Technical information supporting the 2018 inland water native flora (population trends and percentage threatened) trend and condition report card

DEW Technical note 2018/07

Government of South Australia
Department for Environment and Water

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Department for Environment and Water

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Summary

This document describes the indicators, data sources, analysis methods and results used to develop this report and the associated report card. The reliability of data sources for their use in this context are also described.

1 Introduction

1.1 Species

Australia is a country rich in unique plants and animals. They are core to our identity, culturally significant to Indigenous peoples, important to the health of our environment and a strong contributor to our economy. All species are important for a healthy and diverse environment. Once plants and animals become extinct they are gone forever.

John Woinarski, writing for the National Environmental Science Program, makes a compelling case for striving to prevent extinctions. Justification for preventing extinction necessarily covers the spectrum of values held in society from utilitarian value (e.g. plant and animal species provide food or pharmaceuticals) through to the greatness of our society (e.g. extinctions are a sign that our society cares too little for others) and respect for indigenous people (for most indigenous people, affinity with plants and animals is profound).

1.2 Inland water native flora

Inland waters are aquatic-influenced environments located within land boundaries - they can be fresh, saline or somewhere in between. Inland waters can include land where it is influenced directly by aquatic habitat. For example the vegetation near water bodies - e.g. lignum (*Duma florulenta*) - is influenced greatly by proximity to water. South Australian inland waters include rivers, streams, drains, wetlands and salt lakes. Many of these inland waters are ephemeral - they are wet or flooded some of the time but dry at other times. All these types of inland waters can be very productive following flooding, with a range of characteristic species taking advantage of the increased nutrient and water availability. This report card focuses on species whose populations rely on any of these types of inland waters.

Plant species sometimes do not fit neatly into a theme of terrestrial, inland waters or coastal and marine. There is much overlap and a definitive list of species that fall into each theme was not a realistic goal. Here, using the guidelines outlined in the methods each species is assigned to one or more themes as appropriate. Most species were easily assigned to one theme (e.g. beaked red mallee *Eucalyptus socialis* to terrestrial), some were assigned to two themes (e.g. lignum *Duma florulenta* and thatching grass *Gahnia filum* were both assigned to inland waters and terrestrial) and some were assigned to all three themes (e.g. thick-headed samphire *Sarcocornia blackiana*).

1.3 Environment trend and condition reporting

The Minister for Environment and Water under the *Natural Resources Management Act 2004* is required 'to keep the state and condition of the natural resources of the State under review'. Environmental trend and condition report cards for South Australia are produced as a primary means for undertaking this review. Previous environmental trend and condition report card releases reported against the targets in the South Australian Natural Resources Management Plan (Government of South Australia 2012a) using the broad process outlined in the NRM State and Condition Reporting Framework (Government of South Australia 2012b).

As the State NRM plan is currently under review, environmental trend and condition report cards in early 2018 will instead inform the next South Australian State of the Environment Report (SOE) due out in 2018. Again, there is a legislative driver to guide the development of SOE reporting. The *Environment Protection Act 1993*, which is the legislative driver to guide the development of SOE reporting, states that the SOE must:

- include an assessment of the condition of the major environmental resources of South Australia 112(3(a))

- include a specific assessment of the state of the River Murray, especially taking into account the Objectives for a Healthy River Murray under the *River Murray Act 2003* 112(3(ab))
- identify significant trends in environmental quality based on an analysis of indicators of environmental quality 112(3(b)).

Environmental trend and condition report cards will be used as the primary means to address these SOE requirements.

1.3.1 Environmental trend and condition report card continual improvement

Key documents guiding the content of environmental trend and condition report cards are:

- Trend and Condition Report Cards Summary Paper (DEWNR 2017)
- NRM State and Condition Reporting Framework (Government of South Australia 2012b).

As the process by which the environmental trend and condition report cards are produced evolves, there is an increased emphasis, in keeping with the digital by default declaration, on the use of open data and reproducibility. This is one key response to help address the second key learning outlined above. The report cards being produced to inform the 2018 State of the Environment Report are at varying stages along this route to open data and reproducibility.

2 Methods

Species were grouped according to broad taxonomic groups (dicotyledons, ferns and allies and monocotyledons) and habitat preferences (based on the reporting themes of terrestrial, inland waters and coastal and marine).

2.1 Indicators

The indicators used in this inland water native flora report card are percentage threatened and population trends.

2.2 Data sources

This report card is based on three species datasets:

- Regional species conservation assessment project (RSCA)
- Threatened species schedule review (TSSR)
- Flora species threatened worldwide (Pitman and Jørgensen 2002).

The RSCA used IUCN red list categories and criteria (IUCN 2001; IUCN 2012a; IUCN 2012b) to assign conservation status and population trends to each species within each Interim Bioregionalisation of Australia (IBRA, Environment Australia 2000) Subregion in South Australia (Gillam and Urban 2008; Gillam and Urban 2009; Gillam and Urban 2010; Gillam and Urban 2011; Gillam and Urban 2013; Gillam and Urban 2014a; Gillam and Urban 2014b). All vertebrates and vascular plant species were assessed for their level of threat and likelihood of extinction. The process was based on both quantitative and qualitative information to make best use of available science and information, including the expertise of skilled people in various specialist areas. Through workshops, panels of experts rated species according to their perceived risk of extinction (following the methods of IUCN 2012a) and allocated a trend to species' populations. Trends were allocated based on the last 10 years or three generations, whichever was longer, and could also include a future projection over the next 10 years. Panels were made up of persons known to have expertise in certain fields relating to flora and fauna (e,g, herpetology, ornithology, orchids) including field naturalists, persons from specialist groups and staff from the South Australian Museum and Department for Environment and Water. The dataset resulting from this project is available online.

The TSSR project assigned conservation status to all vertebrates (except marine fishes) and vascular plants statewide (i.e. for all of South Australia), using similar methods to the RSCA project.

For the purposes of this report card species populations status were classified as per Table 1 and population trends were classified as per Table 2.

The percentage of flora species threatened worldwide were taken from published data (Pitman and Jørgensen 2002). Estimates of the number and proportion of plant species threatened with extinction worldwide ranged between 22% and 47% (Pitman and Jørgensen 2002).

Table 1 Regional species assessment threat categories (e.g. Gillam and Urban 2008) with report card threatened status

Status	Description	Population status used for report card
EX	Extinct	Not threatened
EW	Extinct in the wild	Not threatened
RE	Regionally extinct	Threatened

Status	Description	Population status used for report card
CR	Critically endangered	Threatened
EN	Endangered	Threatened
VU	Vulnerable	Threatened
RA	Rare	Not threatened
NT	Near threatened	Not threatened
LC	Least concern	Not threatened
DD	Data deficient	Unknown
NE	Not evaluated	Unknown

Table 2 Regional species assessment trend categories (e.g. Gillam and Urban 2008) with report card population trend

Trend	Description	Population trends used for report card
++	Definite increase	Increase
+	Probable increase	Increase
0	Stable	Stable
-	Probable decline	Decline
–	Definite decline	Decline
DD	Data deficient	Unknown
	Not assessed	Unknown

2.2.1 Themes

There is no readily available data set to assign all South Australian species to State of the Environment report themes (terrestrial, inland waters and/or coastal and marine). Therefore, themes were assigned using a variety of datasets, approaches and weightings, including expert knowledge. Details of dataset used are provided in Table 3.

Species were assigned reporting themes at a population level, i.e. if the species population required the theme (habitat) to survive and successfully reproduce. As a result species requiring multiple habitats were assigned multiple themes.

There are a number of caveats related to the assignment of reporting themes which are provided in Table 4.

Table 3 Datasets used to assign reporting themes (terrestrial, inland waters and/or coastal and marine)

Dataset	Usage	Weight	Custodian
Northern Territory flora and fauna database ('MALA' - extract 14 November 2017)	Match binomials to taxa from RSCA and TSSR	low	Department of Environment and Natural Resources, Northern Territory

Dataset	Usage	Weight	Custodian
Queensland WildNet database (extract 15 November 2017)	Match binomials to taxa from RSCA and TSSR	low	Department of Science, Information Technology and Innovation, Brisbane
Plant species attributes	Extract using criteria deemed likely to fit theme definitions (e.g. tolerance of inundation > 6 months suggests inland waters theme). Match binomials to taxa from RSCA and TSSR	medium	Matt White, Arthur Rylah Institute (ARI), Government of Victoria
Plant species attributes ecological lifeform dataset from the Biological Databases of South Australia (BDBSA - extract 24 November 2017)	Expert attribution of themes based on attributes available for about 260 plant species (e.g. many species attributed with 'aquatic' were themed as inland waters). Match binomials to taxa from RSCA and TSSR	medium	Department for Environment and Water, Government of South Australia
South Australian indigenous water dependent sedges & rushes listing (R.L. Taplin 2001) based on records from the State Herbarium of South Australia	Expert attribution of themes to R. L. Taplin categories. Match binomials to taxa from RSCA and TSSR	medium	R.L. Taplin
Encyclopedia of Life species trait information (EOL - extract November 2017)	Expert attribution of themes to keywords. Match binomials to taxa from RSCA and TSSR	low	Encyclopedia of Life
Regional species assessment comments and common names	Expert attribution of themes to keywords. Match binomials to taxa from RSCA and TSSR	low	Department for Environment and Water, Government of South Australia
Threatened species schedules review comments fields and common names	Expert attribution of themes to keywords. Match binomials to taxa from RSCA and TSSR	low	Department for Environment and Water, Government of South Australia
Report card specific theme definitions for vertebrates and specific plant groups	Expert attribution of themes to individual taxa. Match binomials to taxa from RSCA and TSSR	high	Department for Environment and Water, Government of South Australia

Table 4 Known caveats, in no particular order, relating to assignment of reporting themes

Aspect	Caveat
Taxonomy	Taxonomic nomenclature was based on the RSA and TSSR datasets. The exception was in relation to extracting trait data from EOL. In this case the global names resolver function (gnr_resolve) in the taxize package (Chamberlain *et al.* 2018) was used to match taxonomy between RSA and TSSR with EOL
Binomial name matching for assigning theme	In determining themes binomial names only were used to match with theme datasets. This maximized the chances of matching taxonomy between datasets but came at the expense of resolution at the subspecies level. That is, all subspecies (trinomial names) were themed identically

Aspect	Caveat
Flora species - no habitat information	Where no habitat information was readily available for a species and the genera is usually terrestrial then the species has been assigned terrestrial

2.3 Spatial scales

Analyses were undertaken at two spatial scales: statewide and NRM regions. The worldwide data was also included in the analysis to enable use of the worldwide data as a benchmark. Figure 1 shows the NRM regions. As the regions used in the regional species assessment project were not the same as NRM regions, assignation to NRM regions were made as per Table 15 in the Appendix. Boundaries used by the regional species assessment project are plotted with NRM Region boundaries in Figure 1.

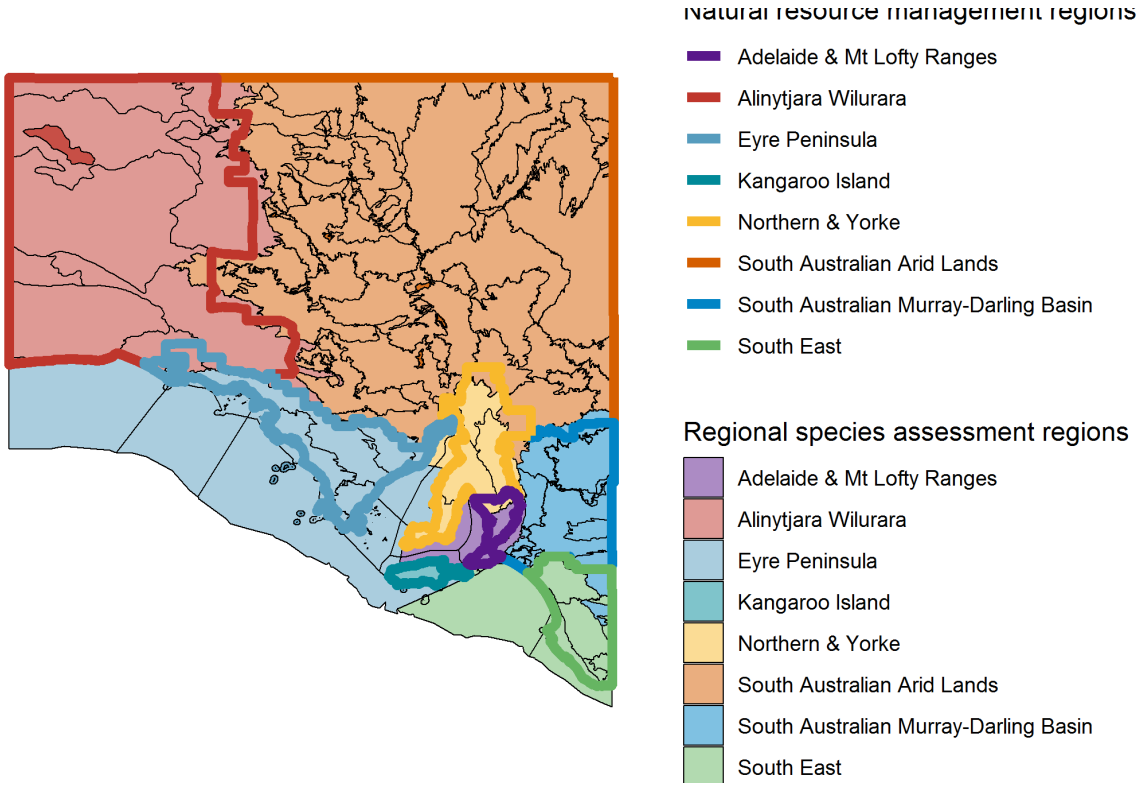

Figure 1 Relationship of regional species assessment regions - based on Interim Biogeographical Regionalisation of Australia (Environment Australia 2000) Subregions - to the NRM regions

2.4 Analysis

2.4.1 Data preparation

The dataset was filtered for species assigned to the theme inland waters. Taxonomic groups within IBRA Subregions formed **analysis units** that fed the analyses. Within each analysis unit the proportion of inland water native flora that had been assessed was determined. As per the methods advocated by the red list of threatened species regarding, 'How many species are threatened?' IUCN, access date August 2017, only analysis units in which

greater than 80% of species had been evaluated were included in further analyses. This was done for both conservation status and population trend.

The percent of species threatened within each analysis unit was determined by counting the threatened species (Table 1) and dividing by the number of species in that analysis unit.

Analysis unit population trends was determined by summing the trends (Table 2) for each species in the unit and dividing by the number of species in that analysis unit.

Each analysis unit formed a data point in the analyses described below.

2.4.2 Trend

Population trends were analysed at two scales: statewide and NRM regions (eight NRM regions, see Figure 1). Bayesian generalised linear mixed models were used to test the following at each scale for:

- statewide, the distribution of credible values for population trend
- regional, the distribution of credible values in each NRM Region for population trend.

Analyses were run using the rstanarm package (Stan Development Team 2016) in R (R Core Team 2017). Taxonomic group was treated as a random effect in the analysis. Each IBRA Subregion was assumed to provide an independent data point for the analysis.

Generic definitions for trend are provided in Table 5, including the specific values used here as thresholds to define the classes. Trend was assigned based on the distribution of credible values for slope relative to those thresholds.

Table 5 Definition of trend classes used

Trend	Description	Threshold
Getting better	Over a scale relevant to tracking change in the indicator it is improving in status with good confidence	Greater than 90% likelihood that species population trends are positive
Stable	Over a scale relevant to tracking change in the indicator it is neither improving or declining in status	Less than 90% likelihood that species population trends are positive or negative
Getting worse	Over a scale relevant to tracking change in the indicator it is declining in status with good confidence	Greater than 90% likelihood that species population trends are negative
Unknown	Data are not available, or are not available at relevant temporal scales, to determine any trend in the status of this resource	-
Not applicable	This indicator of the natural resource does not lend itself to being classified into one of the above trend classes	-

2.4.3 Condition

Conservation status was analysed at two scales: statewide and NRM regions (eight NRM regions, see Figure 1). Bayesian generalised linear mixed models were used to test the following at each scale for:

- statewide, the distribution of credible values for percentage of species threatened
- regional, the distribution of credible values in each NRM Region for percentage of species threatened.

Analyses were run using the rstanarm package (Stan Development Team 2016) in R (R Core Team 2017). Taxonomic group was treated as a random effect in the analysis. Each IBRA Subregion was assumed to provide an independent data point for the analysis.

Generic definitions for condition based on percentage of species threatened are provided in Table 6, including the specific values used here as thresholds to define the classes. Condition was assigned based on comparison of the distribution of credible values for percentage of species threatened to a worldwide benchmark sourced from Vié *et al.* (2009).

Table 6 Definition of condition classes used

Condition	Description	Threshold
Very good	The natural resource is in a state that meets all environmental, economic and social expectations, based on this indicator. Thus, desirable function can be expected for all processes/services expected of this resource, now and into the future, even during times of stress (e.g. prolonged drought)	No species are threatened
Good	The natural resource is in a state that meets most environmental, economic and social expectations, based on this indicator. Thus, desirable function can be expected for only some processes/services expected of this resource, now and into the future, even during times of stress (e.g. prolonged drought)	90% credible intervals are entirely below lower worldwide estimate (<22%)
Fair	The natural resource is in a state that does not meet some environmental, economic and social expectations, based on this indicator. Thus, desirable function cannot be expected from many processes/services expected of this resource, now and into the future, particularly during times of stress (e.g. prolonged drought)	90% credible intervals overlap with range of worldwide estimates (22-47%)
Poor	The natural resource is in a state that does not meet most environmental, economic and social expectations, based on this indicator. Thus, desirable function cannot be expected from most processes/services expected of this resource, now and into the future, particularly during times of stress (e.g. prolonged drought)	90% credible intervals are entirely above upper worldwide estimate (>47%)
Unknown	Data are not available to determine the state of this natural resource, based on this indicator	-
Not applicable	This indicator of the natural resource does not lend itself to being classified into one of the above condition classes	-

2.5 Reliability

Information is scored for reliability based on the average of subjective scores (1 [worst] to 5 [best]) given for information currency, applicability, level of spatial representation and accuracy. Definitions guiding the application of these scores are provided in Table 7 for currency, Table 8 for applicability and Table 9 for spatial representation.

Table 7 Guides for applying information currency

Currency score	Criteria
1	Most recent information >10 years old

Currency score	Criteria
2	Most recent information up to 10 years old
3	Most recent information up to 7 years old
4	Most recent information up to 5 years old
5	Most recent information up to 3 years old

Table 8 Guides for applying information applicability

Applicability score	Criteria
1	Data are based on expert opinion of the measure
2	All data based on indirect indicators of the measure
3	Most data based on indirect indicators of the measure
4	Most data based on direct indicators of the measure
5	All data based on direct indicators of the measure

Table 9 Guides for applying spatial representation of information (sampling design)

Spatial score	Criteria
1	From an area that represents less than 5% the spatial distribution of the asset within the region/state or spatial representation unknown
2	From an area that represents less than 25% the spatial distribution of the asset within the region/state
3	From an area that represents less than half the spatial distribution of the asset within the region/state
4	From across the whole region/state (or whole distribution of asset within the region/state) using a sampling design that is not stratified
5	From across the whole region/state (or whole distribution of asset within the region/state) using a stratified sampling design

Spatial reliability in the case of this inland water native flora assessment was applied to the proportion of analysis units for which more than 80% of taxa had an assessment that was known (i.e. increasing, stable or decreasing in Table 2.

2.6 Software

This report card has been generated using public licence software and reproducible research techniques. This report and the information on the associated report card were prepared using R (R Core Team 2017), RStudio (RStudio Team 2016) and rmarkdown (Allaire *et al.* 2017). The R packages used in the creation of this report and report card are given in Table 10.

Table 10 R (R Core Team 2017) packages used in the production of this report

Package	Citation
bookdown	Xie (2018a)
forcats	Wickham (2018a)
ggridges	Wilke (2018)
gridExtra	Auguie (2017)
knitr	Xie (2018b)
maptools	Bivand and Lewin-Koh (2017)
readxl	Wickham and Bryan (2018)
repmis	Gandrud (2016)
rgdal	Bivand *et al.* (2018)
RODBC	Ripley and Lapsley (2017)
rstan	Guo *et al.* (2018)
rstanarm	Gabry and Goodrich (2018)
stringr	Wickham (2018b)
taxize	Chamberlain *et al.* (2018)
tidytext	Robinson and Silge (2018)
tidyverse	Wickham (2017)
traits	Chamberlain *et al.* (2017)

3 Results

3.1 Inland water native flora summary

Aggregating data from the RSCA and TSSR projects gave a total of 4157 taxa in 13 taxonomic classes. Of those taxa 501 were considered to be inland water native flora. Table 11 shows the number of taxa from each taxonomic group considered to be inland water native flora.

Table 11 Number of taxa in each taxonomic group considered to be inland water native flora

Taxonomic group	Number of taxa
Dicotyledons	413
Ferns and allies	23
Monocotyledons	65

3.2 Population trends

Inland waters species population trends are provided in Table 12 with distribution of credible values and model results displayed in Figure 2 and 3. Using the thresholds provided in Table 5, AW and SAAL NRM regions were stable with less than 90% likelihood that population trends were positive or negative. EP, NY, SAMDB and SE were all getting worse with greater than 90% likelihood that species population trends were negative. Population trends statewide were getting worse.

Table 12 Likelihood of each trend class

Area	Likelihood of getting worse	Likelihood of getting better	Trend
State	0.94200	0.05800	Getting worse
AW	0.57625	0.42375	Stable
EP	0.94100	0.05900	Getting worse
NY	0.98375	0.01625	Getting worse
SAAL	0.67375	0.32625	Stable
SAMDB	0.99975	0.00025	Getting worse
SE	0.97900	0.02100	Getting worse
AMLR	-	-	Unknown
KI	-	-	Unknown

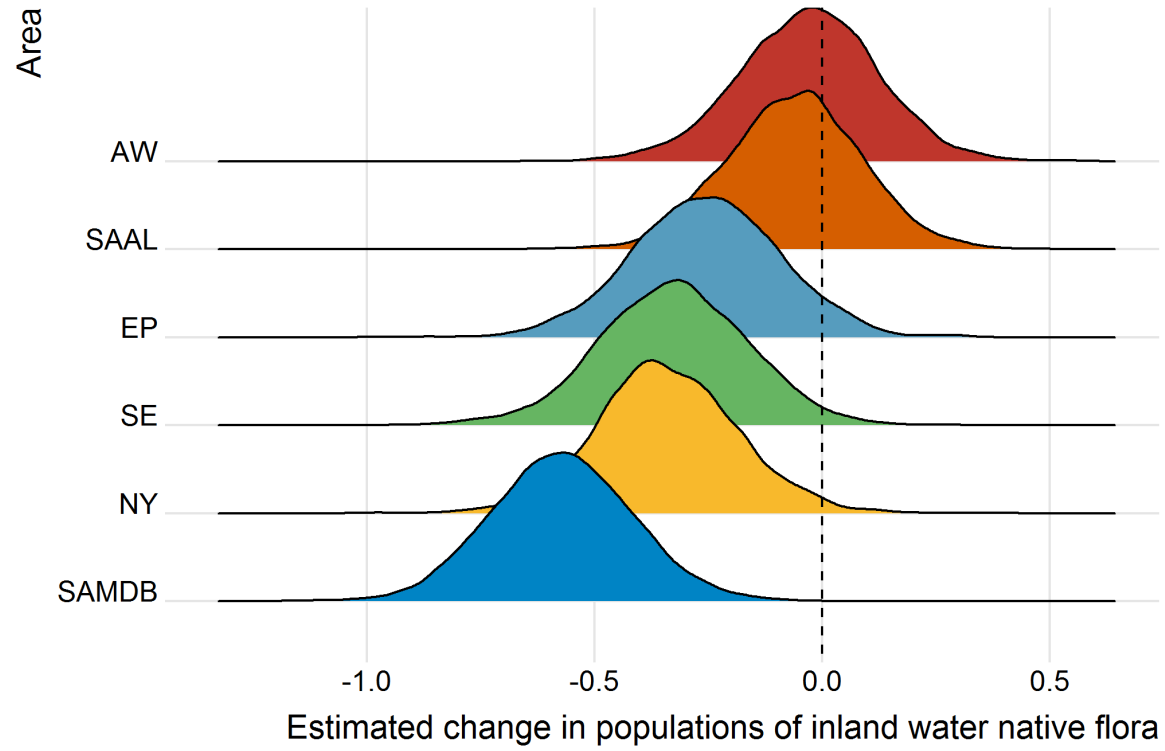

Figure 2 Distribution of credible values for population trend. -1: all species declining to 1: all species increasing

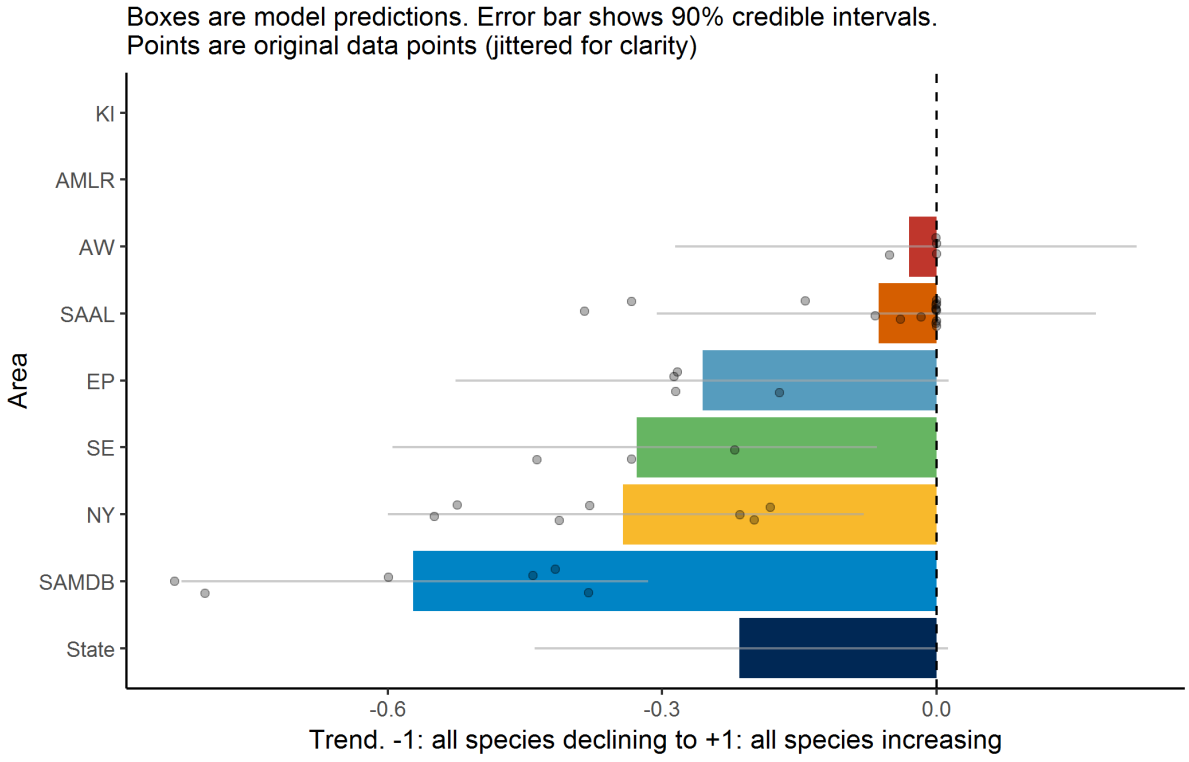

Figure 3 Plot of model results, including original data points

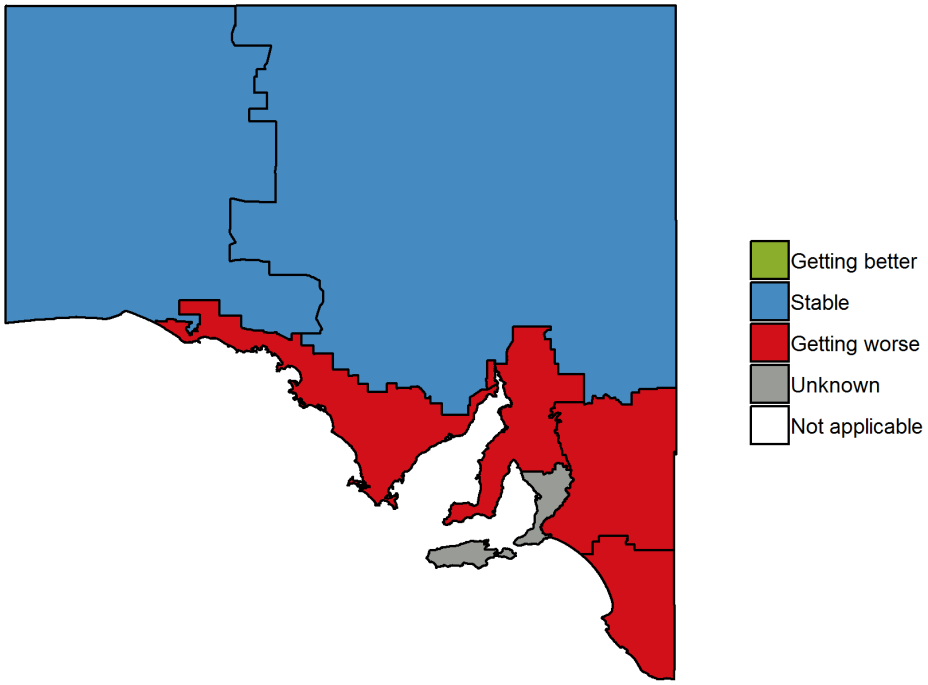

Figure 4 Trend in species populations in each NRM Region

3.3 Condition

Percentage threatened results are provided in Table 13 with distribution and model results displayed in Figure 5 and 6. Using the thresholds provided in Table 6 AMLR, EP, KI, NY, SAMDB and SE NRM regions were classified as fair and AW and SAAL NRM regions were classified as good. Condition at the state scale was fair.

Table 13 Proportion of species threatened

Area	Percentage threatened	90% credible interval	Condition
AMLR	25.3	18.8 to 32.4	Fair
AW	2.3	0.9 to 4.3	Good
EP	18.7	12.8 to 26.2	Fair
KI	22.4	15.7 to 30.3	Fair
NY	23.3	16.3 to 31.7	Fair
SAAL	8.0	5.2 to 11.1	Good
SAMDB	23.7	17.6 to 31.3	Fair
SE	27.9	21.6 to 36.3	Fair
State	19.3	15 to 24.1	Fair

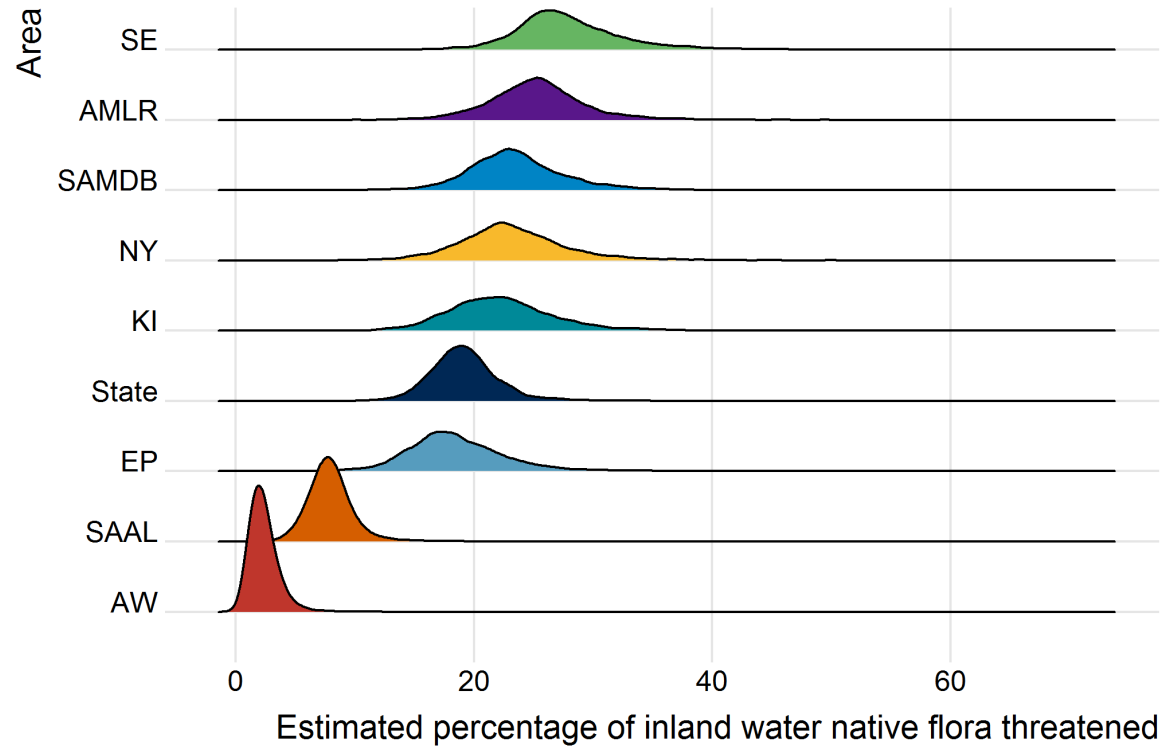

Figure 5 Distribution of credible values for percentage of species threatened

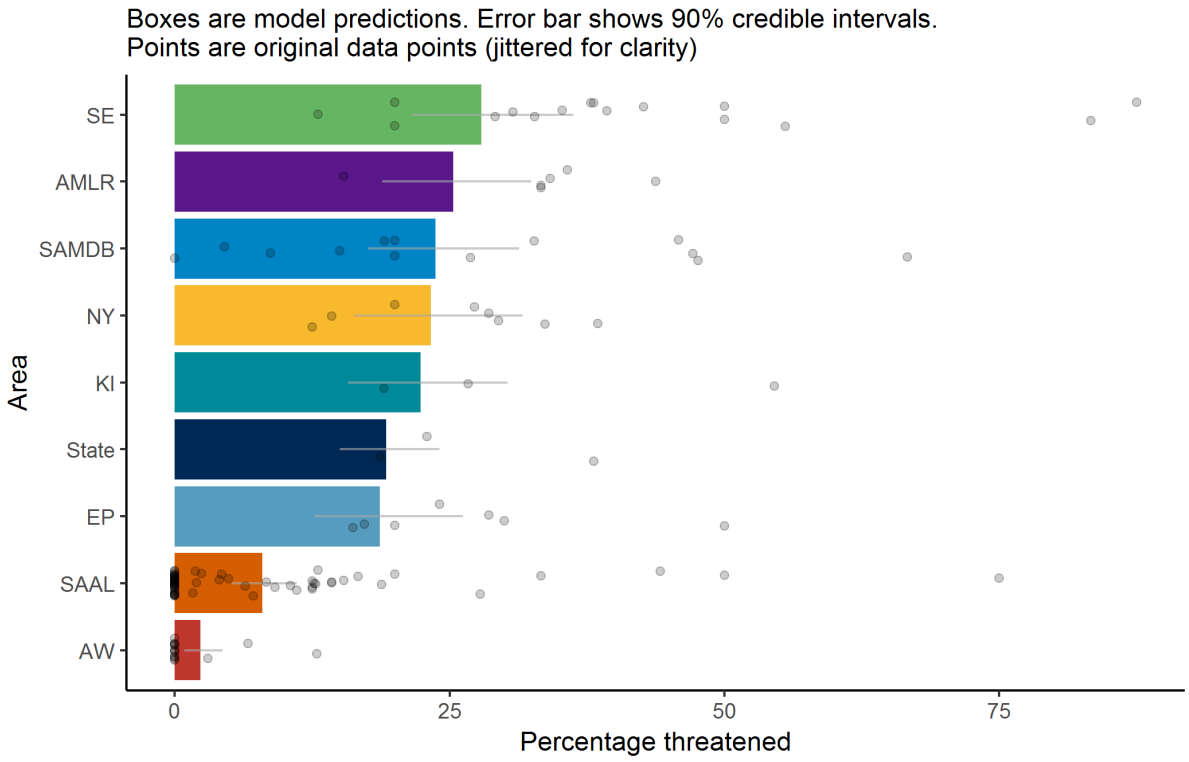

Figure 6 Plot of model results along with raw data

3.4 Reliability

The overall reliability score for this report card is 2.5 (Table 14) as the data are:

- based on reports that are between 10 and 4 years old
- based largely on expert opinion
- available across the entire range of interest (either state or NRM Region) but comparisons are limited for percentage threatened as very few taxonomic groups reach the 80% evaluated threshold worldwide.

Table 14 Information reliability scores for inland water native flora population trends and percentage threatened

Indicator	Currency score	Applicability score	Spatial score	Overall reliability
Percentage threatened	3	1	5	3.0
Population trends	3	1	2	2.0
Overall	-	-	-	2.5

4 Discussion

Trend in species populations statewide was **getting worse**. The 2015 estimate of percentage of species threatened was 19.25% which was classified as **fair** by comparison to a worldwide benchmark.

Ideally information reliability for this report card would be higher than the overall score of 2.5 to provide greater confidence in the results. Aspects that would assist this include using more current data, indicators that are not largely reliant on expert opinion and the ability to compare to worldwide datasets that cover more taxonomic groups than are currently available. As a result, future versions of species reporting may be based on either the Living Planet Index or a similar threatened species index.

Trend and condition results for inland water native flora show a split between the agricultural and arid zone NRM regions. The arid zone NRM regions (AW, SAAL) had lower percentage species threatened and less declining population trends. In contrast the agricultural zone NRM regions (AMLR, EP, KI, NY, SAMDB and SE) all had higher percentage species threatened and, except for KI, more declining population trends. These results are correlated with a decrease in percentage cover of wetlands in several of the agricultural NRM regions (AMLR, KI and SE) and much lower percentage cover of native vegetation in the agricultural NRM regions than the arid NRM regions (Willoughby *et al.* 2017). Habitat loss, in this case through either vegetation clearance or declining wetland area, has consistently been shown to lead to biodiversity loss (Haila 2002; Fahrig 2003), perhaps explaining the results observed.

Intensification of land use (e.g. increase in plantation (hardwood) and orchards/vineyards) across the higher rainfall NRM regions of South Australia represent shifts in land cover from extensive agricultural systems (cropping and grazing) to intensive systems. This shift has also been noted worldwide and is strongly associated with intensification of use of water resources (Meyer and Turner 1992; Vörösmarty *et al.* 2010; Davis *et al.* 2015). Wetlands are particularly susceptible to impacts from water resource development (Brinson and Malvárez 2002), and an estimated two-thirds reduction in global wetland area occurring since 1900 has been mainly attributed to the direct actions of humans (Davidson 2014). It is therefore likely that a corresponding decline in wetland cover in higher rainfall NRM regions is attributable, at least partially, to land use intensification and its associated impacts on water resources. Detailed local-scale studies in the South East provide further evidence to support the link between land and water use intensification and decline in wetland area, but also highlight the importance of a decline in rainfall from approximately 1992 (Harding *et al.* 2015; Harding *et al.* 2017).

Loss of native vegetation cover leads directly to habitat loss and fragmentation, the combination of increased distance between patches of native vegetation and decrease in size of patches (Fahrig 2003). The fragmentation of habitat leads to changes in the way species disperse and use native vegetation. Further, loss of native vegetation cover contributes to the degradation of remaining native vegetation as it is often accompanied by a suite of other pressures such as changed grazing regime, insect attack, disease, weeds, rising water tables, salinity, changed fire regime, increased pollution (exposure to fertilizers, herbicides and insecticides), reduced pollinators and/or unsustainable firewood collection (e.g. Saunders *et al.* 1991). For all these reasons, it is more likely that species will become threatened, or their populations will be declining, in areas with lower levels of native vegetation cover.

5 Appendix

Table 15 Mapping regional species assessment project regions to NRM regions

NRM Region	Regional species assessment region code	Regional species assessment region
Adelaide & Mt Lofty Ranges	KAN2	Fleurieu
Adelaide & Mt Lofty Ranges	FLB1	Mount Lofty Ranges
Adelaide & Mt Lofty Ranges	SVG	St Vincent Gulf (IMCRA)
Alinytjara Wilurara	CR1	Mann-Musgrave Block
Alinytjara Wilurara	CR3	Everard Block
Alinytjara Wilurara	CR2	Watarru
Alinytjara Wilurara	FIN3	Tieyon
Alinytjara Wilurara	GVD3	Maralinga
Alinytjara Wilurara	GVD4	Kintore
Alinytjara Wilurara	GVD5	Tallaringa
Alinytjara Wilurara	GVD6	Yellabinna
Alinytjara Wilurara	HAM	Hampton
Alinytjara Wilurara	NUL1	Carlisle
Alinytjara Wilurara	NUL2	Nullarbor Plain
Alinytjara Wilurara	NUL3	Yalata
Eyre Peninsula	EUC	Eucla (IMCRA)
Eyre Peninsula	MUR	Murat (IMCRA)
Eyre Peninsula	EYR	Eyre (IMCRA)
Eyre Peninsula	EYB3	Eyre Hills
Eyre Peninsula	EYB4	Talia
Eyre Peninsula	EYB5	Eyre Mallee
Eyre Peninsula	SG	Spencer Gulf (IMCRA)
Kangaroo Island	KAN1	Kangaroo Island
Northern & Yorke	EYB1	Southern Yorke
Northern & Yorke	EYB2	St Vincent
Northern & Yorke	FLB2	Broughton
Northern & Yorke	FLB4	Southern Flinders
Northern & Yorke	NSG	North Spencer Gulf (IMCRA)
South Australian Arid Lands	BHC1	Barrier Range
South Australian Arid Lands	BHC4	Barrier Range Outwash
South Australian Arid Lands	BHC5	Bimbowrie
South Australian Arid Lands	BHC6	Curnamona
South Australian Arid Lands	CHC2	Sturt Stony Desert
South Australian Arid Lands	CHC4	Diamantina-Eyre

NRM Region	Regional species assessment region code	Regional species assessment region
South Australian Arid Lands	CHC6	Coongie
South Australian Arid Lands	CHC7	Lake Pure
South Australian Arid Lands	FIN4	Pedirka
South Australian Arid Lands	FLB3	Olary Spur
South Australian Arid Lands	FLB5	Northern Flinders
South Australian Arid Lands	FLB6	Central Flinders
South Australian Arid Lands	GAW1	Myall Plains
South Australian Arid Lands	GAW2	Gawler Volcanics
South Australian Arid Lands	GAW3	Gawler Lakes
South Australian Arid Lands	GAW4	Arcoona Plateau
South Australian Arid Lands	GAW5	Kingoonya
South Australian Arid Lands	GAW6	Torrens
South Australian Arid Lands	GAW7	Roxby
South Australian Arid Lands	GAW8	Commonwealth Hill
South Australian Arid Lands	SSD2	Simpson Desert
South Australian Arid Lands	SSD3	Dieri
South Australian Arid Lands	SSD4	Warriner
South Australian Arid Lands	SSD5	Strzelecki Desert
South Australian Arid Lands	STP1	Breakaways
South Australian Arid Lands	STP5	Macumba
South Australian Arid Lands	STP6	Witjira
South Australian Arid Lands	STP7	Baltana
South Australian Arid Lands	STP2	Oodnadatta
South Australian Arid Lands	STP3	Murnpeowie
South Australian Arid Lands	STP4	Peake-Dennison Inlier
South Australian Murray-Darling Basin	MDD1	South Olary Plain
South Australian Murray-Darling Basin	MDD2	Murray Mallee
South Australian Murray-Darling Basin	MDD3	Murray Lakes and Coorong
South Australian Murray-Darling Basin	MDD4	Lowan Mallee
South Australian Murray-Darling Basin	MDD7	Braemer
South Australian Murray-Darling Basin	RIV6	Murray Scroll Belt
South East	COR	Coorong (IMCRA)
South East	OTW	Otway (IMCRA)
South East	NCP1	Bridgewater

NRM Region	Regional species assessment region code	Regional species assessment region
South East	MDD5	Wimmera
South East	VVP2	Mount Gambier
South East	NCP2	Glenelg Plain
South East	NCP3	Lucindale
South East	NCP4	Tintinara

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