	5.6
Brush-tailed rabbit-rat (Tiwi Islands) Carpentarian	<i>Conilurus penicillatus melbius</i>	Terrestrial:50-5000g	Vulnerable		1	18	16.0
Antechinus	<i>Pseudantechinus mimulus</i>	Terrestrial:<50g	Endangered		1	1	4.0
Christmas Island flying-fox	<i>Pteropus natalis</i>	Terrestrial:Volant:50-5000g		Critically Endangered	1	99	4.0
Chuditch, western quoll	<i>Dasyurus geoffroii</i>	Terrestrial:50-5000g	Near Threatened	Vulnerable	2	29	16.9
Dibbler	<i>Parantechinus apicalis</i>	Terrestrial:50-5000g	Endangered	Endangered	1	2	12.0
Eastern barred bandicoot	<i>Perameles gunnii</i>	Terrestrial:50-5000g	Near Threatened		1	4	12.3
Fawn antechinus	<i>Antechinus bellus</i>	Terrestrial:<50g	Vulnerable	Vulnerable	1	23	16.1
Golden bandicoot (Barrow Island)	<i>Isodon auratus barrowensis</i>	Terrestrial:50-5000g	Vulnerable	Vulnerable	1	1	4.0
Golden bandicoot (mainland)	<i>Isodon auratus auratus</i>	Terrestrial:50-5000g	Vulnerable	Vulnerable	1	20	4.8
Greater slick-nest rat	<i>Leporillus conditor</i>	Terrestrial:50-5000g	Near Threatened	Vulnerable	1	1	17.0
Hastings River mouse	<i>Pseudomys oralis</i>	Terrestrial:50-5000g	Vulnerable	Endangered	1	2	15.0
Humpback whale	<i>Megaptera novaeangliae</i>	Marine:>5000g	Least Concern	Vulnerable	2	2	22.0
Kakadu pebble-mouse	<i>Pseudomys calabyi</i>	Terrestrial:<50g	Vulnerable		1	11	17.6
Koala (combined populations of Qld, NSW and the ACT)	<i>Phascolarctos cinereus</i>	Terrestrial:Arboreal:>5000g	Vulnerable	Vulnerable	3	59	14.9
Kowari	<i>Dasyuroides byrnei</i>	Terrestrial:50-5000g	Vulnerable	Vulnerable	2	6	8.5
Large-eared pied bat	<i>Chalinolobus dwyeri</i>	Terrestrial:Volant:<50g	Near Threatened	Vulnerable	1	1	20.0
Leadbeater's possum	<i>Gymnobelideus leadbeateri</i>	Terrestrial:Arboreal:50-5000g	Critically Endangered	Critically Endangered	1	19	15.8
Long-nosed potoroo	<i>Potorous tridactylus</i>	Terrestrial:50-5000g	Near Threatened		1	36	8.0
north-eastern New South Wales	<i>Potorous tridactylus tridactylus</i>	Terrestrial:50-5000g	Near Threatened	Vulnerable	1	1	17.0
Mala	<i>Lagorchestes hirsutus (Central Australia)</i>	Terrestrial:50-5000g	Vulnerable	Endangered	1	1	3.0
Mountain pygmy-possum	<i>Burramys parvus</i>	Terrestrial:<50g	Critically Endangered	Endangered	1	2	35.0
Northern hairy-nosed wombat	<i>Lasiorhinus krefftii</i>	Terrestrial:5000g	Critically Endangered	Critically Endangered	1	1	17.0
Northern quoll	<i>Dasyurus hallucatus</i>	Terrestrial:50-5000g	Endangered	Endangered	4	91	10.8
Numbat	<i>Myrmecobius fasciatus</i>	Terrestrial:50-5000g	Endangered	Endangered	3	4	8.8
Plains mouse	<i>Pseudomys australis</i>	Terrestrial:<50g	Vulnerable	Vulnerable	1	1	16.0
Rufous hare-wallaby (Shark Bay)	<i>Lagorchestes hirsutus bernieri</i>	Terrestrial:50-5000g	Vulnerable	Vulnerable	1	1	6.0
Silver-headed antechinus	<i>Antechinus argentus</i>	Terrestrial:<50g		Endangered	1	2	3.0
Southern brown bandicoot (south-eastern Australia)	<i>Isodon obesulus obesulus</i>	Terrestrial:50-5000g		Endangered	1	13	10.2
Southern elephant seal	<i>Mirounga leonina</i>	Marine:>5000g	Least Concern	Vulnerable	1	1	29.0
Southern greater glider	<i>Petauroides volans</i>	Terrestrial:Volant:50-5000g	Least Concern	Vulnerable	1	137	12.5
Subantarctic fur seal	<i>Arctocephalus tropicalis</i>	Marine:>5000g	Least Concern	Endangered	1	1	26.0
Tasmanian devil	<i>Sarcophilus harrisii</i>	Terrestrial:5000g	Endangered	Endangered	1	127	22.0
Water mouse	<i>Xeromyz myoides</i>	Terrestrial:<50g	Vulnerable	Vulnerable	2	5	4.0
Western barred bandicoot	<i>Perameles bougainville</i>	Terrestrial:50-5000g	Vulnerable		2	2	11.0
Western ringtail possum	<i>Pseudocheirus occidentalis</i>	Terrestrial:Arboreal:50-5000g	Vulnerable	Critically Endangered	1	1	22.0
Woylie	<i>Bettongia penicillata</i>	Terrestrial:50-5000g	Critically Endangered	Endangered	4	101	6.9
Yellow-bellied glider	<i>Petaurus australis</i>	Terrestrial:Volant:50-5000g	Near Threatened		2	116	12.5
Yellow-bellied glider (Wet Tropics)	<i>Petaurus australis (Wet Tropics)</i>	Terrestrial:Volant:50-5000g	Near Threatened	Vulnerable	1	1	19.0
Yellow-footed rock-wallaby (central-western Queensland)	<i>Petrogale xanthopus celeris</i>	Terrestrial:>5000g	Near Threatened	Vulnerable	1	1	12.0
Yellow-footed rock-wallaby (South Australia, New South Wales)	<i>Petrogale xanthopus xanthopus</i>	Terrestrial:>5000g	Near Threatened	Vulnerable	1	1	7.0

## Further Information

For more information or to become a *Friend of the Index* and receive updates on the progress of the project please contact the TSX Team at [tsx@uq.edu.au](mailto:tsx@uq.edu.au)

The data underpinning the index were contributed by many different individuals and organisations, including Commonwealth, state and territory agencies, research institutions and environmental non-government organisations (e.g., Australian Wildlife Conservancy and Arid Recovery) and consultants. Visit this web page for more information: [tsx.org.au](http://tsx.org.au) Go to the web-app to access and explore the data behind the TMX and to produce reports tailored to your particular needs.

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