

Saving species on Australian islands: A national database of threatened species on Australian islands

In brief

Australia has a wealth of islands (> 9200), many of which support unique, endemic and threatened flora and fauna. The islands occur across vast latitudes and jurisdictions, making coordinated management challenging. To effectively target conservation management across islands, it is important to have a reliable source of data documenting islands that host threatened species. To address this need, we created the first national database of threatened species on Australian islands. We compiled new and existing data into three interlinked tables, which are called the Island Occurrences of Threatened Australian Species (IOTAS), All Threatened Species, and Islands tables. The database covers multiple taxonomic groups. We also combined and edited four recent invasive species datasets to form the first combined database of weed and vertebrate pest species records on Australian islands. This latter database is under development and has incomplete records, but can provide preliminary insight into potential impacts on native species, such as threats from feral predators.

The data suggests that Australia's islands hold multiple threatened species across a range of taxa.

It includes 281 threatened species, occurring across 317 islands. Some of the species (8.8%) occur only on islands, especially plants and birds. Norfolk Island has the highest number of threatened species (55, mostly plants) of all Australian islands. The new database we created is accompanied by a How-to-use manual and video. This database can be used to

inform policy development, target management actions, identify knowledge gaps, as well as support the prioritisation of conservation actions for species on Australian islands. The database can help provide guidance on allocation of management resources within and across islands for threatened and invasive species and can help guide conservation actions.



Maria Island. Image: Drew Lee



Background

Islands are havens for biodiversity, and many islands support ecosystems and species found nowhere else on Earth. However, factors such as isolation, restricted area and high levels of endemism, can also result in greater risk of species vulnerability. Globally, most species extinctions have occurred on islands, and Australia's islands are no exception. To inform island conservation across multiple islands, we need data on the conservation status of island species.

Australia has thousands of islands ranging from small to large, tropical to sub-Antarctic and off-shore to near-shore. With so many islands that range in species diversity, size, distance to the mainland, latitude and human impact, Australian policy makers and planners need a sound evidence-base to help prioritise conservation actions across multiple species and islands. To help effectively target conservation management across Australia's islands we set about creating the first database of threatened species on Australian islands.

Aims

Firstly, we aimed to develop a first national database of threatened fauna and flora for Australian islands and analyse this data to identify islands which could be a priority for management with high

conservation return. Furthermore, we aimed to amalgamate the island database with databases on invasive species and threats on islands to gain greater insights into impacts on threatened species.

Building the threatened species on islands database

In this project, we collated, verified, and assessed data on threatened terrestrial plants and animals (invertebrates, freshwater fish, frogs, reptiles, birds and mammals) on Australian islands and also combined existing and new data on invasive vertebrate species across all Australian islands.

We compiled data on species listed as threatened by either the IUCN Red List and/or the Australian Environmental Protection and Biodiversity Conservation (EPBC) Act. This included terrestrial flora and fauna.

For species whose distributions includes Australian islands, we compiled data on their past and present island occurrence using the primary and grey literature and expert knowledge. This work was done in conjunction with Charles Darwin University. Where possible, we verified species distributions with local and regional experts from state environment departments, researchers and various regional conservation and management bodies across Australian states and territories.



Lord Howe Island. Image: S. Kark



The IOTAS database (Island Occurrences of Threatened Australian Species)

The database of threatened species on Australian islands that we created consists of three interlinked tables. The main table is the Island Occurrences of Threatened Australian Species table, which records the current and past island population status for each species.

The *Islands* table contains geographic information on 9,285 Australian offshore islands. This data was obtained from a spatial database provided by the Australian Department of Agriculture, Water and the Environment under a Creative Commons attribution (Commonwealth of Australia 2015). We included six additional island records where threatened species records exist and added other extra information that we found during compilation and checking of the database.

The *All Threatened Species* table contains threat listings and basic taxonomic and distributional information on 2,428 Australian species and subspecies listed as threatened (Vulnerable, Endangered or Critically Endangered) under either the IUCN's Red List or the Australian Environmental Protection and Biodiversity Conservation Act; as of January 2019. Some more mobile species groups such as pinnipeds, turtles and shorebirds are excluded from the dataset.

The *Island Occurrences of Threatened Australian Species* table contains 1,260 records of occurrences of threatened species and subspecies on Australian islands. Also included are known absences, including local extinctions and failed

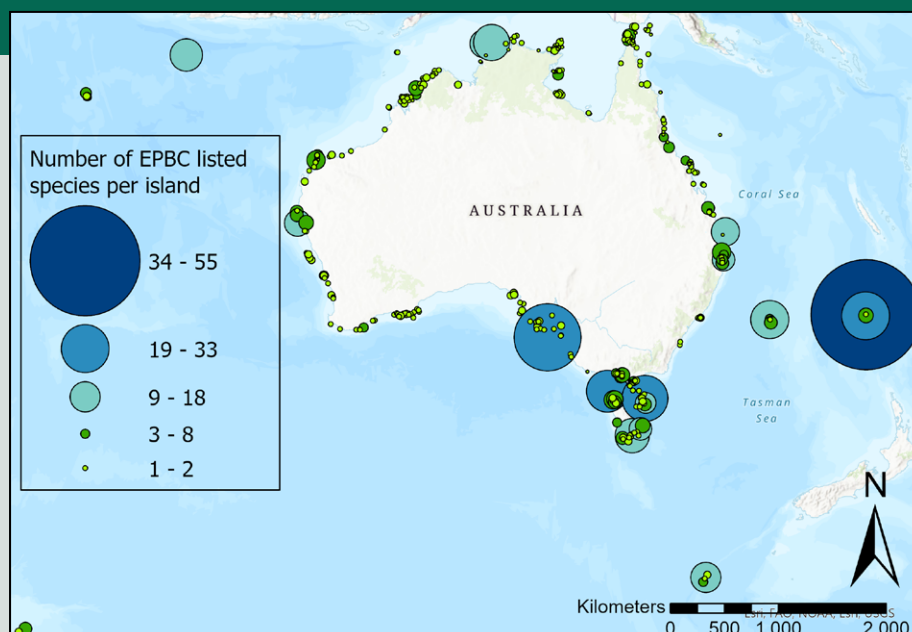


Figure 1: The number of species listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999 per island in Australia.

Table 1: The Australian islands with the largest number of threatened species (listed under the EPBC Act) and the state or territory in which they occur.

Rank	Island	Jurisdiction	Number of threatened species
1	Norfolk	Commonwealth	55
2	Kangaroo	South Australia	27
3	Phillip (Norfolk Island group)	Commonwealth	22
4	Flinders	Tasmania	19
5	King	Tasmania	18
6	Melville	Northern Territory	17
7 (equal)	Bruny	Tasmania	15
7 (equal)	Lord Howe	New South Wales	15
9	Macquarie	Tasmania	14
10 (equal)	Bathurst	Northern Territory	13
10 (equal)	Fraser	Queensland	13

(re)introductions. The number of threatened species per island across Australia's islands can be seen on the map in Figure 1.

There are 281 species in our database listed as threatened under the EPBC Act. These occur over 317 Australian islands. Over a third of these species are plants (122 plant species across 186 islands). Almost 9% of threatened species occur only on islands, with these species dominated by plants and birds.

Islands with threatened species present tend to have only have one threatened species, although some islands support many threatened species but there are records of one island having over 50 threatened species, which was the case for Norfolk Island (See Table 1). Most threatened species (87%) occurred on island locations with some conservation tenure, with ~40% occurring within conservation reserves and ~20% on land managed by Traditional Owners.

Implications and recommendations

The new combined islands databases can be used for research, management, to inform policy development, as well as prioritise conservation actions for species on islands. Spatial analysis of the data can identify large scale threat patterns and patterns of threatened species declines across Australia's islands and help examine the processes shaping these patterns. The database can be used to identify island hotspots and refuges for endemic and threatened species, and the richness of threatened species, particularly on invaded islands, amongst a range of other potential uses.

The data can provide guidance on allocation of management

resources within and across Australian islands for both threatened and invasive species. For example, it can help identify priority islands for management where there is the potential for higher conservation return due to the presence of multiple threatened species that have similar threats. The data could also aid decisions such as where and when to invest in on-ground island management activities and identify opportunities for potential species reintroductions or translocations to islands.

We are currently adding spatial data to the information on threats and information on heritage status of Australian islands (e.g., World

Heritage sites). In the long term we aim to include information on threats to island flora and fauna including human factors, environmental factors, and land cover types and land cover change with time. We would also like the database to include information on management actions, and their costs and effects so that detailed prioritisation analyses can be undertaken.

The database was launched in October 2021 and is available from the following web page <https://karkgroup.org/index/our-projects/australian-islands/>. The Biodiversity Research Group webpage also contains links to a video outlining how to use the database.

Invasive species on Australian islands database

We combined and edited four invasive species datasets created by the Department of Agriculture, Water and Environment and by NESP colleagues to form a collated database of weed and vertebrate pest species records on Australian islands (See figures 2 and 3). This allowed us to cross-reference islands with threatened species against those with and without invasive species, to gain insights into avenues for conservation prioritisation across islands. The different datasets vary in their quality and coverage, and even after data amalgamation and reconciliation there remain numerous gaps in the data. At this stage results from analyses should be interpreted with caution. The invasive species on islands database contains 8037 individual records with thirteen descriptive fields for each record. We have records for 6280 occurrences of invasive species on offshore Australian islands which comprises of 742 different

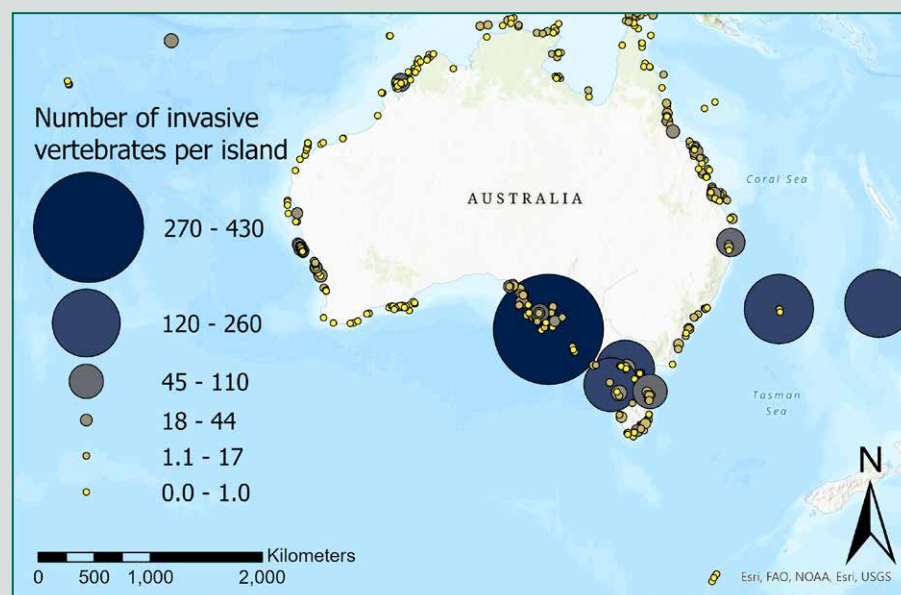


Figure 2: The number of weeds on each Australian island.

invasive species across 1292 islands. These were predominately plants, mammals, and birds.

To obtain greater insight into the threats faced by species on Australian islands we combined the database of threatened species on Australian islands with invasive

species on islands. We found that threatened species also occur on 185 of the invaded islands.

We also integrated species-specific threat information for threatened species which was collated in another NESP Threatened Species Recovery hub project (Project 7.7;



Invasive species on Australian islands database (continued)

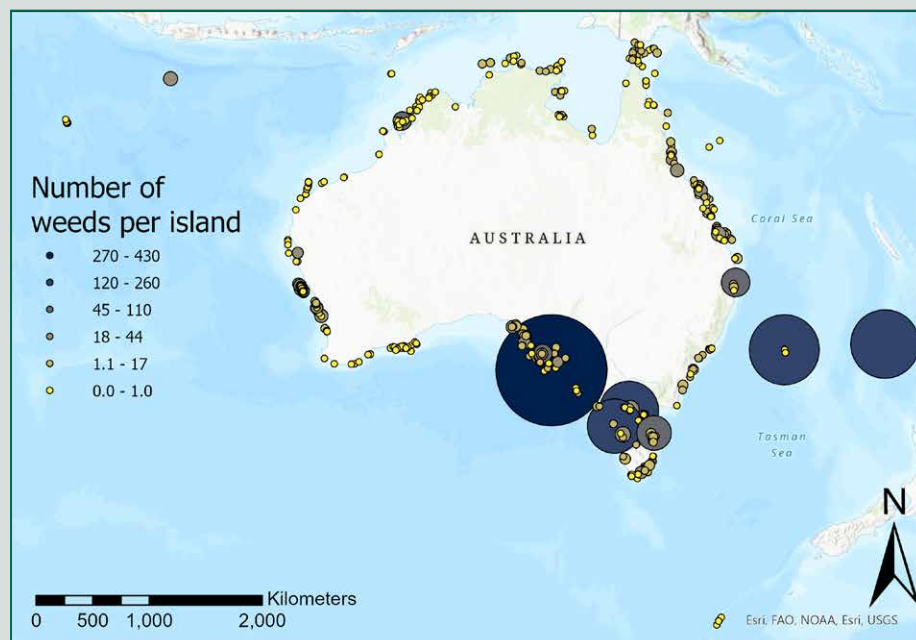


Figure 3: The number of invasive vertebrate species on each Australian island.

Table 2: The Australian islands which have no invasive species present and have threatened species present according to the databases.

	Island	Jurisdiction	Number of threatened species
1	Barrow Island	Western Australia	8
2	Augustus Island	Western Australia	6
3	Bernier Island	Western Australia	5
4	Dorre Island	Western Australia	5
5	Ball's Pyramid	New South Wales	5
6	Nepean Island	Commonwealth	5
7	Heard Island	Commonwealth	5
8	Storr Island	Western Australia	3
9	Bald Island	Western Australia	3
10	Hidden Island	Western Australia	3
11	Trimouille Island	Western Australia	3
12	Blackburn Island	New South Wales	3
13	North Keeling Island	Commonwealth	3
14	Bishop and Clerk Islands (North)	Tasmania	3
15	Pedra Branca	Tasmania	2
16	Boongaree Island	Western Australia	2
17	Adolphus Island	Western Australia	2
18	Lachlan Island	Western Australia	2
19	Molema Island	Western Australia	2
20	Chambers Island	Western Australia	2
21	Dolphin Island	Western Australia	2
22	Mondrain Island	Western Australia	2
23	Workhouse Islet	Commonwealth	2
24	McDonald Island	Commonwealth	2
25	Judge And Clerk Islands (North)	Tasmania	2

Ward et al. 2021). We trialled cross-referencing the three datasets to identify threats from co-occurring invasive alien species to threatened species, to summarise how many invasive species are likely to impact a threatened species and to determine which islands have multiple threatened species impacted by an invasive species group (e.g., bird, cats, rodents). This information can be used to help target management interventions, such as invasive species control interventions that may operate more efficiently or successfully at a higher level (e.g., predator proof fencing or general weed control programs). It can also be used to identify safe havens for conservation and other priority islands for conservation actions, for example islands that have multiple threatened species but no introduced (and/or invasive) species, such as the example shown in Table 2.

The databases reflect data collated and verified up to 2020 based on a range of verifiable sources. It is as complete as possible, yet we are aware that there may be missing information and there will be a need to update the database over time. This is especially true for the invasive species database, where substantial updates are necessary. The data for each of the islands has been collected and reported at different points in time due to the fact that many islands are not monitored regularly. We believe it is important to increase field work, research and data collection on Australian islands to support conservation and management decisions on Australian islands and to examine the impacts of factors such as climate change, fire and human activity on islands.

Acknowledgements

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Cited material

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Forest on Norfolk Island. Image: Leah Dann



Database Custodians

The Biodiversity Research Group,
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