Atlas of Living Australia

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Atlas of Living Australia
Future Directions
National Consultation

Findings Report

Acknowledgments

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Foreword

The Atlas of Living Australia (ALA) is Australia's national biodiversity data infrastructure. The ALA acquires, harmonises and delivers open biodiversity data to support research, education, government and industry sectors. A decade after its launch, it is timely for the ALA to consider its future state given the evolution of technology, changes to user expectations, and a changing national and international policy landscape. The ALA Future Directions National Consultation process was designed to capture and synthesise stakeholder insights and needs. For the first time, we have been able to identify Australia's interests for, and expectations from, national biodiversity data infrastructure. This information will shape ALA's future developments.

The funding of the ALA by the Australian Government's National Collaborative Research Infrastructure Strategy (NCRIS) in 2006 reflected the Australian Government's commitment to improve biodiversity outcomes by providing more and better quality data. Working closely with data partners in museums, collections, government agencies and citizen science programs and with individuals, the ALA has transformed Australia's capability in this space. The success of the global Living Atlases program, which leverages ALA infrastructure and now operates in over 23 countries, illustrates the international impact that the ALA and NCRIS have delivered.

I am grateful to the many stakeholders who so willingly contributed to the ALA Future Directions National Consultation process. The ALA looks forward to working with stakeholders as we further develop this critical national infrastructure. I also thank the staff of the ALA for their commitment to this process.

Dr. Joanne Daly

Honorary Fellow, CSIRO

Author and Leader of the
ALA Future Directions National Consultation process

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Executive Summary

The Atlas of Living Australia (ALA) has been delivering biodiversity data for nine years. The national consultation process will help to inform the development of its new strategy. This activity has also been encouraged by the announcement of further funding through the Australian Government's National Collaborative Research Infrastructure Strategy (NCRIS). The consultation process adopted a semi-structured interview approach, framed around strengths, weaknesses, opportunities and threats, to garner the views of over 90 members of the ALA community, nationally and globally.

The results indicate that the ALA has pioneered a step-change in the way that Australia's biodiversity data are utilised through its approach to open data access and by providing innovative products and services and mobilising the national biodiveristy community. It now delivers more than 85 million records. The ALA's global impact has received recognition both through its technical and strategic contribution to the Global Biodiversity Information Facility (GBIF) and its technical leadership of the global Living Atlases initiative. In this regard, the ALA was acknowledged as one of the world's foremost national biodiversity data infrastructures.

The consultation highlighted that the expectations of the ALA's stakeholders are evolving and the ALA has not adapted as best possible. Notable concerns to address if the ALA is to realise its full potential as an operational data infrastructure are:

- **data quality** – this is critical for reliable decision making and quality research outputs. It is also important if the ALA seeks to move not only to aggregate data, but also to have a custodial role of curated data.

- **data diversity** – to ensure that the ALA can effectively deliver to major national biodiversity reporting, assessment and monitoring programs and help address the 'big questions' in biodiversity research.

This requires data sets that are more diverse, representative or comprehensive in terms of geography, time and taxonomy. The ALA will also need to assist partners to prioritise data collection and digitisation efforts to align with national needs.

With respect to opportunities, many stakeholders encouraged the ALA to:

- **include more industry data** as in some jurisdictions this can represent more than 85% of the current biodiversity survey effort and would provide a useful complement to the data already harmonised or potentially available from museums, collections and state biodiversity data programs.

- **focus the ALA's product and services portfolio** to reduce some confusion about the mission and scope of the ALA and to provide ongoing support for priority operations.

- **support national capability to provide standard, interoperable biodiversity data** by assisting state and territory biodiversity data systems to align their approaches with respect to standards and with hard and soft data infrastructure.

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Introduction

In Australia, effective biodiversity research, management and education all rely on comprehensive data about Australia's species. While regional or local approaches to biodiversity are relevant to some issues, it is difficult to make informed science inferences or management decisions without an integrated national overview of biodiversity in domains such as risk assessment, national-scale ecological modelling, biosecurity and responses to climate change.

Historically, one barrier to Australia's biodiversity research and management efforts has been the fragmented and inaccessible nature of biodiversity data. Data and information on Australian species have been, and still are, generated and housed in relative isolation in museums, herbaria, collections, universities, research organisations, and government departments and agencies. Obtaining an integrated suite of data from these groups takes considerable time and effort and often results in incomplete information. To overcome these issues, Australia's biodiversity information needs to be aggregated, connected and easily discoverable.

The ALA portal addresses this need. Launched in 2010, it is a centralised web-based infrastructure to capture, aggregate, manage, discover and analyse all classes of biodiversity and related data, through a suite of tools and spatial layers for use by research, industry, government and the community.

The ALA is a partnership among organisations with stewardship of biodiversity data and expertise in biodiversity informatics, including museums, biological collections, community groups, research organisations, governments, and natural resource managers. CSIRO is the lead agency for the ALA.

The ALA delivers more than 85 million biodiversity occurrence records of more than 111,000 different species from across Australia. These data are integrated with more than 500 contextual and spatial layers. It is accessed by more than 45,000 users in research, government, industry, and citizen science. The ALA enables its users to deliver impact; supports research excellence in fields such as biodiversity, genetics and ecosystem science; delivers to major natural resource management programs; and supports the international community through the provision of Australian biodiversity data.

The ALA also supports a host of activities by its users, including research, biodiversity discovery and documentation, environmental monitoring and reporting, conservation planning, biosecurity activities, education and citizen science. Enterprises and organisations leverage off the ALA's open infrastructure to create and enhance their own services and products.

The ALA is founded on the principle of open data access, which is realised through a Creative Commons by-default model for its data. This is important in the context of maximising re-use of public data produced, collected, held and funded by government as well as contributing to the Global Biodiversity Information Facility (GBIF), a global e-infrastructure for biodiversity occurrence records.

The ALA has 32 staff and forms the largest aggregate of software developers focused on biodiversity data in Australia, and one of the most significant groups internationally.

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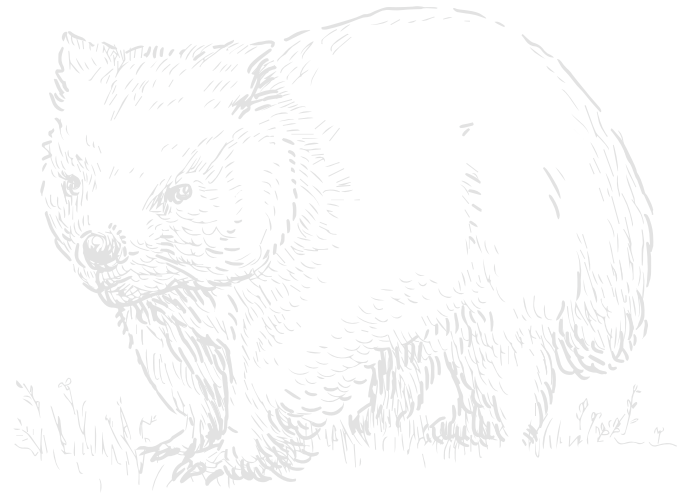
Future Directions National Consultation

The ALA is recognised as one of the world's foremost national biodiversity data infrastructures.

However, it is timely to consult with the ALA community regarding future directions. The drivers for this include:

- The ALA web portal is approaching its 10th year of operations, thus its important to reflect on the past and ask its community what has worked well and what could be improved.

- Through NCRIS, the ALA has secured operational funding for five years to June 2023, with potential funding for a subsequent five years. The ALA has a responsibility to consult with stakeholders to help set future priorities for this public, national infrastructure.

- The ALA's community and related programs in NCRIS have matured and new technologies have developed in a wide range of areas, including advanced imaging and genetics. ALA's stakeholder expectations have changed in accord and the ALA needs to respond to these and other emerging trends.

The consultation process adopted a semi-structured interview approach framed around a strengths, weaknesses, opportunities, and threats framework (SWOT) to garner the views of over 100 members of the national and international community.

The results of this report are based on a qualitative assessment of the interviews. It focuses on the areas of consensus among stakeholders.

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Stakeholders

The outcomes in this report reflect the combined contribution of more than 90 individuals and 35 organisations.

The ALA consulted with stakeholders including: related NCRIS facilities; Federal and State Government agencies with an interest in biodiversity data; existing data providers to the ALA, including natural history collections, research users in academia and science agencies, environmental management and conservation organisations; professional bodies of increasing importance to the ALA; and organisations and individuals working in the citizen science sector.

The national consultation process was designed to provide national geographic coverage in addition to interviewing key international stakeholders. The outcomes in this report reflect the combined contribution of 90 individuals and approximately 35 groups nationally and internationally. An overview of the groups consulted through the national consultation process is shown in **Appendix A**.

Figure 1. Summary of organisations and individuals consulted during the Future Directions National Consultation by sector and by interest
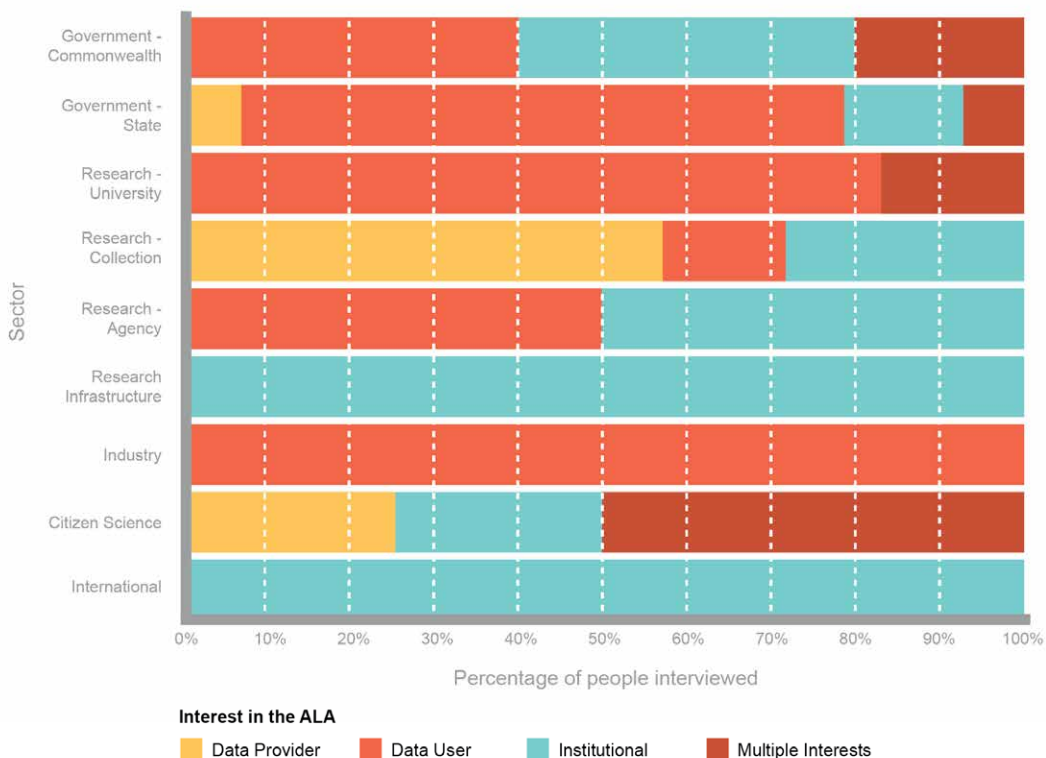
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Results

4.1 Strengths

The ALA is widely recognised as leading a step-change in how Australia harmonises and shares its biodiversity data globally. This has been achieved through significant investment over a 12-year period by NCRIS with significant in-kind contribution from ALA's data partners and co-investment and administrative support from CSIRO.

Although the ALA's priority at inception was to deliver impact to the research community, the consultation highlights the significant value now delivered to other users of biodiversity data such as government, industry and community groups. For example, in some states and territories the ALA delivers a data aggregation function for that jurisdiction not provided by any other institution. This is seen as particularly valuable in more remote parts of Australia where there may be a paucity of biodiversity data available to support research, management and reporting.

With respect to the ALA's original purpose and focus on museums and collections data, stakeholders recognise the critical role the ALA has played in unlocking and improving national access to these unique data assets. For smaller institutions, building such a contemporary data delivery system would not have been possible.

The ALA has built and supported IT products to enable the broader biodiversity data community to deliver structured data to national and global users. For example, a number of institutions

now use core ALA infrastructure to support their operations, including the Australasian Virtual Herbarium, Australian Plant Pest Database, the Department of Environment and Energy's implementation of the MERIT platform to support its monitoring and evaluation programs, and targeted products such as FishMap.

This extends globally through the ALA's and GBIF's Living Atlases program, which now sees 23 instances of ALA infrastructure supporting national biodiversity data systems outside Australia. Through ALA, NCRIS and partner investment, the ALA's contemporary IT infrastructure is now supporting multiple programs that are delivering major efficiency gains while improving the flow of data to a national system.

The ALA has also built a suite of products and services designed to mobilise Australia's biodiversity data. In addition to the core domain (ala.org.au) infrastructure, products and services include the BioCollect portfolio for supporting field data capture, ZoaTrack for animal movement data, the Spatial Portal for advanced analysis and data visualisation, and ALA4R to support analysts to use the R-package for analysis of ALA data.

Stakeholders reflected on the active leadership and coordination role delivered by the ALA, and the benefits this has delivered to Australia's biodiversity data community. Through its leadership and participation in existing forums, the ALA has been responsible for championing a standards-based approach to biodiversity data management. For example, within the Australian biodiversity data community, the ALA has promoted the use of biodiversity information standards developed by TDWG (a non-profit organisation and community dedicated to developing biodiversity information standards).

Top 5 strengths:

- Software team of high calibre and critical mass that solves the complex data interoperability issues to harmonise biodiversity data.

- Impressive amount of Australia's biodiversity data, particularly plant and bird data which are of good quality, and can be accessed free of charge.

- User friendly interface and good IT products that have underpinned and improved national and global awareness of, and access to, Australia's biodiversity holdings/collections.

- Well networked and well regarded domestically and internationally and has built a national community that is working to improve provision of biodiversity data.

- Strong institutional support from CSIRO that has helped ALA weather funding uncertainty and to retain its quality staff.

Overall, it's done a very good job. The ALA has set the global standard for biodiversity informatics and the work completed in partnership with GBIF has helped progress the cause of biodiversity databasing. There's a lot the ALA should be proud of.

Professor Andy Lowe – Ecology and Evolutionary Biology, University of Adelaide

4.2 Weaknesses

There was some confusion about ALA's mission or direction and stakeholders saw the breadth of the ALA's product portfolio as a weakness. In particular, selected products were developed by the ALA in response to project funding opportunities rather than a clear strategic vision. This has created a budgetary legacy and stakeholders commented that some of these products had no or limited forward maintenance plans, and questioned the value of the original investment. Stakeholders also sought a clearer insight into the ALA's work program, with respect to products, services and data priorities. Their feedback suggested that improving awareness of the ALA technical roadmap might help partners better align their digital biodiversity data acquisition and ICT work programs.

Foremost of the concerns, mentioned by most stakeholders, was the quality of some data delivered by the ALA and how the ALA deals with quality issues. Stakeholders specifically commented on uncertainty about taxonomic and spatial accuracy of ALA data. While it was widely acknowledged that responsibility rested with the data custodians to correct errors, it was evident that there remains a role for the ALA to provide better metrics so that users can assess whether data are fit for their purpose.

Given ALA data now originates from a variety of sources including individuals, citizen science programs, collections and museums and government programs, to name only a few, improved treatment of occurrence record metadata will become increasingly critical.

Citizen science records were seen as invaluable but less likely to be of high quality. Thus there needs to be effective controls and quality measures implemented to provide confidence in citizen science data reliability. Data quality also remains a challenge as ALA transitions from an aggregator of biodiversity data to a custodian of data for some communities. Regardless of custodianship of data, ALA may need to play a more assertive role in ensuring data quality improves, either by developing tools itself or facilitating efforts by its major providers.

The ALA has a weakness with invertebrate records. Most records are not digitised and of those that are, many species are only represented by a single specimen that may have an incorrect name attached or may be out of date.

Data quality is also a general term for other challenges identified by stakeholders including the limited geographic, temporal and taxonomic spread of data delivered through the ALA. This limits users of the ALA in their efforts to address key national biodiversity questions such as understanding species decline or ecological change more broadly. It also limits the use of the ALA to support national biodiversity monitoring, reporting and assessment programs such as State of the Environment reporting.

Top 5 weaknesses:

- Lack of clear strategy and priorities for developing the work program and lack of consultation about this in the past.

- Too many disconnected products and services because the work program is driven by project funding and opportunity rather than by a focused strategy.

- Data quality or fitness for purpose can be hard to assess and poor in some cases, including reliability of taxonomic names, lack of absence data or information about the quality of species identifications.

- Data types are not comprehensive, for example the ALA lacks genomics data and longitudinal (i.e. survey) data at scale or from a national perspective.

- Data are not targeted to key national biodiversity questions or assessments, but rather may reflect historical inconsistency of past sampling strategies given the initial focus on collections and museum data.

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As a biodiversity data system team, we need more clarity with regard to where the ALA is heading at a technical level and communicating a forward plan is critical. Having greater visibility on ALA's technical roadmap would assist us to align our systems.

Ron Avery – Biodiversity Information Systems, Department of Planning, Industry and Environment, NSW Government

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4.3 Opportunities

One of the core drivers for the national consultation process is that since the inception of the ALA much has changed – in ICT, biodiversity research, environmental policy and government programs. These changes provide the ALA new opportunities to deliver benefit if it can better understand and align with emerging drivers.

Historically, the ALA has focused on harmonising and publishing biodiversity data from collections, museums, major research, citizen science activities and some government programs. The ALA now delivers more than 85 million records. Stakeholders noted the need to better prioritise future data ingest activities and to help stakeholders prioritise future survey and digitisation programs within the framework of nationally comprehensive goals. There was widespread recognition that the ALA could play an enhanced domestic leadership role in areas such as biodiversity data informatics, to complement its international contribution.

Both Federal and State Government agencies highlighted that industry environmental assessment data, often acquired by consultants on behalf of industry and government, will increasingly become the major source of new biodiversity data in Australia. In some states, it is estimated that in excess of 85% of that state's biodiversity data now comes from such programs. This provides an opportunity for the ALA to address one of its weaknesses and will assist the ALA to deliver a truly nationally representative and comprehensive biodiversity data infrastructure. Citizen science records can play a key role here by ensuring good records for common species. Museum collections may focus on new or unusual species, but it may be the common species that are the bellwethers, giving early notice of changes in distribution and abundance.

Stakeholders were interested in the ALA working with data owners to improve data quality or to provide curated data sets, similar to those provided for weather data by the Bureau of Meteorology. Metadata analytics would inform potential users of the strengths and weaknesses of different data sets and automated systems could be used to query or correct latitude and longitude references. The ALA may be able to provide a better presentation layer of data that has been curated, while leaving the underlying data intact.

The maturing of the NCRIS program also offers opportunities to better integrate data and capabilities across partner NCRIS capabilities for national benefit. For example, the Terrestrial Ecosystems Research Network (TERN), the Integrated Marine Observing System (IMOS) and BioPlatforms Australia also collect and harmonise biodiversity data, some of which are of a similar nature to the ALA's data, while much complements the data holdings of the ALA. All three facilities spoke positively about collaborative opportunities. These platforms together could create an environmental data commons to be served by the different portals. The platforms could also explore the use of shared help desks or developers to solve common problems.

The strong software capability of the ALA staff provides a platform to build further the suite of tools that assist stakeholders. These tools could be focused on priority areas for the nation such as biosecurity, rare and endangered species, or species of conservation concern. Partnerships could also be established with parties developing emerging technology solutions.

Top 5 opportunities:

- Provide national leadership and coordination with respect to standards, biodiversity informatics, data quality and future system development.

- Deliver a more integrated national data capability and suite of services through partnerships with related NCRIS facilities.

- Become a data repository for monitoring surveys and environmental assessments collected by government and industry.

- Collect and digitise data that address key biodiversity-related research questions.

- Provide analytics that can support decision making or research insights including in new areas such as biosecurity.

"

The Australian Biological Resources Study and Bush Blitz program, and the broader Biodiversity Science Section of the Department of the Environment and Energy, will continue to leverage the ALA species occurrence data to better understand gaps and national priorities for biodiversity discovery surveys, and potentially for time series modelling and analyses.

Dr Sue Fyfe – Australian Biological Resources Study, Department of the Environment and Energy, Australian Government

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4.4 Threats

Stakeholders identified that the ALA's key threat comes from resourcing: either the lack of ongoing resourcing that could see the ALA cease operations, cost-shifting by organisations, or a reduction in resources that would reduce the ALA's ability to deliver current service levels, let alone deal with increases in volume, variety and velocity of new data. Future funding opportunities, no matter their source, may be more geared towards specific solutions and domains rather than more generalised facilities like the ALA. New funding sources often look to support new activities rather than sustaining existing, on-going activities, which could make it harder for ALA to acquire resources to sustain its operations.

Stakeholders identified the issue of data quality as a threat that could lead to reputational damage. Poorly identified species, incorrect coordinates, missing data or biased data all affect the utility of the ALA and can create legal complications where regulatory decisions are affected. Misidentification of a species of trade or biosecurity concern could also impact negatively on the ALA's reputation.

The ALA's broad coverage of biodiversity data is also problematic as it is difficult to serve all stakeholders well. The ALA could be challenged by more specialised portals that deliver more, and better, quality data or services for specific needs. For example, the Federal Government also supports a separate portal for biosecurity relevant data and the Western Australian Government supports a pest identification app; both functions that could be part of the ALA suite of activities. Partnerships and collaborative efforts with other portals may help to overcome some of these issues and allow each portal to provide excellence in focused areas.

In contrast, the ALA's failure to expand and deal with new data streams was also seen as a threat. This is particularly so in new data streams that are emerging in ecology and biodiversity sciences such as wireless sensor networks, genomics and high-quality digital imaging. These data streams are not easy to integrate into the existing ALA framework, which focuses mainly on observational data records.

There is anecdotal evidence that some partners perceive the potential for the ALA to be ephemeral and this has limited their willingness to use it to support their operational biodiversity management programs. While no infrastructure or facility can guarantee its existence in perpetuity, the ALA needs to address how it can be a responsible custodian of data that may exist beyond the ALA.

Other comments suggested that some state-based institutions felt the ALA had undermined their own efforts to attract funding for their institutional responsibilities to collect and digitise biodiversity data. A reluctance to share data can also reflect the need for institutions to justify their own impact. Aggregation of data through national portals can mean that attribution of data to individual institutions can be complex or cumbersome. This can drive institutions to want to directly deliver data through their own portals, even if this means that data can no longer be aggregated purposefully for a more national approach.

When conducting interviews, the ALA had some expectation that new international e-Research programs may be a risk to the ALA's function. However, few if any such threats were identified by ALA stakeholders, perhaps confirming the world-leading nature of ALA infrastructure.

Top 5 threats:

- Lack of ongoing resources because of dependence on government funding.

- Reputational risk through poor data quality or failure to engage more with subject matter experts in taxonomy and ecological sciences.

- Unclear mandate undermined by competitors who can better deliver specialised portals at lower cost.

- Failure to deal with new data streams in ecology and genomics, including the variety, volume and velocity of data flow that will be difficult to integrate.

- Owners of data not willing to share data openly and nationally due to the constraints they work in.

The biggest threat would be not providing data of value thereby limiting the important work of the research and conservation management communities.

Joe Miller – Executive Secretary, Global Biodiversity Information Facility

4.5 Summary of results

Strengths

- High calibre biodiversity informatics and software development team
- Harmonised and published large amount of Australia's biodiversity data
- High-quality software products
- Built a national and global network around biodiversity informatics
- Strong institutional support

Weaknesses

- Lack of clear, forward-focused strategy
- Disconnected products and services
- Data quality and assessing fitness for purpose can be difficult
- Data not comprehensive nationally (geographic, taxonomic, temporal)
- Data not well targetted to address national challenges

SWOT

Opportunities

- National leadership in informatics, data and systems
- Integrated data services across partner capabilities (e.g. NCRIS)
- Engage with government and industry/consulting sector to improve data holdings
- Delivery of curated quality assured data to users informed by research needs
- Data services and analytics for new sectors (e.g. biosecurity)
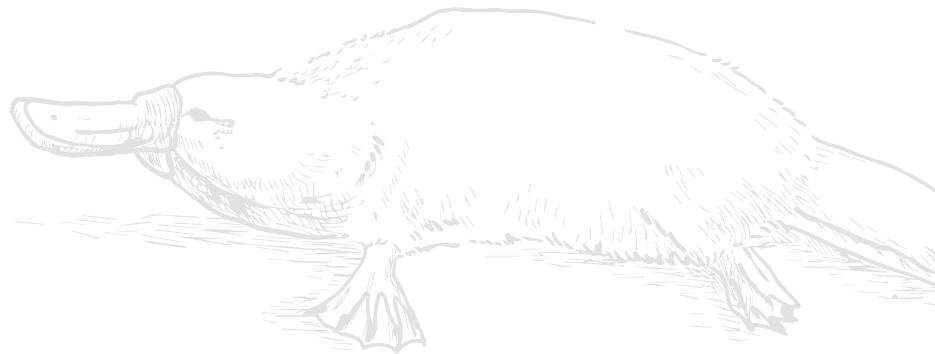
Threats

- Lack of ongoing resources
- Reputational risk from poor data quality
- Unclear mandate undermined by competitors who can deliver competing data services
- Failure to deal with new data types
- Reluctance of providers to provide data to the ALA

5

Other considerations

This report has focused on the areas of consensus among stakeholders. As a complement to this approach, the ALA staff have begun a more detailed, quantitative analysis of the textual content of the interviews with a view to revealing areas of divergence. Their interim results re-affirm the areas of consensus:

• products and tools
• national influence and leadership
• collaboration
• data quality and data types.

The preliminary analysis also illustrates there were considerable differences in perspective. For example, with respect to the taxonomic backbone used in the ALA, museums and collections were seeking an agreed taxonomic backbone, one that was current and could be kept up to date, and one that could be used in real time for identifications. State Government interviewees on the other hand, were more likely to want different taxonomic backbones recognised so that each State could record data under the legislated taxonomy used by that State.

Views differed as to the ALA's future role in presenting new data streams, some stakeholders seeing this as vital, others suggesting that it was better to leave some of these new streams to other, specialist portals. The ALA could examine its past decisions and do a root-and-branch rebuild of core elements, particularly names, images and occurrence records. These nuances in viewpoint are important to the ALA as it seeks to serve a variety of stakeholders.

Further quantitative analysis of the interview data is warranted but are beyond the scope of this report. However, establishing the ALA's role in the taxonomic area versus its role in providing environmental data are a key issue for the ALA to establish in its strategic plan and stakeholders held a range of views on this.

The role of the ALA in meeting government decision-making requirements also needs careful consideration. One interviewee commented that the ALA is not designed to meet legislative needs, which may explain why the Federal Government has funded an independent data infrastructure for invasive species distribution and spread (**https://www.planthealthaustralia.com.au/resources/auspestcheck/**). Verifiable identifications are critically important for policy makers, both for conservation purposes and for biosecurity. This issue may be less critical for other stakeholders, for whom species assemblages may offer greater value.

Other stakeholders noted the need for the ALA to be better at demonstrating the value of the data it provides. For example, GBIF keeps an annual tally of the scientific papers that use GBIF data. Such records could be obtained for the ALA. Better recognition of source data requires unique identifiers to be used with data points, an area that requires the ALA to keep up with or lead international trends. Recognition of the value of the ALA would support its case for ongoing financial support.

The ALA may wish to consider developing a scientific advisory group with biodiversity expertise to help prioritise its work program against its mission. The group could identify how biodiversity data are evolving and in what ways the ALA could leverage this.

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Conclusion

The challenge for the ALA is to provide the necessary focus on areas in which it can excel while partnering with others to build a truly national capability.

The expectations and requirements of stakeholders for a truly national capability exceed the funding envelope of the ALA. Hard choices will need to be made to ensure that investments by the ALA are in key priority areas and that infrastructure can be maintained at a high standard. Additional project funding will need to be aligned with strategy. The temptation is always to do something that is new and to neglect the core – but infrastructure needs to be maintained. This requires a strong sense of the central purpose of the ALA and the use of this as a yardstick for all activities.

In addition to these elements of building infrastructure for national benefit, it was also clear that stakeholders saw a key role for the ALA in 'soft diplomacy' – to offer leadership by facilitating institutions to work together. The ALA has a role in identifying gaps in the national capability and working with others to ensure that these are filled, even if not by the ALA.

The ALA's relationships with other NCRIS facilities and international bodies was also seen to be an important way of fulfilling this part of its role. The future is bright, and opportunity abounds.

The ALA is well positioned to shape a future role that continues to be critical in the delivery of national biodiversity data.

The feedback from stakeholders is clear. Stakeholders want:

- **Quality data** that have been corrected for obvious errors; and include metadata that indicate fitness for purpose, including suitability for research

- **Relevant data from a range of users** that addresses key biodiversity questions including longitudinal data, data of sufficient geographic and taxonomic spread, and monitoring data from government programs, consultants and industry

- **Integration of new data streams** beyond the historical occurrence records, such as images, genomics, sound recordings and environmental assessment data

- **Tools and standards** to assist in the collection, integration, analysis and synthesis of these data.

Where to next?

With the ALA Future Directions National Consultation process complete and findings published, the ALA's response will be encoded through a new ALA strategy to be endorsed by the ALA Advisory Board in early 2020. The strategy will balance stakeholder feedback against the current ALA resourcing profile and project priorities.

Results from the national consultation will also be critical in informing ALA responses to future Australian Government research infrastructure investment planning processes led by the Department of Education. This includes future NCRIS road-mapping processes in 2020.

Appendix A

Organisations contributing to ALA Future Directions National Consultation

Government – Federal

Department of Agriculture and Water Resources

Department of Education and Training

Department of Environment and Energy

Peak bodies

Australian Citizen Science Association

Bioplatforms Australia

Climatewatch

Council of Heads of Australasian Herbaria

Earthwatch

Environmental Consultants Association, Western Australia

Greening Australia

Integrated Marine Observing System

Mangrove Watch

Taxonomy Australia

Terrestrial Ecosystem Research Network

Government – State

NSW – Department of Planning, Industry & Environment

NT Chief Botanist

NT Department of Environment & Natural Resources

NT Central Land Council

Qld – Department of Environment & Science

SA – Department for Environment & Water

Tas – Department of Primary Industries, Parks, Water and Environment

Government – State (cont'd)

Vic – Department of Environment, Land, Water & Planning

Vic – Office of the Lead Scientist

WA – Environmental Protection Agency

WA – Department of Biodiversity, Conservation & Attractions

WA – Western Australian Biodiversity Science Institute Department of Environment and Energy

Research

Australian National University

Charles Darwin University

Commonwealth Scientific and Industrial Research Organisation

DNA Zoo Australia

Macquarie University

Monash University

National Academy of Sciences

University of Adelaide

University of Canberra

University of Melbourne

University of New South Wales

Museums and collections

Australian National Insect Collection

Museums Victoria

Tasmanian Herbarium

University Herbaria

Other

BHP

Global Biodiversity Information Facility

iDigBio

Appendix B

ALA Future Directions National Consultation interview questions

Category	Stakeholders who have worked with ALA or are very familiar with the ALA	Alternate question for stakeholders not familiar with ALA (question is the same, if cell is blank)
1. Introduction	Are you familiar with the work of the ALA or have you worked with the ALA? Do you work with specific ALA data, products or services?	An opportunity to introduce ALA and its purpose
2. User needs	What are your major needs for biodiversity data and how will they develop over the next 10 years? Consider not only the data that you collect but also the data that you will need to access. *Consider the need for inter-operability with other data sources and databases in other institutions.*	-
3. Strengths	How well has ALA met your needs up to the present time? *What are the good things about the ALA? Are there aspects of the ALA that you particularly value?*	How well are your data needs met at present? What is the best aspect? Who do you see as potential future providers to your needs?
4. Weaknesses	Are there areas that ALA has failed to deliver that are critical to your needs, or those of your collaborators? • Be specific as this helps us • Are there areas that you believe can be reduced (outsourced, or terminated)? • Are there key activities missing?	What limitations do you experience with your current solutions that could to be solved in the future?

Category	Stakeholders who have worked with ALA or are very familiar with the ALA	Alternate question for stakeholders not familiar with ALA (question is the same, if cell is blank)
5. Opportunities	How would you like to see ALA develop to support your needs or those of the broader national biodiversity data system? • What are the highest priority areas for development? • Where should the ALA further develop its platforms, products and services? • Should the ALA take a leadership role or coordinating role?	What are the priorities for your activities in data management? • Consider platforms, standards, liaison role *Does an infrastructure like ALA provide for your future needs?*
6. Threats	What do you perceive as threats to ALA? • Solutions from other initiatives, failure to secure ongoing funding, failure to meet stakeholder needs, new data types	What are the major strategic threats to the provision of adequate system-wide data services that you require?
7. National	Overall, how effective is the national system for the management of biodiversity data? *What future role should the ALA play in the national system for data management of biodiversity data?*	-
7. National	ALA is a key part of an international network – what are the pluses and minuses of this participation to your future data needs? *Are there any international initiatives that you feel are of importance to the ALA?* Consider networking opportunities; open source software solutions; access to international data; setting of standards	-