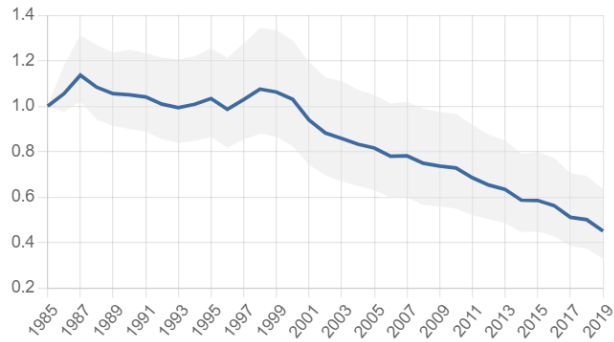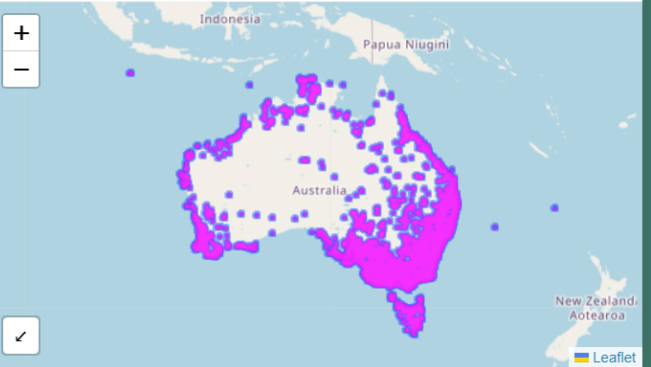# TSX | Threatened Species Index

Australia's Threatened Species Index

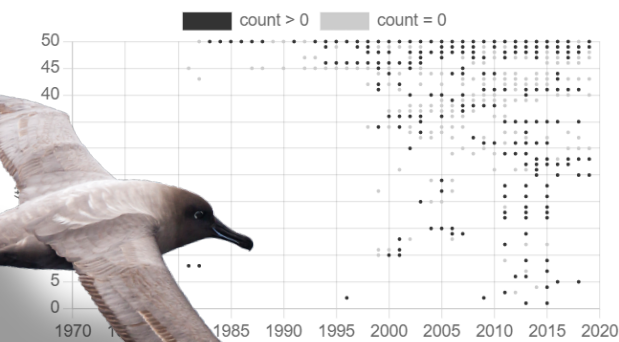## *Manual for data providers and users*

tern Ecosystem Research Infrastructure

NCRIS National Research Infrastructure for Australia An Australian Government Initiative

Australian Government
Department of Climate Change, Energy, the Environment and Water
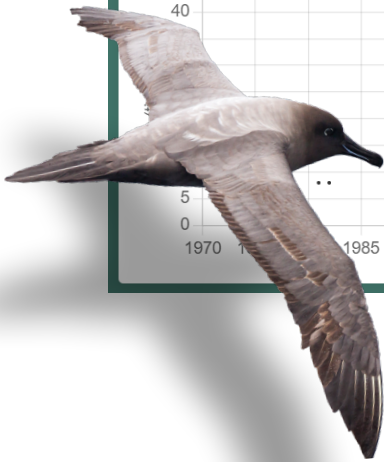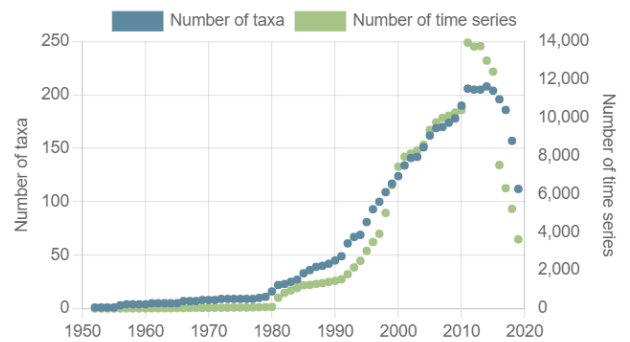
PURPOSE OF THIS MANUAL

Australia's Threatened Species Index (TSX) provides reliable and robust measures of change in the relative abundance of Australia's threatened and near-threatened species.

This manual introduces readers to the TSX, providing a brief history of its creation and a description of how it works. Importantly, readers will learn how to contribute data to the TSX and how to use the TSX to understand how species trends are calculated.

This manual is intended to be a practical guide to contributing to and using the TSX. We hope that this manual will make the TSX more accessible, ensuring the index fulfills its aim of informing and improving the management of Australia's threatened and near-threatened species.

VIDEO TUTORIALS

A series of online video tutorials have been prepared to accompany this manual. The table below provides a summary of the video tutorials, including the length of each video and the links to each. Links to each video are also provided in the relevant sections.

A summary of the ten online video tutorials that accompany this manual.

TOPIC		SUB-TOPIC	DURATION
DATA IMPORT TEMPLATE	1	Source columns	04:05
	2	Survey columns	05:39
	3	Sighting columns	04:13
	4	Getting your data into the template format	15:18
DATA MANAGEMENT INTERFACE	5	Creating a new dataset & uploading data	04:55
	6	Identifying & fixing errors in your data file	03:08
	7	Uploading new data to an existing dataset	06:38
	8	Dataset filtering & downloads for custodians	08:46
	9	Downloads page for program managers	09:08
TRENDS VISUALISER TOOL	10	Generating & interpreting abundance trends	06:11

SUPPORT

TSX contributors and users requiring further support are encouraged to reach out to the TSX team at the Terrestrial Ecosystem Research Network, University of Queensland.

TSX General Enquiries: tsx@tern.org.au

FURTHER RESOURCES

This manual is intended to be a stand-alone guide to Australia's Threatened Species Index. However, the following additional resources may assist you in using or contributing to the TSX.

1. The TSX website 🔗

2. Key TSX publications:

    Bayraktarov, E. et al. (2021). A threatened species index for Australian birds. 🔗 Conservation Science and Practice 2021;3:e322.

    Tulloch, A. et al. (2023) Effects of different management strategies on long-term trends of Australian threatened and near-threatened 🔗 mammals. Conservation Biology 2023;2:e14032.

3. The Living Planet Index Technical Report 🔗

ACKNOWLEDGEMENTS

Numbat (Endangered)
Image: Shutterstock

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KEY DEFINITIONS

The TSX is created based on multiple time series of population abundance (or a proxy of abundance), brought together to reveal changes in threatened species abundances over time. To interpret the results of the TSX correctly, refer to the following definitions of some commonly used terms.

Species: a group of living organisms consisting of morphologically similar individuals capable of exchanging genes and producing fertile offspring. The species is the principal natural taxonomic unit, ranking below a genus and denoted by a Latin binomial — for example, Leipoa ocellata, the Malleefowl.

Population: a group of organisms that belong to the same species, living in a distinct area of habitat at a certain time. There can be multiple populations of one species, based on the size of their range and distribution of their habitat. For example, Malleefowl that occur in New South Wales belong to different populations than Malleefowl occurring in Western Australia.

Abundance: abundance is the number of individuals counted per survey site. For example, three Malleefowl within a fragment of habitat. Counting the number of individuals of a species at a given study site gives a relative representation of a species' local population size.

Proxy of abundance: a proxy is a parameter, metric or rate that is assumed to be strongly correlated with abundance. For example, counts of nests instead of the birds, or counts of scats instead of the mammal itself. Detection or reporting rate (number of detections divided by the number of surveys or recordings) is an important proxy used in the TSX.

Relative abundance: relative abundance refers to the rate at which populations are changing over time. Some of these populations may contain many individuals, some very few, but it is the relative change that we are trying to measure, rather than the total change in absolute numbers of individuals.

Confidence intervals: these are calculated each time an index value is produced. A technique called 'bootstrapping' is used to resample the trends in each index and produce an upper and lower estimate of the index calculation. This illustrates the amount of variation in the underlying trends: wider confidence intervals represent more variation.

The above definitions are largely borrowed from the Living Planet Index (LPI) documentation. You can read more about the LPI in Section 5.2.3. and in the 'Further reading' section at the end of this document.

Match-stick Banksia (Endangered)
Image: Shutterstock

CHAPTER 1
THE THREATENED SPECIES INDEX (TSX)

1.1. WHAT IS THE TSX?

1.1.1. PURPOSE AND OBJECTIVES

Understanding changes in the abundance of Australia's threatened species is fundamental to conserving the continent's biodiversity. Without estimates of population change, it is impossible to gauge the success of conservation policies, nor measure the benefits of conservation investments or justify further targeted responses. Likewise, without trusted measures of threatened species trajectories, it is impossible to demonstrate to both the Australian public and the international community that our obligations to conserve biodiversity are being met.

The Threatened Species Index (or 'TSX' for short) seeks to provide reliable and robust measures of change in the relative abundance of Australia's threatened and near-threatened species at national, state and regional levels. The TSX is a tool, intended for use by Australia's ecologists, environmental decision-makers, natural resources managers and citizens to understand threatened species trends. The key output of the TSX are graphs of abundance trends through time, demonstrating whether the abundance of our threatened and near-threatened species is growing, declining or stable *(as explained in section 1.1.2).*

The TSX provides a service that had not previously existed. It enables a variety of tasks that are central to estimating trends of Australia's threatened species, including:

1 Importing and storing species monitoring datasets into a single unified database

2 Processing and aggregating monitoring datasets into a single unified database

3 Calculating and viewing population trends over time

4 Visualising population trends and statistics via a web browser

The TSX is built upon the vast array of monitoring projects for threatened species that have been conducted over recent decades. The TSX captures these data in a centralised database, with an annual program of sourcing monitoring data from researchers, government scientists, rangers, environmental consultants, recovery teams and citizens engaged in biodiversity projects across the country. Currently, the TSX extends only to birds, mammals, and plants, although other groups — amphibians, reptiles, fishes and invertebrates — will be progressively included in the index over coming years.

At the release of the 2022 index, the TSX contained data for 278 taxa from 230 data sources including 19,892 time series from 1952 to 2019. For birds, monitoring data for 70 species and subspecies from ~7,800 sites were included. For mammals, data were available for 79 species and subspecies from more than 2,000 sites. For plants, data were included from 129 species and subspecies from more than 800 sites. These datasets are continually improved through an annual data call that captures new data (for existing monitoring programs or new ones) and collates historical data whenever it becomes available.

As such, the TSX is a continually improving measure of long-term abundance trends for Australia's threatened species. Annual releases of the index provide an update on the status of species based on new monitoring data. However, they also increase the accuracy of historical trends, as more-and-more data from the past is identified, collated and included in the index.

The TSX is managed by the NCRIS-funded Terrestrial Ecosystem Research Network (TERN) at The University of Queensland and supported by the Australian Government Department of Climate Change, Energy, the Environment and Water (DCCEEW).

1.1.2. INTERPRETING THE TSX

How to interpret the TSX

This illustration explains how to interpret the TSX trend graphs found on the TSX Trend Visualiser Tool and Data Management Interface. It briefly explains the time period displayed and what the confidence intervals and index values show.

Baseline
The index starts at the value of 1. If the trend line and confidence intervals move away from this baseline, we can say there has been an increase or decline compared to the baseline year.

Confidence Intervals
The shaded areas show 95 percent confidence intervals. These illustrate how certain we are about the trend in any given year relative to the baseline year.
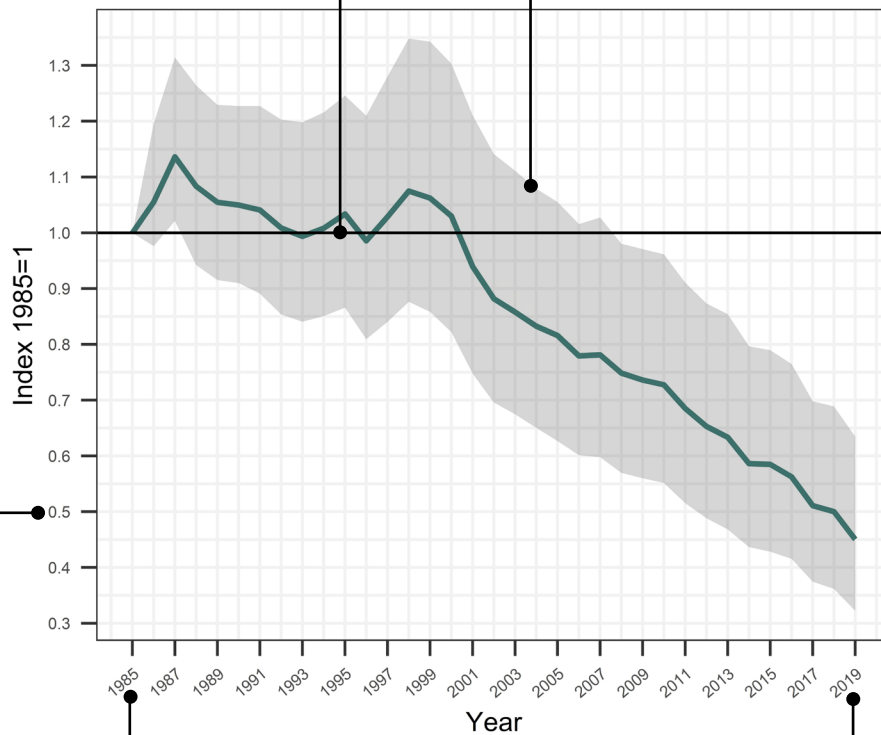
Index Values
These represent the average change in population abundance, as a proportion of the abundance at the baseline year. Hence, for any given year in the time series, the index value and confidence intervals shown represent the overall trend in that year compared to the baseline year.

Baseline year
The baseline year for the index is by default set to 1985 so that the index value in any given year is relative to 1985. This is the earliest year for which we have adequate data available. Although 1985 is the default, other baselines are used (or may be selected) when there isn't enough data to produce an index for the 1985 baseline.

Final Year
The final year of the index is also set by the availability of data. Because data takes time to collect, process, and publish, there can be a time lag. The final year of the index is currently set to be 3 years prior to the current year, to allow sufficient time for data to accrue.

1.1.3. KEY COMPONENTS OF THE TSX

The TSX has two key components that will be the focus of this training manual and are detailed extensively in the following chapters. These components are:

TSX Trend Visualiser Tool: The TSX is produced annually through a workflow that captures new threatened species monitoring data, processes these data and estimates updated trends, and then releases these trends on a dedicated webpage – the TSX Trend Visualiser Tool (https://tsx.org.au/tsx). The visualiser tool allows the primary trends of the TSX to be viewed, plus secondary trends that are subsets of the main index. For example, as below, you may wish to view the trends for migratory shorebirds in Queensland, and specifically for the period from 1990 onwards. Whatever the permutation, you can generate a summary of the underlying data and also download the aggregated data itself.

TSX Data Management Interface: The second key part of the TSX infrastructure is the Data Management Interface (https://tsx.org.au/data/login). The interface will be a major focus of this training manual, with it being the portal through which data providers can upload their raw data to the TSX, access cleaned time series data from these raw data, and download population trends for particular species, particular sites, or combinations of species and sites. The Data Management Interface is therefore a primary tool for our data providers, who are often interested in (and need to report on) the trends for their particular focal species, sites or management projects.

The Threatened Species Index Trend Visualiser Tool, available at https://tsx.org.au/tsx. Users can access the main index trend (A) or use the visualiser to access subsets of the trends, such as for migratory shorebirds in Queensland from 1990 onwards (B).
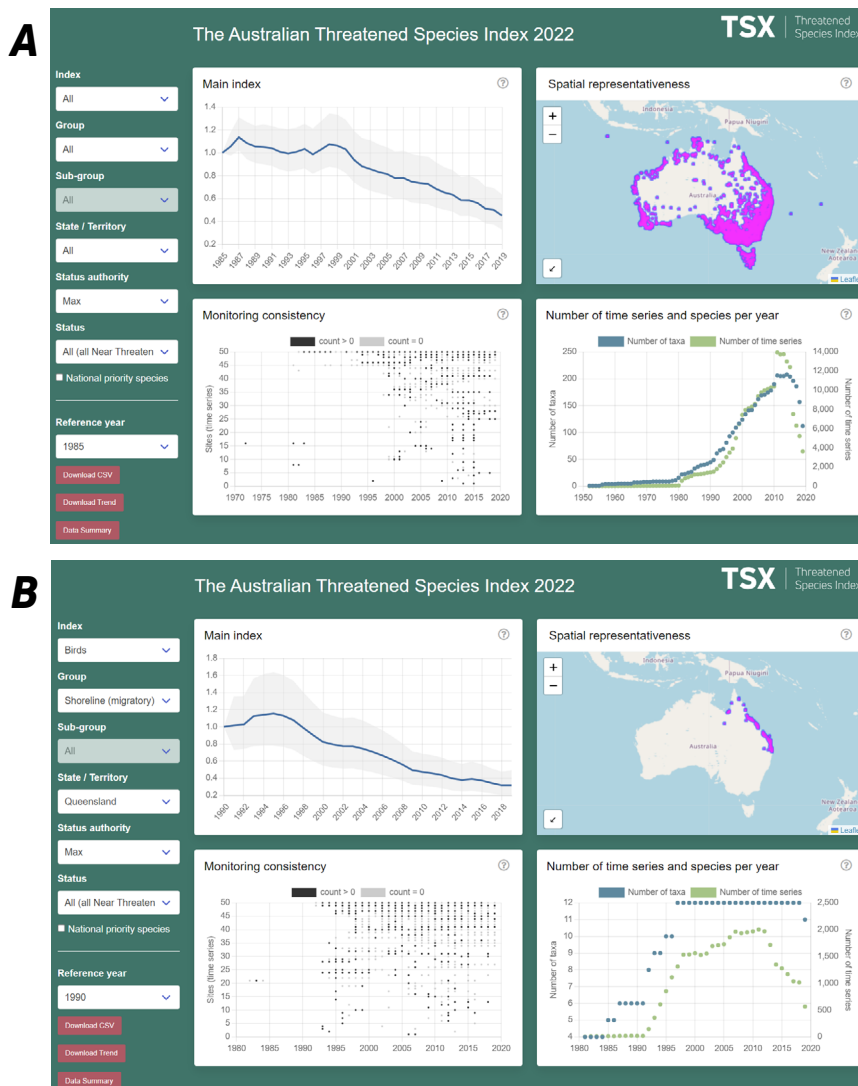
The Threatened Species Index Data Management Interface, available at https://tsx.org.au/data/login. It is through this portal that data providers can upload data, access time series derived from their data and download population trends.
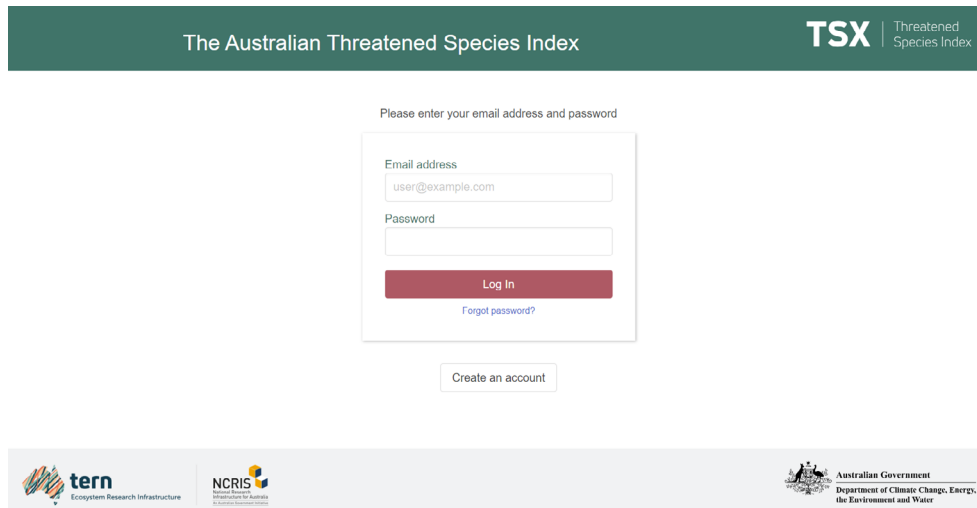
1.2. WHO USES THE TSX?

The TSX is for anyone interested in Australia's threatened species. It is specifically designed to be an open-source, transparent and accessible data source for Australians wanting to understand trends in threatened species abundance. Its intent is to provide the objective estimates of threatened species abundance that are needed to interrogate the success or failure of conservation policy and investments, and to guide change (where required) to maximise the chance of persistence of Australia's threatened taxa.

Data providers to the TSX are diverse, ranging from Australian government departments (Federal and State), NRM bodies, environmental NGOs, private companies, recovery teams, researchers and academics, environmental consultants, naturalist groups and citizen scientists. Anyone is free to contribute data to the TSX.

Major users of the TSX include government departments, NRM bodies and environmental NGOs (for example, the Australian Wildlife Conservancy and Birdlife Australia). Notably, the Australian Government's Department of Climate Change, Energy, the Environment and Water uses the TSX in their Corporate Reporting and for producing the five-yearly audit of Australia's environment — the 'State of the Environment' report. The TSX is now an important tool for understanding the state of Australia's biodiversity and will grow in value as more species groups are added in future.

1.3. HOW CAN YOU CONTRIBUTE?

The TSX is always looking for new datasets on trends for threatened and near-threatened species. If you are involved in a monitoring program that collects population-related measures for an Australian threatened species, your data could contribute to growing the TSX.

To contribute, please first skip ahead to Chapter 5 of this manual to find out what sort of data are useful for the TSX. If you believe you may have suitable data for the index, please contact our project team via email: tsx@tern.org.au. We also encourage you to review our Contributing Data page of the TSX website for further information.

For those that have suitable data, Chapter 2 of this manual provides a step-by-step guide to uploading data through our Data Management Interface.

CHAPTER 2
COLLATING YOUR THREATENED SPECIES MONITORING DATA

2.1. INTRODUCTION TO THE DATA IMPORT TEMPLATE

To integrate your threatened species monitoring data into the TSX database it must be formatted using the TSX data import template. Formatting your data using the template ensures that you can smoothly and successfully upload your data within our Data Management Interface (detailed in Chapter 3.)

Download the current data import template here

2.1.1 GENERAL STRUCTURE OF TEMPLATE

The current TSX data import template is an Excel spreadsheet containing 34 columns, including a mix of required and additional data. Column names for each of these columns can be found in row five, with a brief description of each column, and the sort of information that must be provided, found in row three. Within each column description we have indicated whether the column is '**REQUIRED**' or '**OPTIONAL**'. All columns labelled as '**REQUIRED**' must be completed to successfully upload your data into the Data Management Interface.

The different components of the TSX data import template.

Column descriptions

Columns are labelled as either ***REQUIRED*** or ***OPTIONAL***

3	*SourceDescription. This text field describes the data source. Please use the following structure: 'State/Territory-Species/Taxon Group(s)-Institution/Organisation' e.g. QLD-Poephila_cincta-BTFRT.* **REQUIRED.**	*Provide any further details on the data source. E.g. "Black Throated Finch Recovery Team (BTFRT) monitoring".* **OPTIONAL.**
4		
5	**SourceDesc**	**SourceDescDetails**
6	WA-Potorous_gilbertii-UWA	Gilbert's potoroo monitoring - Doe Lab UWA
7	SA-Acacia_araneosa-DEW	Balcanoona Wattle annual monitoring
8	TAS-Acanthiza_pusilla_magnirostris-UTAS	King Island UTas annual ecology field trip

Column names

Gouldian Finch (Endangered)
Image: Shutterstock

The 34 columns of the template are split into three broad sections:

SOURCE

The first six columns, 'Source fields', are where the custodian must provide details on the source that the data is coming from.

1 *Source*

▶ *(04:05)*
A guide to the source related columns of the template.

The six 'Source fields' columns of the TSX data import template with examples.

Source fields					
SourceType	**SourceDesc**	**SourceDescDetails**	**SourceProvider**	**DataProcessingType**	**SourcePrimaryKey**
custodian	WA-Potorous_gilbertii-UWA	Gilbert's potoroo monitoring Doe Lab UWA	University of Western Australia	Data are standardised by effort	WA-Potorous_gilbertii-UWA_1
custodian	SA-Acacia_araneosa-DEW	Balcanoona Wattle annual monitoring	SA Department of Environment and	None (data are raw data)	SA-Acacia_araneosa-DEW_1
custodian	TAS-Acanthiza_pusilla_magnirostris-UTAS	King Island UTas annual ecology field trip	University of Tasmania	None (data are raw data)	TAS-Acanthiza_pusilla_magnirostris-UTAS_1

SURVEY

The next 21 columns, 'Survey fields', are where the custodian must provide details on the specific surveys that were conducted, for example, site names, locations, and dates.

2 *Survey*

▶ *(05:39)*
A guide to the survey related columns of the template

The first 12 of 21 'Survey fields' columns of the TSX data import template with examples.

Survey fields											
LocationName	**SiteName**	**Y**	**X**	**Projection Reference**	**Positional AccuracyInM**	**SearchType Desc**	**StartDate**	**FinishDate**	**Start Time**	**Finish Time**	**DurationIn Minutes**
Big Boulder National Park	Site1	-38.123	144.568	GDA94	100	Live-trapping	28/01/2007	31/01/2007	5:00	8:30	210
Ironstone Ranges	Big Billy Bore	-38.432	144.877	GDA94	5	Quadrat survey	7/07/2011	7/07/2011	8:00	10:35	155
King Island Flora Reserve	Field Hut	-27.457	153.234	GDA94		Calls heard from survey	15/03/2012	15/03/2012	6:00	6:20	20

SIGHTINGS

The final seven columns, 'Sightings fields', are where the custodian must provide details on the specific sightings of the survey, for example, what species and how many individuals were recorded.

3 *Sightings*

▶ *(04:13)*
A guide to the sighting related columns of the template.

The seven 'Sightings fields' columns of the TSX data import template with examples.

Sightings fields						
TaxonID	**Common Name**	**Scientific Name**	**Count**	**UnitOfMeasurement**	**UnitType**	**Sighting Comments**
m_359	Gilbert's Potoroo	*Potorous gilbertii*	0.1	Trapping success: number of encounters	Continuous	Total of 24 individuals captured with 240
p_392	Spidery Wattle, Balcanoona	*Acacia araneosa*	26	Sample: abundance (counts)	Continuous	Long term 25m*25m quadrat, with counts
u475a	King Island Brown Thornbill	*Acanthiza pusilla magnirostris*	6	Proxy: recorded calls	Continuous	Total calls per 20-minute survey

2.1.2. EXPLANATORY SHEETS

To assist you with completing some of the template columns we also have included some explanatory sheets within the data import template spreadsheet. Perhaps the most helpful sheets are the three Taxonomic List sheets. Within each sheet we have provided a list of all Australian species and subspecies within that taxonomic group, including their scientific and common name as well as a unique 'TaxonID' that is critical for data processing in the TSX workflow. These sheets include details on the conservation status of all species and whether they can be included in the TSX.

An example of the first few rows of one of the Taxonomic List sheets included in the TSX data import template.

TaxonID	Taxon CommonName	Taxon ScientificName	Synonyms	EPBC Status	2020 Action Plan Status	IUCN RedList Status	National Priority Taxa	Considered for the TSX
u149	Far Eastern Curlew	*Numenius madagascariensis*		Critically Endangered	Endangered	Endangered	1	1
u20	Plains-wanderer	*Pedionomus torquatus*		Critically Endangered	Critically Endangered	Critically Endangered	1	1
u305	Orange-bellied Parrot	*Neophema chrysogaster*		Critically Endangered	Critically Endangered	Critically Endangered	1	1
u309	Swift Parrot	*Lathamus discolor*		Critically Endangered	Critically Endangered	Critically Endangered	1	1
u311a	Western Ground Parrot	*Pezoporus wallicus flaviventris*	*Pezoporus flaviventris*	Critically Endangered	Critically Endangered	Least Concern	1	1
u603	Regent Honeyeater	*Anthochaera phrygia*		Critically Endangered	Critically Endangered	Critically Endangered	1	1
u197	Australasian Bittern	*Botaurus poiciloptilus*		Endangered	Endangered	Endangered	1	1

2.2. GETTING YOUR DATA INTO THE DATA IMPORT TEMPLATE

Given the structure of the template, it is easiest to work from left to right. As most of the 'Source fields' columns, specifically the first five columns, are related to the whole dataset (i.e., are not row specific) you will find that most of this information can be copied down for every row. Exempt from this is the 'SourcePrimaryKey' column. It is important that every row of your dataset has a unique primary key value, to ensure that each sighting value is recognised as unique, which is crucial to accurately build a time series. Of equal importance is the 'SiteName' column that forms the spatial basis of a time series. Ensure that 'SiteName' remains consistent for each specific monitoring site.

If you have added your data directly to the template file, you must first delete all explanatory headers (rows 1-4) and sheets before attempting to upload. Please ensure each dataset (file) contains information from only one source (i.e. you can include only one unique 'SourceDesc' value per dataset). We also recommend converting your file to a comma separated value (csv) format before attempting to upload. There are no limitations to the use of non-standard characters (e.g. symbols) when uploading data, but if such characters are present we recommend saving your csv file with UTF-8 encoding.

4

▶ *(10:18)*

A guide to getting your raw data into our data import template

Spectacled Flying Fox (Endangered)
Image: Nicolas Rakotopare

2.3. DETAILED RUN-THROUGH OF THE TEMPLATE COLUMNS

The 34 columns of the TSX data import template with descriptions and examples for Gilbert's Potoroo monitoring in Western Australia.

Number	Field	Name	Column Description	Required or Optional	Example
1	Source	SourceType	Specify whether your data is provided as electronic primary data as a custodian or extracted from a published paper/report. Select: 'paper/report' or 'custodian'.	Required	custodian
2	Source	SourceDesc	SourceDescription. This text field describes the data source. Please use the following structure: 'State/Territory-Species/Taxon Group(s)-Institution/Organisation'.	Required	WA-Potorous_gilbertii-UWA
3	Source	SourceDesc Details	Provide any further details on the data source and monitoring.	Optional	Gilbert's potoroo monitoring, Doe Lab UWA
4	Source	SourceProvider	Name of institution or individual.	Optional	University of Western Australia
5	Source	DataProcessing Type	Indicate whether abundance estimates have been pre-processed. Select your data processing type from the 'DataProcessingType' sheet.	Required	Data are standardised by effort
6	Source	SourcePrimary Key	This text field is a concatenation between SourceDesc and the primary key in the original data (if existing) or a consecutive number starting at 1. Each row needs to have a unique text field.	Required	WA-Potorous_gilbertii-UWA_1
7	Survey	LocationName	Populate the general name of location. This field is not related to SiteName.	Optional	Two Peoples Bay Nature Reserve
8	Survey	SiteName	This text field describes the name of a (fixed) site. Sites are the spatial basis for the time series, i.e. each site will form a different time series.	Required	SiteA
9	Survey	Y	Populate the latitude/longitude or easting/northing coordinates of the original data format.	Required	-34.9742
10	Survey	X		Required	118.1766
11	Survey	Projection Reference	Specify the projection reference of the XY coordinates entered - see 'ProjectionReference' sheet for a full list of options.	Required	GDA94
12	Survey	Positional AccuracyInM	Enter the positional accuracy of spatial coordinates provided in m.	Optional	100
13	Survey	SearchTypeDesc	This text field describes the search type (= monitoring method used).	Required	Live trapping
14	Survey	StartDate	Populate the date when monitoring was started and ended. Format date as DD/MM/YYYY. Use the format 00/00/2001 if only the monitoring year is available and 00/10/2001 if only the month and year are available.	Required	28/01/2007
15	Survey	FinishDate		Required	31/01/2007
16	Survey	StartTime	Populate the StartTime and FinishTime of monitoring as HH:MM in 24 hours format (select 'h:mm' under Custom formats).	Optional	05:00
17	Survey	FinishTime		Optional	08:30
18	Survey	DurationIn Minutes	Populate the duration of monitoring in minutes.	Optional	210
19	Survey	DurationIn Days/Nights	Populate this field on monitoring duration by entering the number of days or nights spent e.g. trap days/nights.	Optional	4
20	Survey	NumberOfTraps PerDay/Night	If you use traps, populate this field with information on the number of traps or number of cameras set at a site per day or night.	Optional	60
21	Survey	AreaInM2	Populate this field on area surveyed in square meters. Note that 1 hectare = 10000 square metres.	Optional	2500
22	Survey	LengthInKm	Populate this field as length of transect surveyed in kilometres.	Optional	0.05
23	Survey	Survey Comments	Include any additional information about the survey including disturbance or other factors that may influence the detection of the individuals.	Optional	Trapping within pre-defined 50mx50m block
24	Survey	Monitoring Program	Specify whether monitoring has been carried out within a large national or jurisdictional monitoring program.	Optional	Western Shield Wildlife Recovery Program
25	Survey	Monitoring Program Comments	Provide any comments or further details on the monitoring program here.	Optional	In collaboration with WA Department of Biodiversity, Conservation and Attractions

26	Survey	Management Category	Specify whether the monitored population is being actively managed for conservation. Select one category from the 'ManagementCategory' sheet.	Required	Actively managed
27	Survey	Management Category Comments	Provide any comments or further details on the management here.	Optional	Fox baiting every 3 months
28	Sighting	TaxonID	Select TaxonID and ScientificName from the appropriate 'Taxonomic list' sheet. Include 'CommonName' where possible. These values must be exactly as listed. Including any surplus characters or spaces will lead to errors.	Required	m_359
29	Sighting	CommonName		Optional	Gilbert's Potoroo
30	Sighting	ScientificName		Required	Potorous gilbertii
31	Sighting	Count	Indicate the abundance estimate you have recorded for this survey. Specify 0 for absences/non-detections.	Required	0.1
32	Sighting	UnitOf Measurement	Select the unit of measurement from 'UnitOfMeasurement' sheet.	Required	Trapping success: captures per 100 trap nights
33	Sighting	UnitType	Select the type of unit in the 'UnitOfMeasurement' field from the 'UnitType' sheet.	Required	Continuous
34	Sighting	Sighting Comments	Add any additional information with relevance to the monitored species.	Optional	24 individuals captured within 240 trap nights.

Lesser Swamp Orchid (Endangered)
Image: Nicolas Rakotopare

CHAPTER 3
USING THE TSX DATA MANAGEMENT INTERFACE

3.1. INTRODUCTION TO THE INTERFACE

The TSX Data Management Interface is a web-based interface accessible to all data providers. As detailed below, the interface is where all data providers can upload their raw data to the TSX, access cleaned time series data from these raw data, and download population trends; for species, particular sites or combinations of species and sites. This interface is therefore a primary tool for our data providers, who are often interested in (and need to report on) the trends for their particular focal species, sites or management projects.

3.2. CREATING AN ACCOUNT AND LOGGING IN

Go to https://tsx.org.au/data/login

If you haven't previously created an account, select 'Create an account'.

For existing users, it is critical that you enter the email address you have used in past communications with the TSX team.

Login or create your account here.

3.3. CREATING A NEW DATASET

STEP 1. CREATE YOUR NEW DATASET

If you haven't previously contributed data to the TSX, or have done but wish to add an entirely new dataset, you can do so by selecting 'Create New Dataset'.
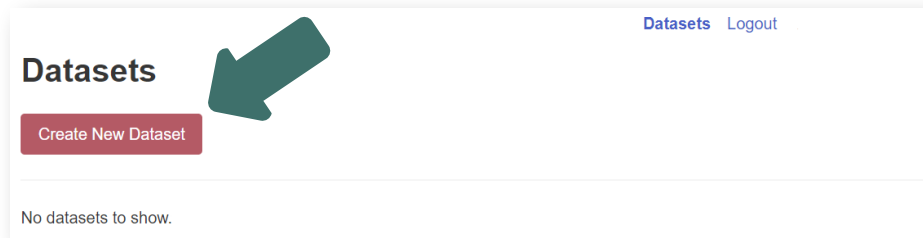
(04:55) *A guide to uploading a new dataset using the TSX data management interface*

STEP 2. FILLING OUT YOUR DATASET DETAILS

When filling out the details on your dataset, please use the following structure for the **Dataset description** field:

'State-Species/Taxon Group(s)-Institution/Organisation'.

Some examples include:

- 'WA-Potorous_gilbertii-UWA'
- 'NSW-Plants-DPE'
- 'NSW-Acacia_meiantha-and-Eucalyptus_recurva-CentralWestLLSNRM'

** A forward slash (/) in the suggested structure above means you can include either value in the description, not both. Please use an underscore (_) between genus and species/subspecies if including a species name **

Data provider is generally the organisation who owns the data, for example 'The State of New South Wales' (for NSW government agencies) or 'Australian Wildlife Conservancy', with **Author** being the individual/s that collected and/or submitted the data. For citizen science programs, **Data provider** and **Author** can be the same.

You will see that the **Monitoring program** for your dataset is set to "N/A". If your dataset is part of a larger monitoring program (for example, the 'Saving our Species' program in NSW), we ask that you include these details. If your program isn't already listed in the drop-down menu and you are entering a new program, please use the following naming structure:

'STATE-PROGRAM-ORGANISATION'

Some examples include:

- 'Qld-NRMNaturalHeritageTrust-CapeYorkNRM'
- 'ACT-ThreatenedSpeciesMonitoring-EPSDD'

If you would like to provide any additional details on your monitoring program, you can do so in the 'MonitoringProgramComments' column in the TSX data import template when you upload your data.

** Note that these details can be changed later, see 'Updating an existing dataset' below. **

Once all your details are entered, click on '**Create Dataset**'.

New Dataset

Datasets   Logout

Dataset description

Data provider

Author(s)

Monitoring program
N/A

Monitoring program
N/A
N/A
SoS monitoring program
New program...

Monitoring program
New program...
Name of monitoring program

STEP 3. UPLOADING DATA TO YOUR NEW DATASET

UPLOADING YOUR DATA

Head to the **Import Data** section and then **Select file**. Ensure the data type **Type 1** is selected. It is here you should select your survey data that you've entered into the TSX data import template. We encourage you to name your data file in a logical format, for example:

'State-Species/Taxon Group(s)-Institution/Organisation-Template-Year-Initials/Name'

Some examples include:

- 'WA-Potorous_gilbertii-UWA-Template-2022-JDoe'
- 'NSW-Plants-DCCEEW-Template-2022-JDoe'
- 'NSW-Acacia_meiantha-and-Eucalyptus_recurva-CentralWestLLSNRM-Template-2022-JDoe'

** A forward slash (/) in the suggested structure above means you can include either value in the description, not both. Please use an underscore (_) between genus and species/subspecies if including a species name **

DATA PROCESSING NOTES

If your raw data has been pre-processed (e.g. abundance estimates are extracted from model outputs or counts have been standardised by effort) or if you have any notes about your data or getting your data into the required template format, we encourage you to leave these details in the Data Processing Notes section.

Import History

None

Import Data

Data type
Type 1

Data file
Select file
Tip: the import will run faster if records belonging to the same survey and site are grouped into contiguous rows instead of scattered throughout the file

Delete Dataset

Deleting this dataset will remove it from the index and cannot be undone. All previously imported data and processing notes will be deleted.

If you wish to update your dataset, simply import an new file using the 'Import Data' section above.

☐ I understand and wish to delete this dataset

Delete this dataset

Datasets   Logout

WA-Potorous_gilbertii-UWA

Dataset Details   Edit

Data Provider
TSX Example

Authors
TSX

Contact Information
TSX Team
UQ
NA
tsx@tern.org.au

Custodians

Custodians are users who have access to import data and edit details for this dataset.

TSX Team
tsx@tern.org.au

Custodian email address   Add Custodian

Data Processing Notes

There are have been no notes recorded for this data source.

Add notes about how this data was processed before uploading to the TSX web interface.

STEP 4. DATA CHECKING AND IMPORT SUCCESS

Your uploaded data is put through a verification process that involves checking the spelling of species scientific and common names, validating your survey coordinates with their defined projection, identifying any missing or duplicated data, and validating the dates and times you have entered for your surveys. If there are no issues with your data, you will a see a large green box containing a thumbs up. You can then select 'Finish importing data'.

Import Data

Data type

Type 1

Data file

File uploaded: WA-Potorous_gilbertii-UWA-TEMPLATE.xlsx

👍 Looks good! No errors detected. Please review the log below before importing the data.

Finish importing data   Upload an edited file

Import log

```
2022-03-30 04:08:37,635 - INFO - Starting import
2022-03-30 04:08:37,636 - INFO - Deleting all previous data for this source
2022-03-30 04:08:37,645 - INFO - File format: Excel Spreadsheet
2022-03-30 04:08:37,665 - INFO - Note: SourceDesc, SourceType and SourceProvider will be ignored since this
information is specified via the web interface
2022-03-30 04:08:42,396 - INFO - Not committing changes - dry run only
2022-03-30 04:08:43,475 - INFO - Processed 9/10 rows
2022-03-30 04:08:43,476 - INFO - Import processing complete. Errors: 0, Warnings: 0
```

If issues are detected, you will need to review the **Import log** which will help you identify the specific row and column where an issue was found. Use this log to guide you in fixing the errors identified. Then use the **Upload edited file** to re-upload your corrected data. After successful upload you can select **Finish importing data.**

Import Data

Data type

Type 1

Data file

File uploaded: WA-Potorous_gilbertii-UWA-TEMPLATE-ERROR.xlsx

⚠ Some issues were detected in the uploaded file. Please check the log below and then upload a new version for checking.

Upload an edited file

Import log

```
2022-03-30 04:11:04,449 - INFO - Starting import
2022-03-30 04:11:04,450 - INFO - Deleting all previous data for this source
2022-03-30 04:11:04,460 - INFO - File format: Excel Spreadsheet
2022-03-30 04:11:04,484 - INFO - Note: SourceDesc, SourceType and SourceProvider will be ignored since this
information is specified via the web interface
2022-03-30 04:11:09,815 - ERROR - Row 9: SiteName: must not be empty
2022-03-30 04:11:09,815 - ERROR - Row 10: SiteName: must not be empty
2022-03-30 04:11:09,820 - INFO - Not committing changes - dry run only
2022-03-30 04:11:10,496 - INFO - Processed 9/10 rows
2022-03-30 04:11:10,496 - INFO - Import processing complete. Errors: 2, Warnings: 0
```

6

▶ *(03:08)*

A guide to navigating and fixing upload errors

If your data has been successfully imported, you will see a large green box containing a party popper. When this happens, you will see the **Status** of your dataset change to **Imported (unapproved).**

This indicates that the TSX team need to complete one final check of your data and approve it for integration into the TSX database. Every time you make a change to your data file the TSX team will need to re-approve your dataset. Note that you will still be able to access the **Dataset Downloads** section of your dataset while your data is unapproved.

Import History

Filename	Status	Uploaded
WA-Potorous_gilbertii-UWA-TEMPLATE.xlsx	Imported (unapproved) (log)	30/03/2022 14:07

Import Data

Data file

File uploaded: WA-Potorous_gilbertii-UWA-TEMPLATE.xlsx

🎉 All data has been imported without errors. See full import log below.

Import log

```
2022-03-30 04:12:07,049 - INFO - Starting import
2022-03-30 04:12:07,050 - INFO - Deleting all previous data for this source
2022-03-30 04:12:07,059 - INFO - File format: Excel Spreadsheet
2022-03-30 04:12:07,081 - INFO - Note: SourceDesc, SourceType and SourceProvider will be ignored since this
information is specified via the web interface
2022-03-30 04:12:11,469 - INFO - Committing changes
2022-03-30 04:12:12,545 - INFO - Processed 9/10 rows
2022-03-30 04:12:12,545 - INFO - Import processing complete. Errors: 0, Warnings: 0
```

Datasets   Logout

Datasets

Create New Dataset

Showing 1 / 1 datasets

Search datasets

| Description	Created ▼	Status
WA-Potorous_gilbertii-UWA	30/03/2022 13:50	Imported (unapproved)

3.4. UPDATING AN EXISTING DATASET

STEP 1. LOCATING YOUR DATASET

If you have previously contributed data to the TSX, you should find at least one dataset listed on your 'Datasets' page. If you know you have contributed data, but it is not listed on this page, please contact the TSX team at tsx@tern.org.au. To access your dataset, simply click on its name.


(06:38)
A guide to uploading new data to an existing dataset using the TSX Data Management Interface
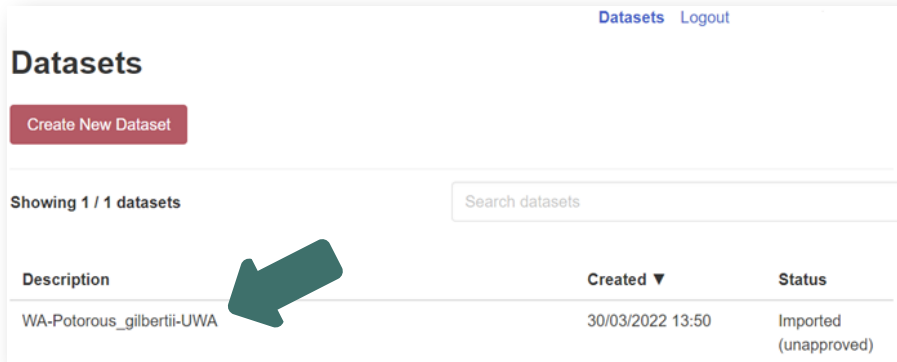
STEP 2. EDITING YOUR PRE-EXISTING DATASET DETAILS

You will see in the Dataset Details section that the TSX team has already filled out some details on your dataset. We encourage you to check these details and update them, particularly the contact information, where necessary. You can do this by selecting 'Edit'.
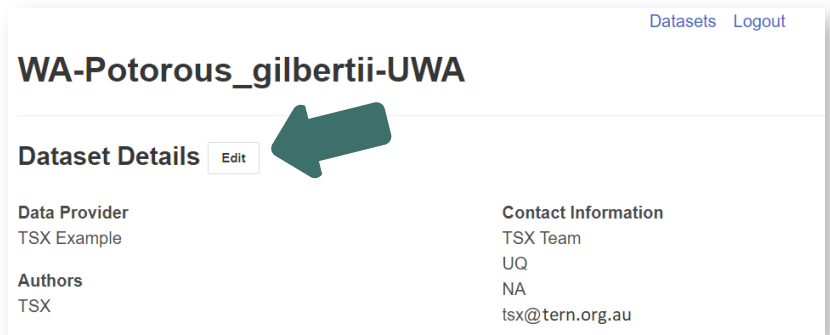
In most cases, you will see that the **Monitoring program** for your dataset is set to "N/A". If your dataset is part of a larger monitoring program, we ask that you update these details. If your program isn't already listed in the drop-down menu and you are entering a new program, please use the following naming structure:
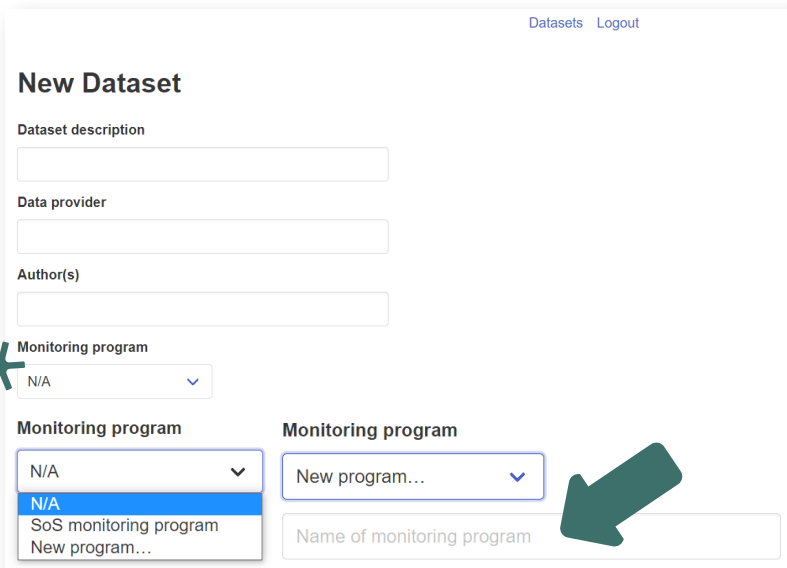
'State-Program-Organisation'

Some examples include:

- 'QLD-NRMNaturalHeritageTrust-CapeYorkNRM'

- 'ACT-ThreatenedSpeciesMonitoring-EPSDD'

If you would like to provide any additional details on your monitoring program, you can do so in the 'MonitoringProgramComments' column in the TSX data import template when you upload your data.

Once all your details are entered, click on **Update Dataset.**

STEP 3. MODIFYING EXISTING UPLOADS

You will find your existing data within the **Import History** section. Please download and check these data. In some cases, you will see that multiple files are listed in your **Import History** section, with the data file listed first being the most up to date one (see its date and time).

The process for adding new monitoring data to an existing dataset is to add these data as new rows to your existing spreadsheet, and then re-upload the entire dataset. **See Chapter 2 for a reminder of how to enter your monitoring data if you need a refresher.**
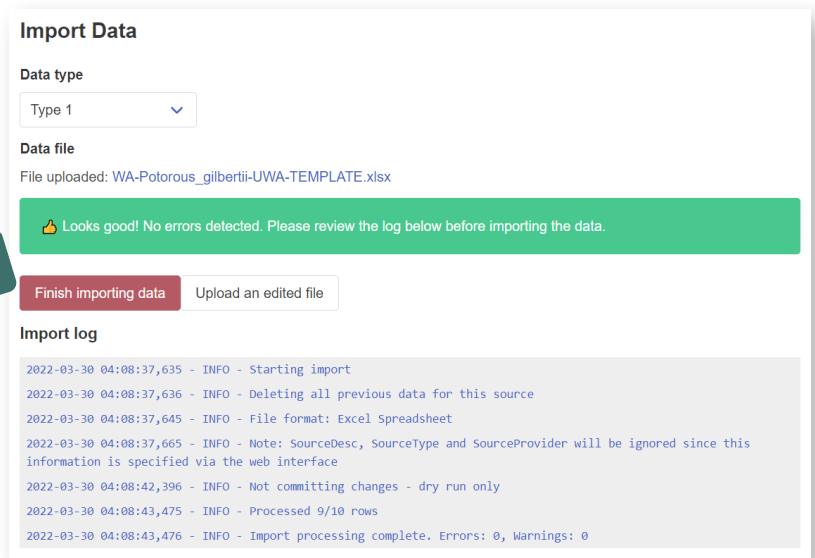
Once you have added your new monitoring data, save the file with an extension that indicates this is an updated dataset. For example, add a Year extension to the file name **(e.g., WA-Potorous_gilbertii-UWA_2023).** Re-upload the dataset in the **Import Data** section using **Select file.**

Pre-2022 data providers:

If you contributed data before 2022 you will see that the TSX team have added a few additional columns to your data file — **DataProcessingType, UnitType, MonitoringProgram** and **ManagementCategory** — to align with the current TSX data import template. These columns will have rows that are either currently left empty or filled with "N/A" values. Please ensure you review and replace all "N/A" values with the correct information (please see the TSX data import template for descriptions of these fields). This information is critical to the inner-workings and final release of the TSX and so you will be unable to re-upload your file if you do not fill out this extra information.

STEP 4. DATA CHECKING AND IMPORT SUCCESS

Your re-uploaded data is put through a verification process that involves checking the spelling of species scientific and common names, validating your survey coordinates with their defined projection, identifying any missing or duplicated data, and validating the dates and times you have entered for your surveys. If there are no issues with your data, you will a see a large green box containing a thumbs up. You can then select 'Finish importing data'.

Import Data

Data type

Type 1

Data file

File uploaded: WA-Potorous_gilbertii-UWA-TEMPLATE.xlsx

👍 Looks good! No errors detected. Please review the log below before importing the data.

Finish importing data   Upload an edited file

Import log

2022-03-30 04:08:37,635 - INFO - Starting import
2022-03-30 04:08:37,636 - INFO - Deleting all previous data for this source
2022-03-30 04:08:37,645 - INFO - File format: Excel Spreadsheet
2022-03-30 04:08:37,665 - INFO - Note: SourceDesc, SourceType and SourceProvider will be ignored since this information is specified via the web interface
2022-03-30 04:08:42,396 - INFO - Not committing changes - dry run only
2022-03-30 04:08:43,475 - INFO - Processed 9/10 rows
2022-03-30 04:08:43,476 - INFO - Import processing complete. Errors: 0, Warnings: 0

6

📽 *(03:08)*

A guide to navigating and fixing upload errors

Australian Sea Lion (Endangered)
Image: Nicolas Rakotopare

Import Data

Data type

Type 1

Data file

File uploaded: WA-Potorous_gilbertii-UWA-TEMPLATE-ERROR.xlsx

⚠ Some issues were detected in the uploaded file. Please check the log below and then upload a new version for checking.

Upload an edited file

Import log

```
2022-03-30 04:11:04,449 - INFO - Starting import
2022-03-30 04:11:04,450 - INFO - Deleting all previous data for this source
2022-03-30 04:11:04,460 - INFO - File format: Excel Spreadsheet
2022-03-30 04:11:04,484 - INFO - Note: SourceDesc, SourceType and SourceProvider will be ignored since this
information is specified via the web interface
2022-03-30 04:11:09,815 - ERROR - Row 9: SiteName: must not be empty
2022-03-30 04:11:09,815 - ERROR - Row 10: SiteName: must not be empty
2022-03-30 04:11:09,820 - INFO - Not committing changes - dry run only
2022-03-30 04:11:10,496 - INFO - Processed 9/10 rows
2022-03-30 04:11:10,496 - INFO - Import processing complete. Errors: 2, Warnings: 0
```

If issues are detected, you will need to review the **Import log** which will help you identify the specific row and column where an issue was found. Use this log to guide you in fixing the errors identified. Then use the **Upload edited file** to re-upload your corrected data. After successful upload you can select **Finish importing data.**

Import History

Filename	Status	Uploaded
WA-Potorous_gilbertii-UWA-TEMPLATE.xlsx	Imported (unapproved) (log)	30/03/2022 14:07

Import Data

Data file

File uploaded: WA-Potorous_gilbertii-UWA-TEMPLATE.xlsx

🎉 All data has been imported without errors. See full import log below.

Import log

```
2022-03-30 04:12:07,049 - INFO - Starting import
2022-03-30 04:12:07,050 - INFO - Deleting all previous data for this source
2022-03-30 04:12:07,059 - INFO - File format: Excel Spreadsheet
2022-03-30 04:12:07,081 - INFO - Note: SourceDesc, SourceType and SourceProvider will be ignored since this
information is specified via the web interface
2022-03-30 04:12:11,469 - INFO - Committing changes
2022-03-30 04:12:12,545 - INFO - Processed 9/10 rows
2022-03-30 04:12:12,545 - INFO - Import processing complete. Errors: 0, Warnings: 0
```

If your data has been successfully imported, you will see a large green box containing a party popper. When this happens, you will see the **Status** of your dataset change to **Imported (unapproved).** This indicates that the TSX team need to complete one final check of your data and approve it for integration into the TSX database. Every time you make a change to your data file the TSX team will need to re-approve your dataset. Note that you will still be able to access the **Dataset Downloads** section of your dataset while your data is unapproved.

Datasets   Logout

Datasets

Create New Dataset

Showing 1 / 1 datasets

Search datasets

Description	Created ▼	Status
WA-Potorous_gilbertii-UWA	30/03/2022 13:50	Imported (unapproved)

Brush-tailed Rock Wallaby (Endangered)
Image: Nicolas Rakotopare

3.5. DATA DOWNLOADS AND TREND GENERATION

Within each of your individual datasets you will find a section called
Downloads. This is where you can filter a dataset, download raw and
aggregated data, as well generate and download population trends.

3.5.1 FILTERING YOUR DATASET

Using several different filtering tools, a user can filter their dataset for
specific species and sites.

8

▶️ *(08:46)*

*A guide to downloading
data and generating
population trends*

This annotation explains the different elements of the dataset filtering functionality of the TSX Data Management Interface

Species
Select all, one, or a
combination of species.

Downloads

[TSX Dataset Downloads Factsheet]

Download Factsheet
Download a factsheet that explains
the inner workings of the TSX Data
Management Interface, covering data
processing, estimating population
trends, and estimating an index.

Filtering criteria for downloads

Species

| 2 options selected | × ▾ |

[Import List] [Export List]

Common name	Scientific name	Taxon ID	
Bar-tailed Godwit	Limosa lapponica	153	⊗
Black-tailed Godwit	Limosa limosa	152	⊗

Import & Export List
Upload a list of species.
Download your current
selection to be uploaded
next time.

Sites

| 1 option selected | × ▾ |

Site name	Site ID	
Darwin Harbour	266894	⊗

Selected data subset contains 32 individual survey counts, 2 taxa, 1 dataset and approx. 2 time series.

Site
Select all, one, or
a combination of
monitoring sites.

Data Subset Information
View a summary for your
data subset including the
number of survey counts,
taxa, and time series.

3.5.2. DOWNLOADING RAW AND AGGREGATED DATASETS

After filtering a dataset, users can download the raw and time series data for their data subsets. The data is provided in a zip folder in comma separated value (csv) format. The download also includes a data dictionary that explains each column of the file.

Download Raw Data (CSV format)

Download Time Series (CSV format)

### 3.5.3. GENERATING POPULATION TRENDS FOR YOUR DATASETS

After filtering a dataset, users can generate a population trend for their data subset. This trend is generated from all time series of at least 2 years in length in the filtered (or unfiltered) dataset. A user can also download this trend in text (txt) format. To understand how to interpret these trends please see Box 1 (Section 1.1.2). Note that the reference (baseline) and final year of the trend will be specific to the dataset. You may also find that your trend contains a broken line for some or all of the trend. This simply means that this portion of the trend was calculated from data on only one species. An unbroken line (with confidence intervals) indicates that this portion of the trend was calculated from data on two or more species.

An example of a dataset specific population trend generated within the TSX Data Management Interface.

Generate Population Trend

Download Population Trend (TXT format)
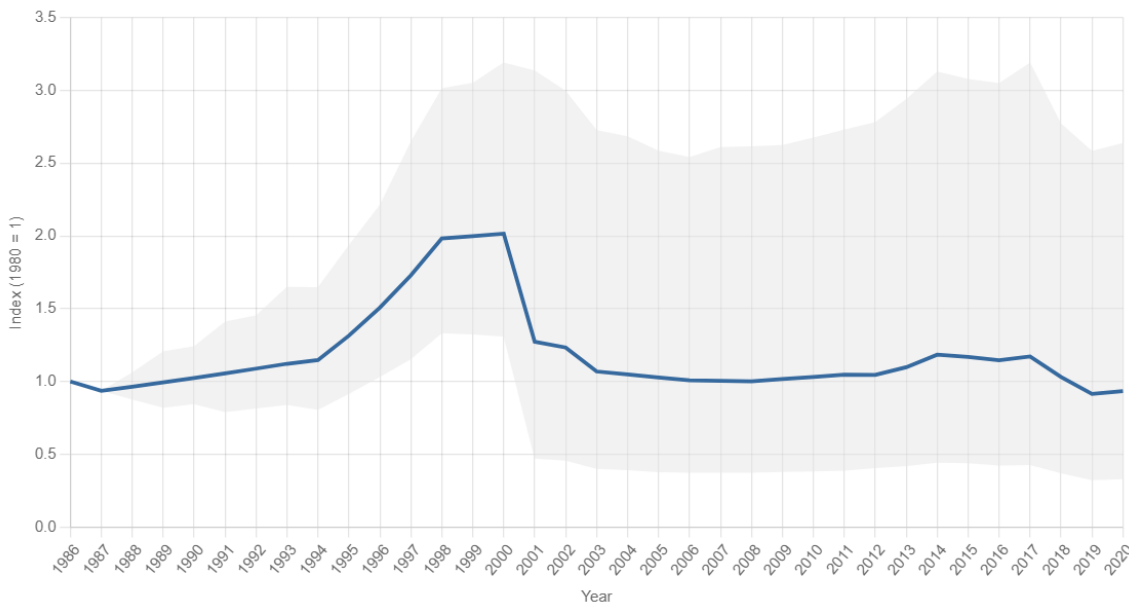
3.6. FUNCTIONALITY FOR PROGRAM MANAGERS

Across Australia, there are various higher-level programs under which threatened species monitoring occurs. Examples include the Australian Government's Saving Native Species program, the Western Shield program run by the Western Australian Government, and the Saving our Species program run by the New South Wales Government. The TSX now provides the capacity for individual monitoring datasets to be allocated to such programs, and for relevant staff to be defined as 'Program Managers' for these programs. A Program Manager is an individual with an overarching responsibility for administering or reporting on the outcomes of a program. Program Managers can access raw and aggregated data for their program/s, and generate trends to support program reporting.

A new top-level Downloads page has been added to the TSX Data Management Interface to support this functionality. On this page, various criteria may be selected to define a subset of the data across the program(s) that the program manager has access to:

- State/Territory.
- Program – any combination of programs to which the user has access to may be selected.
- Species – individual species may be selected from a drop-down list, or a species list uploaded.
- Intensive Management – options include 'All sites (managed & unmanaged)', 'No known management' and 'Actively managed'.

9

▶ *(09:08)*

A guide to using the downloads page functionality for program managers

Raw and aggregated time series data for the selected data subset may be downloaded (with coordinates redacted from raw data). Population trends for the data subset, generated using the LPI method, can also be viewed and downloaded. The latter required modification of the TSX workflow to enable on-demand processing of the data subsets based on the selected subset criteria.

Wandering Albatross (Vulnerable)
Image: Nicolas Rakotopare

This annotation explains the different elements of the filtering functionality of the 'Downloads' page for Program Managers in the TSX Data Management Interface.

Taxonomic Group
Choose a taxonomic group.

State / Territory
Choose a state or territory

1. Subset Criteria

Data that meets *all* of the criteria selected below will be included in the subset download.

State/Territory

New South Wales

Programs
☑ SoS monitoring program

Programs
Choose a monitoring program (all programs for which you have been listed as a Program Manager will be visible).

Taxonomic Group

Birds

Species

2 options selected   ✕ ▾

Import & Export List
Upload a list of species. Download your current selection to be uploaded next time.

Import List   Export List   ⑦

Common name	Scientific name	Taxon ID
Northern Eastern Bristlebird	Dasyornis brachypterus monoides	u519b ⊗
Southern Eastern Bristlebird	Dasyornis brachypterus brachypterus	u519a ⊗

Species
Select all, one, or a combination of species.

Sites

All sites

Sites
Select all, one, or a combination of monitoring sites.

Management Category
You can view trends according to how the sites are managed, including all sites, managed sites, or sites with no known management.

Management ⑦

All sites (managed & unmanaged) ▾

Selected data subset contains 611 individual survey counts, 2 taxa, 2 datasets and approx. 79 time series.
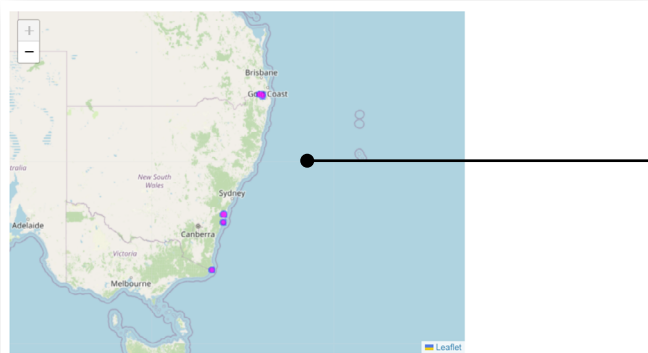
Data Subset Information
View a summary for your data subset including the number of survey counts, taxa, and time series.

Map
You can see a map of the location of all monitoring sites in your data subset.

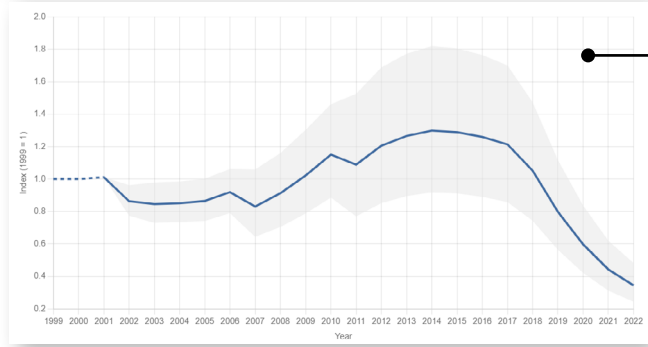**2. Download Data Subset**

Download Raw Data (CSV format)

Download Time Series (CSV format)

Population Trend

Note: This trend has been generated using the Living Planet Index methodology, which is designed for producing composite trends, not single-species trends.

Download Population Trend (TXT format)

Downloads
You can download the raw and time series data for your data subset.

Trend
You can view and download the trend for your data subset. See section 1.1.2 for an explanation on how to interpret the trend. Dashed lines indicate that this section of the trend is built from data on only one species, and the unbroken line indicates the trend has been built from data on multiple species.

CHAPTER 4
USING THE TSX TREND VISUALISER TOOL

4.1. INTRODUCTION TO THE WEB-BASED VISUALISER TOOL

When the TSX is released, the trends are uploaded to our dedicated webpage – the TSX Trend Visualiser Tool (https://tsx.org.au/tsx). The visualiser allows the primary trends of the TSX to be viewed, plus secondary trends that are subsets of the main index. For example, you may wish to view the trends for migratory shorebirds in Queensland only, and specifically for the period from 1990 onwards. Whatever the permutation, you can generate a summary of the underlying data and download the aggregated data itself.

🔟 (06:11)

A guide to using the TSX Trend Visualiser Tool

4.2. VISUALISER COMPONENTS EXPLAINED

4.2.1. SUB-SETTING FUNCTIONALITY

Using the sub-setting tool, users can filter the TSX database to view refined Index trends.

This annotation explains the different elements of the filtering functionality of the TSX Trend Visualiser Tool.


Sub-group
Choose which subgroup of species to include in your index, e.g. 'Arboreal' or 'Volant' terrestrial mammal species.

Status authority
Choose the included species based on the maximum conservation status, EPBC status, or IUCN Red List status.

Management
View trends according to how the monitoring sites are managed, including; all sites, actively managed sites, or sites with no known management.

Reference year
Set the reference year for your trend.

Downloads
To find out more about what you can download from the TSX Trend Visualiser Tool, see Section 5.3.

Index
Choose which index to visualise including Birds, Mammals, Plants, or All indexes.

Group
Choose which group of species to include in your index, e.g. 'Marine' or 'Terrestrial'.

State / Territory
Choose a state or territory.

Status
Choose to include all species, threatened species only or near-threatened species only.

National priority species
View trends for only the national priority species according to the Australian Government's Threatened Species Action Plan (2022-2032).

4.2.2. INDEX PLOT

The index plot shows the average change in populations compared to a base year. It shows a relative change and not population numbers themselves. At the reference year, the index has a score of 1. All subsequent values are relative to this initial index value. Hence, a score of 1.2 means a 20% increase compared to the reference year, while a score of 0.8 means a 20% decrease compared to the reference year. For a more detailed description on how to interpret the index plot please see Section 1.1.2.

An example of an index plot on the TSX Trend Visualiser Tool.
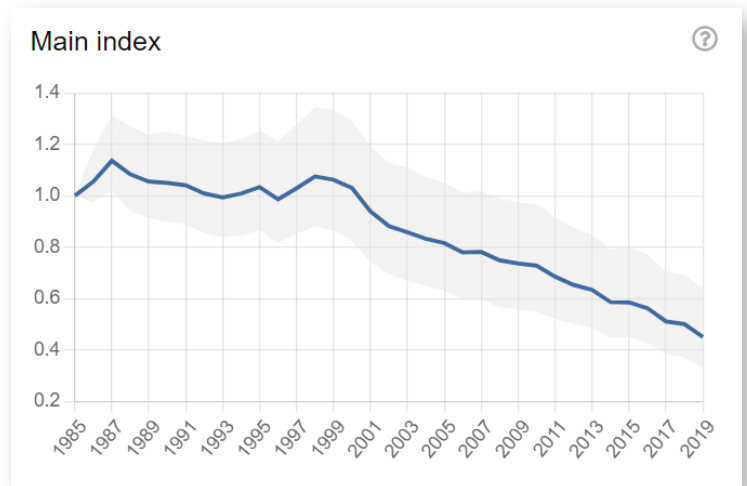
An example of a spatial representativeness map on the TSX Trend Visualiser Tool.
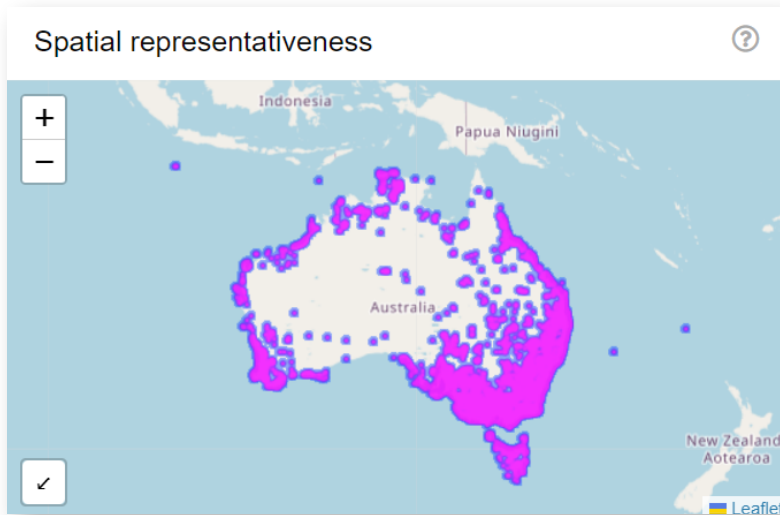
4.2.3. SPATIAL REPRESENTATIVENESS MAP

The spatial representativeness map shows where the monitoring data used to calculate a particular index was recorded in Australia. Sites are buffered to obscure precise locations.

An example of a monitoring consistency plot on the TSX Trend Visualiser Tool.
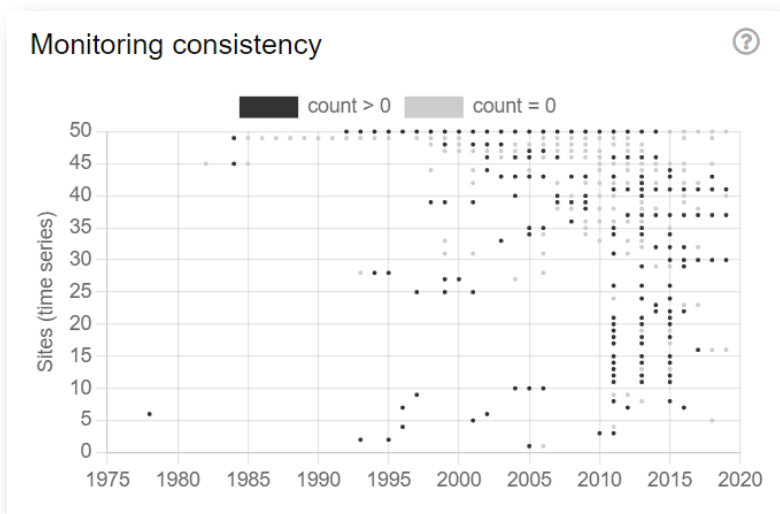
4.2.4. MONITORING CONSISTENCY DOT PLOT

This dot plot shows the particular years for which monitoring data were available, from a random 50 site sample of the whole dataset (or data subset). Each row represents a time series where a species/subspecies was monitored with a consistent method at a single site. The dots represent count values for the metric used to quantify the species/subspecies while zeros indicate absences (non-detections) of those species at the site.

4.2.5. NUMBER OF TIME SERIES AND SPECIES PER YEAR DOT PLOT

This plot shows the number of species/subspecies (in blue) and the number of time series (in green) available in each year to calculate the index. The number of species and time series will always decline closer to the final year, given the lag in integration of datasets into the index (resulting primarily from the lag in the availability of data, given that it takes time for data providers to collate and submit, or takes time for the TSX team to identify data in the literature). This downturn in data availability closer to the release year is the reason that a 3-year lag is implemented in trend calculation, as data quality is poorer closer to the release year.

An example of a time series and species data availability plot on the TSX Trend Visualiser Tool.
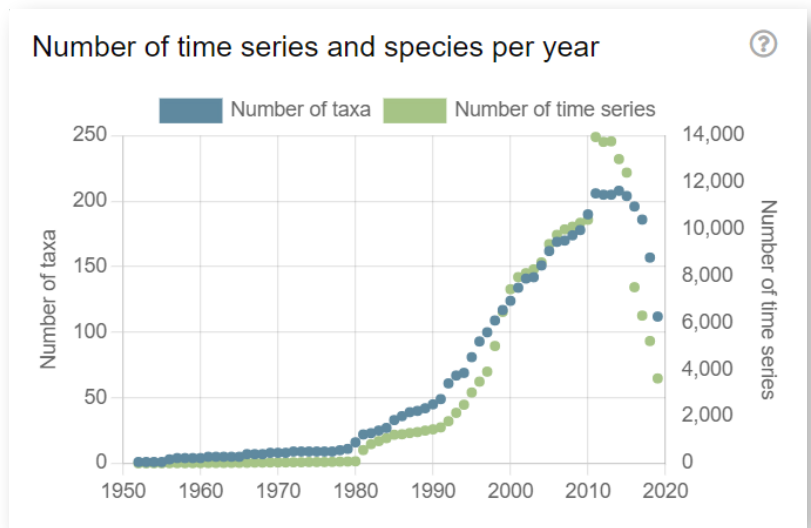
4.3. DATA DOWNLOADS AND SUMMARY

4.3.1. DATA AND TREND DOWNLOADS

You can download the aggregated dataset (in csv format) containing all time series used to calculate the index. Within the zipped folder download you will also find a data dictionary that explains each column of the dataset.

You can also download the trend data (in txt format) for the index you have generated. Doing so allows you to produce your own graphs of the trend, in the program of your choice. **LPI_final** is the estimate of the trend (the geometric mean across all species). **CI_low** is the lower 95% confidence interval for the mean trend. **CI_high** is the upper 95% confidence interval for the mean trend.

An example of a trend data download from the TSX Trend Visualiser Tool.

```
"LPI_final" "CI_low" "CI_high"
"2000" 1 1 1
"2001" 0.912079598126372 0.849783085333091 0.967407491675216
"2002" 0.856020665454417 0.784993831626964 0.925203732330732
"2003" 0.832950390381301 0.75552693430817 0.913760724565491
"2004" 0.808429168659544 0.725412775344782 0.8883995737362
"2005" 0.792030131659628 0.703140058925648 0.883907120578804
"2006" 0.756517984381099 0.665767889255938 0.855867132844627
"2007" 0.758422870050199 0.661483488511555 0.867983068871256
"2008" 0.726706292717672 0.62872628700403 0.838610387228526
"2009" 0.714672087114327 0.613278200475527 0.822343794288155
"2010" 0.706506622001463 0.605295834651406 0.82880373103443
"2011" 0.665019021226757 0.563321653913109 0.785743866064653
"2012" 0.633900951112109 0.529495964699788 0.751124694778999
"2013" 0.614944855433589 0.515177232792489 0.737229128967984
"2014" 0.569216103399895 0.47546392198195 0.679941584760489
"2015" 0.567837887792925 0.462885466964 0.688530279582842
"2016" 0.546200139337501 0.446933600174934 0.667209925260502
"2017" 0.496074424052303 0.405141361292428 0.614559912569176
"2018" 0.485579454283574 0.389375938640157 0.607653442329747
"2019" 0.437294661340571 0.342568676564353 0.565780792187663
```

Download CSV

Download Trend

Phillip Island Hibiscus (Endangered)
Image: Shutterstock

4.3.2. DATA SUMMARY

Users can download a data summary for the index they have generated, which includes some summary statistics as well as some information about the data for each species included in the index.

Data Summary

The 4 main summary statistics included are:

- **Average time series length**
  This statistic represents the average time period between the first year of a survey at one site and the last year, for all time series included in the index. Note that this includes data gaps. Longer time series are generally better at tracking long term change in abundances.

- **Number of samples (years) per time series**
  This statistic represents the average number of years with a value in a time series. Trend estimates are derived from these values and fit across missing years to produce annual estimates of change per year.

- **Number of data sources in index**
  Each dataset contributed to the TSX is considered a separate data source. This statistic represents the total number of data sources that contribute to the index. Please note that this value is distinct from the number of data providers.

- **Number of taxa in index**
  This statistic represents the total number of unique taxa (species and subspecies) that contribute to the index.

Under the summary statistics, users will find a list of all species included in the index. For each species we provide details on their conservation status according to both the EPBC Act and the IUCN Red List, as well as information on the number of time series and number of data sources that contained data on the species. For each index permutation, users will also find a list of species not included in the index. This list will depend on the taxonomic group, functional group, or statuses a user has selected on the visualiser tool. This list allows users to better understand how representative the index is.

An example of a data summary generated in the TSX Trend Visualiser Tool.

Time-series length (mean ± SD): 15.2 ± 7.6

Number of samples (years) per time series (mean ± SD): 9.1 ± 7.1

Number of data sources in Index: 8

Number of taxa in Index: 24

Taxon name	Taxon scientific name	Functional group	IUCN status	EPBC status	# data sources	# time series	Mean time-series length	Spatial representativeness
Black-tailed Godwit	Limosa limosa	Shoreline (migratory)	Near Threatened	None	2	118	18.0	nan
Common Greenshank	Tringa nebularia	Shoreline (migratory)	Least Concern	None	2	223	16.3	nan
Curlew Sandpiper	Calidris ferruginea	Shoreline (migratory)	Near Threatened	Critically Endangered	2	187	17.5	nan
Far Eastern Curlew	Numenius madagascariensis	Shoreline (migratory)	Endangered	Critically Endangered	2	333	14.8	nan
Great Knot	Calidris tenuirostris	Shoreline (migratory)	Endangered	Critically Endangered	2	180	14.9	nan
Greater Sand Plover	Charadrius leschenaultii	Shoreline (migratory)	Least Concern	Vulnerable	2	150	15.0	nan
Lesser Sand Plover	Charadrius mongolus	Shoreline (migratory)	Least Concern	Endangered	2	199	15.8	nan
Nunivak Bar-tailed Godwit	Limosa lapponica baueri	Shoreline (migratory)	Near Threatened	Vulnerable	1	320	15.3	nan
Red Knot	Calidris canutus	Shoreline (migratory)	Near Threatened	Endangered	2	112	15.9	nan
Red-necked Stint	Calidris ruficollis	Shoreline (migratory)	Near Threatened	None	2	269	15.8	nan
Sharp-tailed Sandpiper	Calidris acuminata	Shoreline (migratory)	Least Concern	None	2	195	16.7	nan
Terek Sandpiper	Xenus cinereus	Shoreline (migratory)	Least Concern	None	2	194	15.5	nan
Capricorn Yellow Chat	Epthianura crocea macgregori	Terrestrial	Least Concern	Critically Endangered	1	14	9.5	98.2
Eastern Major Mitchell's Cockatoo	Cacatua leadbeateri leadbeateri	Terrestrial	Least Concern	None	1	61	10.9	33.2
Northern Eastern Bristlebird	Dasyornis brachypterus monoides	Terrestrial	Endangered	None	1	8	6.5	10.5
Painted Honeyeater	Grantiella picta	Terrestrial – Dry sclerophyll woodland/forest	Vulnerable	Vulnerable	1	24	11.5	29.8
South-eastern Brown Treecreeper	Climacteris picumnus victoriae	Terrestrial – Dry sclerophyll woodland/forest	Least Concern	None	1	36	9.5	20.9
South-eastern Hooded Robin	Melanodryas cucullata cucullata	Terrestrial – Dry sclerophyll woodland/forest	Least Concern	None	1	17	6.4	22.9
Southern Squatter Pigeon	Geophaps scripta scripta	Terrestrial – Dry sclerophyll woodland/forest	Least Concern	Vulnerable	1	61	9.6	32.4
Northern Rufous Scrub-bird	Atrichornis rufescens rufescens	Terrestrial – Rainforest	Endangered	None	1	17	10.9	2.1
Eastern Purple-crowned Fairy-wren	Malurus coronatus macgillivrayi	Terrestrial – Tropical savanna woodland	Least Concern	None	1	19	12.9	19.1
Gouldian Finch	Chloebia gouldiae	Terrestrial – Tropical savanna woodland	Near Threatened	Endangered	1	3	15.0	15.7
Southern Black-throated Finch	Poephila cincta cincta	Terrestrial – Tropical savanna woodland	Least Concern	Endangered	1	23	6.4	0.4
Australasian Bittern	Botaurus poiciloptilus	Wetland	Endangered	Endangered	1	11	9.5	21.7
Heard Island Black-faced Sheathbill	Chionis minor nasicornis	Marine	None	None	0	0		
Heard Island Imperial Shag	Leucocarbo atriceps nivalis	Marine	Least Concern	Vulnerable	0	0		
Macquarie Island Imperial Shag	Leucocarbo atriceps purpurascens	Marine	Least Concern	Vulnerable	0	0		
Amsterdam Albatross	Diomedea amsterdamensis	Marine – Albatrosses and Giant-Petrels	None	Endangered	0	0		

CHAPTER 5
HOW DOES THE TSX WORK?

5.1. DATA THAT UNDERPINS THE TSX

5.1.1. DATA THAT ARE USEFUL FOR THE TSX

Calculating trends requires "time series" data — data on a population parameter (a count or detection rate) that is collected at the same place over time and with the same method. In order for your data to be able to be used as a time series for the TSX, it must:

- Be collected at the same specific place each time, not in a general region (e.g. 'Sherwood Arboretum' is acceptable, whereas 'Brisbane' is not).

- Have full resolution coordinates (e.g. a latitude and longitude) with a specified datum/projection.

- Be collected in at least two different years.

- Contain information on the year the survey was undertaken. However, month and date are also helpful for seasonal comparisons if that information is available.

- Specify the species and (if applicable) the subspecies that was surveyed.

- Specify what you counted (e.g. nests) and have a count, e.g. 50.

- Be collected with the same method each time. Metadata on effort, such as survey duration and size of area surveyed, are also important so that we can compare 'apples with apples'.

An example of raw data that is suitable for inclusion in the Threatened Species Index.

ID of fixed site	GPS coordinates where the site is located (WGS84)		Species name	Search Type Description	Unit	Year	Count
16093	-36.31880	144.92780	Malleefowl	Fixed route search	Proxy: breeding pairs	1998	9
16093	-36.31880	144.92780	Malleefowl	Fixed route search	Proxy: breeding pairs	2006	6
16093	-36.31880	144.92780	Malleefowl	Fixed route search	Proxy: breeding pairs	2014	2

5.1.2. DATA THAT ARE NOT USEFUL FOR THE TSX

Currently, the TSX cannot, as a general rule, incorporate data from one-off surveys or incidental sightings (e.g., seeing a Swift Parrot at Melbourne's Royal Park on 18 April 2021). Whilst these observations are extremely valuable for spatial applications such as defining and modelling species ranges, one-off data points are not conducive to building time series of population trends. Statistical techniques to build time series from such data are being pursued; however, these techniques must account for the significant temporal fragmentation of such data, and biases arising from the way such data are collected. The TSX aims to make use of one-off survey data in future, if reliable statistical approaches are developed to build time series from these data.

Likewise, monitoring data that include a material change in monitoring method part way through the time series cannot be used as a single trend. For example, monitoring of Northern Quolls using cage traps, followed by a change to using camera traps when this technology became available. When this occurs, the trend must be split into two separate time series, unless some means of calibrating the abundance data is possible between the different techniques.

Another important limitation on monitoring data is where uncertainty occurs in species identification. For example, where two morphologically similar species or subspecies occur in sympatry, it may not be possible to allocate detections or counts to the correct taxon. If so, a reliable time series cannot be constructed.

5.1.3. MAXIMISING THE USEFULNESS OF YOUR DATA FOR THE TSX

To maximise the usefulness of your monitoring data for the TSX, you should:

Be consistent. Don't change survey methods/protocols. Survey in the same season/month each time, especially when this is influential for counts or detection rates. For example, Far Eastern Curlew numbers have been going up in Darwin Harbour over the last decade, but a shift in the survey timing (to winter, for example) would undermine the trend data, as Far Eastern Curlews are migratory and only present in Australia at particular times of year.

Decide what you are counting. Choose the unit of measurement you use and stick to it. Examples include counts of breeding pairs, nests or individuals, trapping rates, densities of individuals (counts over fixed areas/transects) or detection rate (no. of detections / no. of non-detections).

Monitor for the long-term. Although a time series can be as short as two years, this is an extremely short time-frame. The longer you monitor a site, and the more consistently surveyed it is, the greater the ability to detect change. Note that monitoring sites every year is preferable; however, the TSX can include time series with missed years, which occurs commonly in ecological monitoring (due to gaps in finances, fieldworker availability or even something as mundane as a vehicle breakdown on the way to a site one year).

Add to existing time series. Why start a new time series from year zero if someone around the corner has been surveying a site for 10 years already? Find out if you can help to keep their monitoring going, replicating their method to ensure consistency in survey effort and methodology.

Record true absences of species. Zero counts are just as important in ecological data as non-zero counts. If absences or non-detections of a species are not recorded, then trend estimates may be significantly biased.

Collect representative data. Try to sample sites from a representative set of sites, but don't try to do too much. You don't need to count every individual every year to get a reliable population trend.

5.1.4. DATA SOURCES AND THE ANNUAL DATA CALL

As of 2022, the TSX has collated time series data from over 230 data providers from across Australia. Our most significant contributions have come from government and NGOs (78% of datasets). Crucial contributions have also come from academia (14% of datasets). Other sources of data for the TSX include consultancies and citizen scientists.

The number of datasets contributed by each type of data provider to the 2022 Threatened Species Index.
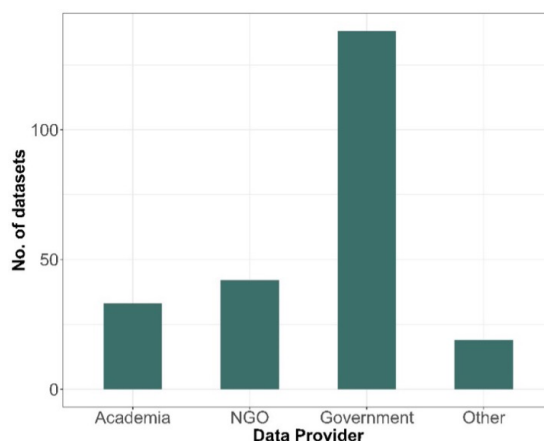
Consultations with providers and the collation of new datasets occurs primarily during the annual TSX data call. During this process, the TSX team reach out to all existing data providers, as well as new potential data providers, to seek new data. If new data is available, the custodians are directed to upload/update their dataset using the TSX Data Management Interface. To find out more about the interface and how to upload/update a dataset, see Chapter 4.

5.1.5. THE TYPES OF DATA CURRENTLY INCLUDED IN THE TSX

The TSX collates threatened species monitoring data collected using a large variety of methods. These methods differ significantly between each taxonomic group. For birds, the most common monitoring method is area counts, followed by fixed point counts. For mammals, the most common monitoring method is direct observation (e.g. spotlighting and distance sampling), followed by trapping. For plants, the most common monitoring method is whole population counts, followed by partial population counts (e.g. quadrats along a transect).

Passive monitoring methods, such a camera trapping, acoustic monitoring and eDNA, are increasingly being used to monitor Australia's biodiversity. As such, these techniques represent a significant potential data source for the TSX. However, there are various challenges to constructing reliable time series from these data sources. As such, the TSX currently does not include eDNA data and limited camera trapping and acoustic monitoring data. If you have data of this nature, we encourage you to contact the TSX team to discuss the best way to integrate your data into the index.

The percentage of time series collected using different monitoring methods for each taxonomic group in the 2022 Threatened Species Index.
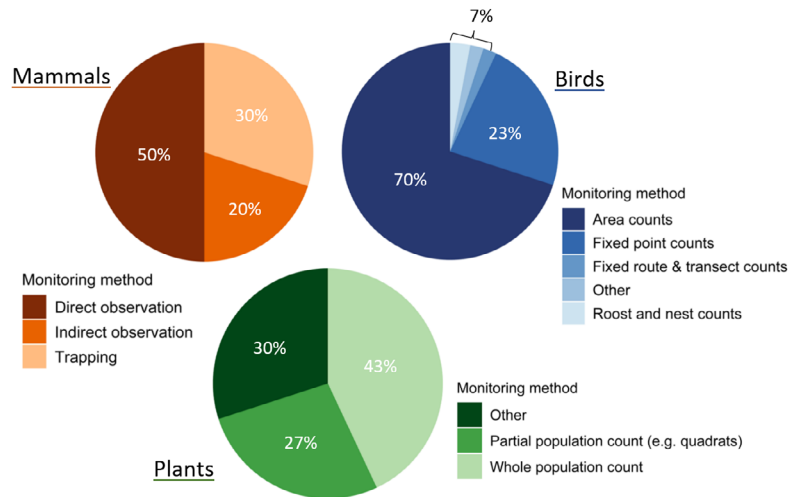
5.1.6. DATA SHARING AGREEMENTS

Given the nature of this project, involving the use of confidential data for a large number of sensitive species, the TSX team have developed a Data Provider Agreement that covers an agreed use of data supplied to the index and precautions taken for data security. Among other things, the agreement ensures that a provider's data will be stored securely, credited appropriately, and that spatial data is de-identified in our aggregated datasets which are shared publicly. Where appropriate, data providers may also opt in or out of data sharing with third parties, including the Atlas of Living Australia and Australian Government. Within these agreements a data provider can also set an embargo for their data, meaning that their data will feed into the calculation of the index, but all aggregated data are removed from the publicly available dataset. This can be helpful if there are sensitivities about the counts themselves, or when the data form part of a study that is yet to be published or part of a student project.

5.2. DATA PROCESSING AND TREND GENERATION

To prepare your monitoring data for inclusion in the TSX, it is first processed using our automated scientific workflow, as described below.

5.2.1. DATA PROCESSING TO GENERATE TIME SERIES

The first step of the workflow is the transformation of your raw data (in long format, with rows as individual surveys) into time series data (in wide format, with years as columns). Each individual time series represents all annual survey abundance values for a single site and single species, with all abundance values being directly comparable (e.g. raw count, density etc). In cases where surveys occurred more than once a year, all intra-annual abundance values are aggregated to generate a single annual abundance value. The method of aggregation to an annual value is based on advice from the data custodian but can include taking an average or maximum value, or by calculating a reporting rate.

The transformation of raw monitoring data (top) into time series data (bottom)

ID of fixed site	GPS coordinates where the site is located (WGS84)		Species name	Search Type Description	Unit	Year	Count
16093	-36.31880	144.92780	Malleefowl	Fixed route search	Proxy: breeding pairs	1998	9
16093	-36.31880	144.92780	Malleefowl	Fixed route search	Proxy: breeding pairs	2006	6
16093	-36.31880	144.92780	Malleefowl	Fixed route search	Proxy: breeding pairs	2014	2

ID of fixed site	GPS coordinates where the site is located (WGS84)		Species name	Search Type Description	Unit	1998	2006	2014
16093	-36.31880	144.92780	Malleefowl	Fixed route search	Proxy: breeding pairs	9	6	2

5.2.2. TIME SERIES DATA FILTERING

After generating your time series data, we apply some strict filtering criteria to your data to ensure that it is suitable for the calculation of trends using the Living Planet Index methodology (see section 5.2.3 below) and the TSX more generally. The criteria applied are:

- Time series are limited to the minimum and maximum year of the index (1985-2019 as of 2022).
- Time series based on incidental surveys are excluded.
- Taxa are excluded if they are not recognised as threatened or near-threatened (that is, the highest listing for the species under the Australian Environmental Protection and Biodiversity Conservation Act 1999 or IUCN Red List is Least Concern, Extinct, or not listed).
- Surveys from sites with inaccurate coordinates are excluded (e.g., a terrestrial species with site coordinates in the ocean).
- All-zero time series are excluded
- Data sources with certain data agreement requirements, standardisation of method and consistency of monitoring descriptions are excluded.
- Sites with less than 2 years of data are excluded

Please note that the above filtering only occurs when calculating the final index, not when producing dataset specific trends in the TSX Data Management Interface. In these cases, all time series (of two years or greater in length) generated from your uploaded raw data will be used when calculating the customised trends.

5.2.3. TREND ESTIMATES USING THE LIVING PLANET INDEX METHODOLOGY

To generate the index from all suitable time series data in the TSX database we use the Living Planet Index (LPI) methodology, as outlined below. The text below borrows from the LPI technical supplement, "The Living Planet Index 2022 - A Deep Dive into the Living Planet Index". Further information on the workings of the LPI method can be found in the document linked to the right.

💾 *Download further information on the workings of the LPI method here.*

Step 1 — DATA TRANSFORMATION

All time series abundance values are log transformed to reduce their variance.

Step 2 — DATA INTERPOLATION

For time series with six or more sample years, a generalised additive model (GAM) is fitted to the data. Annual abundance values (on the log-scale) are then interpolated from this model for the entire length of the time series.

For time series with less than 6 sample years, or for which a GAM cannot be fitted, missing annual abundance values are determined using linear interpolation in which a constant annual rate of change is assumed between years for which data is available.

Step 3 — CALCULATING ANNUAL RATES OF CHANGE

For each time series, the rate of change in abundance from each year to the next is calculated as the ratio of abundance between them (abundance in year t divided by abundance in year t-1). As such, the differences between years are a ratio of change. This means that we can combine information from populations with different measures of abundance and different numbers of individuals, as all are simply represented as ratios of change from one year to the next.

Step 4 — AGGREGATION TO THE SPECIES LEVEL AND HIGHER

For each species, these inter-annual rate of change values are averaged across all sites to give an overall trend for that species (specifically, by taking the arithmetic mean of values for each time-step).

As the TSX includes data for multiple species, these species-specific inter-annual changes are furthered aggregated across all species (using a geometric mean) to create a single overall trend.

Step 5 — GENERATING THE INDEX AND BOOTSTRAPPING

These trend values are then turned into an index by setting the value to 1 in the first sampling year and relating each annual change to this baseline.

95% confidence intervals (with 1000 bootstrap resamples) are calculated around these values, which describe how certain we are about the index value in any given year relative to the baseline year accounting for variation between species.

5.2.4. LIMITATIONS

While the TSX team implements rigorous data quality standards (see section 5.3), a trend is ultimately only as good as the underlying data. Limitations must be considered when interpreting the TSX trends.

When interpreting the national trends, it is important to consider that we only have information for the species and locations that people actually monitor. As it stands, the most current TSX (2022) is based on monitoring data for 278 species, collected at 10,741 sites and 19,893 time series datasets. This is a significant dataset; however, these data stem largely from the south and east of the continent, with less representation of inland areas and limited representation of arid Australia. While this means the more developed parts of the country are represented, it is also true that the distribution of threatened species aligns with this spatial pattern.

The temporal accumulation of data must also be considered when interpreting the national trends. For the 2022 index, in 1985 (the reference year) data were available for 33 species (12% of total) from 1,312 time series (6% of total). Species and time series included in the calculation of the 2022 index grew rapidly after 1990 before declining in more recent years. In turn, data quality is weakest early and late in the time series.

Perhaps of greatest importance for interpreting the national trends is the dominance of birds in the dataset. In 2022, birds made up 25% of the species represented in the index and 84% of time series datasets. As such, the overall national trend closely follows the trend for birds.

For any particular trend permutation, it is imperative to examine the spatial representativeness and species and time series data availability plots when examining a trend, as these tell you how reliable the generated trend is likely to be. Consider the example below — the trend for mammals in the Northern Territory from the 2022 index. The trend plot suggests a significant increase in abundance after 2017; however, the species and time series availability plots show that the index only includes data from a single-species after 2017. Clearly this upturn in the trend is not representative of overall trends for mammals in the Northern Territory after 2017.

An example of a spurious trend – the trend for mammals in the Northern Territory between 2018 and 2019. The species representation plot shows that the upturn in abundance between 2018 and 2019 results from data for only a single species.

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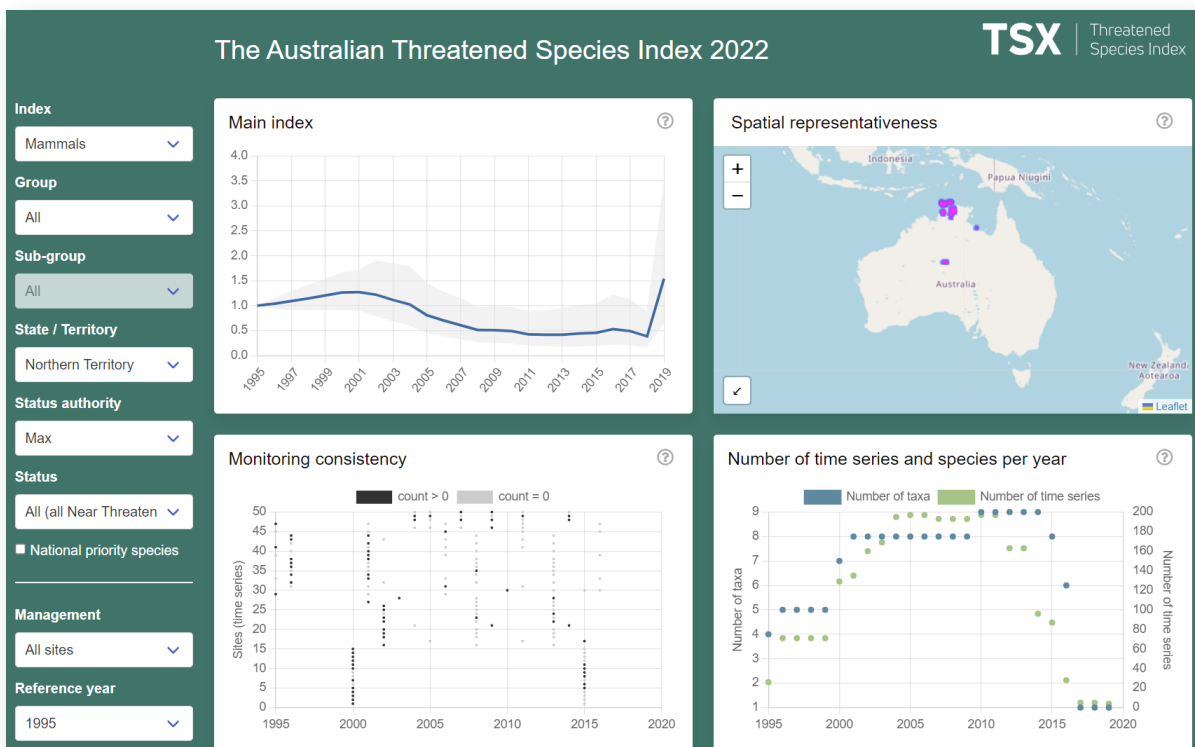
The TSX also now includes the ability to generate single species trends, via the Data Management Interface. Care must be taken when interpreting these trends. They are merely the ratio of the population parameter supplied from one year to the next, with interpolation of missing years of data included using the approaches described in section 5.2.3. As such, they are prone to larger variance ('noise') than is seen in the multi-species trends, for which the LPI method was specifically designed. Likewise, any factors that lead to unrepresentative oscillations of abundance will not be filtered out, such as periods of dormancy for the focal taxa (consider orchids that don't flower during drought) or periods abundance booms (which could be real or merely the result of a temporary influx of individuals to the sampled area, such as threatened honeyeaters flocking to flowering eucalypts).

5.3. DATA QUALITY ASSURANCE

To ensure that we produce the most accurate index, given the available data, we go through a rigorous custodian feedback survey process. For each new dataset received in the annual data call we populate a personalised survey that is sent to the data custodian. The purpose of this survey is to evaluate the accuracy of the data provided and whether the trend produced is an accurate representation of the population being monitored. The custodian has the opportunity to review summary statistics for their data, the trend produced, and additional diagnostic maps and plots. Only when a custodian approves the dataset is it included in the annual release of the index. In situations where a custodian is unable to provide feedback, or chooses not to, the TSX team will assess the data, trend and diagnostic plots and make an informed decision about whether or not to include the monitoring dataset in the final release of the index.

5.4. MANAGING SENSITIVE LOCATION DATA

Given the sensitive nature of the location of threatened species monitoring, coordinates and sensitive site names are removed before the data is shared publicly. The publicly available aggregated database of the TSX currently only identifies locations to the level of biogeographic subregions, which are typically greater than 10x10km. These are the Interim Biogeographical Regionalisation for Australia (IBRA) subregions of which Australia has 419 in total.

5.5. ANNUAL RELEASE OF THE TSX

Once the TSX is calculated using all quality assured monitoring data it is ready to be released. This first involves calculating all trend permutations for all index subsets (e.g. species group and sub-group, state and territory, reference year etc.). These permutations are then uploaded to our TSX Trend Visualiser Tool, accessible to the public.
To find out more about the visualiser tool, and how to use it, please see Chapter 4.

Orange-bellied Parrot (Critically Endangered)
Image: J. Harrison/Wikimedia

FURTHER READING

TSX PUBLICATIONS

Bayraktarov, E. et al. (2021). A threatened species index for Australian birds. Conservation Science and Practice 2021;3:e322.

Bayraktarov, E. et al. (2021). Variable effects of protected areas on long-term multispecies trends for Australia's imperilled birds. Conservation Science and Practice 2021;3:e443.

Tulloch, A. et al. (2023) Effects of different management strategies on long-term trends of Australian threatened and near-threatened mammals. Conservation Biology 2023;2:e14032.

LIVING PLANET INDEX PUBLICATIONS AND REPORTS

Loh, J. et al. (2005). The Living Planet Index: using species population time series to track trends in biodiversity. Philosophical Transactions of the Royal Society of London B 360, 289–295.

Collen, B. et al. (2009). Monitoring change in vertebrate abundance: the Living Planet Index. Conservation Biology 23, 317–327.

McRae, L. et al. (2017). The diversity-weighted Living Planet Index: controlling for taxonomic bias in a global biodiversity indicator. PLoS ONE 12, e0169156.

WWF (2022). Living Planet Report 2022 – Building a nature positive society. Almond, R., Grooten, M., Juffe Bignoli, D. and Petersen, T. (Eds). WWF, Gland, Switzerland.

Westveer, J. et al. (2022). A Deep Dive into the Living Planet Index: A Technical Report. WWF, Gland, Switzerland.

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DCCEEW (2022). Threatened Species Action Plan, 2022-2032. Department of Climate Change, Energy, the Environment and Water, Canberra.

Murphy, H. and Van Leeuwen, S. (2021). Biodiversity. State of the Environment Report, 2021. Australian Government, Canberra.

DCCEEW (2024). The Saving Native Species Program. Department of Climate Change, Energy, the Environment and Water, Canberra.

DCCEEW (2024). Regional Delivery Partners MERI Framework. Department of Climate Change, Energy, the Environment and Water, Canberra.