

The chill winds of climate change freeze funding for biodiversity's critical infrastructure—a personal view

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ABSTRACT

Australia signed the United Nations Convention on Biological Diversity, and Federal, State and Territory governments have accepted the need to conserve and manage Australia's unique biodiversity. It is argued that high priority is given to protecting vertebrates, while invertebrates, which constitute the majority of the fauna, are neglected. In part this is because the invertebrate fauna is largely undescribed. Funds for correcting this anomaly are declining, with fewer taxonomists available to do the work. While in principle governments support the need to document and manage Australia's biodiversity, this rarely translates into adequate funding. With climate change threatening Australia's biodiversity, the need for adequate funding for the conservation of Australia's invertebrates is more critical than ever.

Key words: funding, taxonomy, invertebrates

Introduction

Australia signed the United Nations Convention on Biological Diversity in June 1993 and agreed to accept the obligations that the Convention imposes. The Federal Department of the Environment, Water, Heritage and the Arts is responsible for administering the *National Strategy for the Conservation of Australia's Biological Diversity* (<http://www.environment.gov.au/biodiversity/publications/strategy/index.html>) which provides the framework for documenting, managing, and monitoring Australia's biodiversity. A review of the *National Biodiversity Strategy* has been conducted by the Natural Resource Management Ministerial Council and a new strategy was expected to be endorsed in April 2010. However this has not happened.

Each State and Territory has an environment department (the exact name varying between them), and varying agencies responsible for National Parks, Marine Parks and Fisheries which all support in principle the need to conserve and protect biodiversity. This is critical given that Australia is one of seventeen countries described as "megadiverse". This group of countries, which represent less than 10% of the global surface, but supports more than 70% of the world's biological diversity. Eighty percent of Australia's native species are found nowhere else in the world, but in 200 years fewer than 172,000 species have been described from an estimated 580,000–680,000 species (FASTS 2008—see foreword section). Some biologists argue that the number of species of terrestrial invertebrates alone may exceed this estimate by an order of magnitude (Majer *et al.* 1994). Ponder and Lunney (1999) explored in detail the vast number of undescribed invertebrates in all Australian ecosystems; little has changed since then.

The areas where this diversity is largely undocumented are soil faunas, meiofaunal communities of marine and freshwater sediments, and many of the smaller representatives of marine sediments and planktonic

communities. But even the larger invertebrates are still undescribed or have been misidentified or confused within suites of cryptic species (Hutchings and Peart 2000; Ford and Hutchings 2005). Majer *et al.* (1994) found that 90% of the arthropods collected from the canopies of *Eucalyptus* species near Perth and Sydney were undescribed.

Given that much of Australia's biodiversity is undescribed how do we conserve it? The usual response is that if habitats are conserved then this will conserve their associated biota. This is commonly referred to as surrogacy. While this may be valid little testing has occurred to support this concept. One example of testing has been undertaken by Shokri *et al.* (2009) who investigated infaunal communities of various sediment types in Broken Bay, NSW and found a good correlation. However this study is an exception. An example of the magnitude of this problem is the recent rezoning of the Great Barrier Reef where 70 bioregions were identified and a minimum of 20% of each is protected in "green" or no take zones. The bioregions are based on major plant and animal communities (Day *et al.* 2003; Fernandes *et al.* 2005). It is assumed that conserving these communities will protect the majority of other species and less conspicuous communities. However a full inventory of the reef is not available. For example, only a small percentage of fauna has been sampled or described. This means the conservation zones established on the Great Barrier Reef may fail to conserve important components of the reef's plants and animals. Given the limited criteria used in establishing the conservation zones on the Great Barrier Reef, monitoring of their effectiveness in protecting the reef's biodiversity is essential. There are monitoring programmes, but these are primarily restricted to monitoring fish and corals, with no attempt to monitor other invertebrates. This is understandable given the

limited funds available and the lack of adequate surveys of the reefs non-vertebrate fauna. These limitations in protecting Australia's best known marine icon highlights the problems associated with governments committing to biodiversity conservation, but failing to provide adequate funds for biological surveys and training for taxonomists.

Such information is critical to ensure that these conservation zones have been correctly sited. The boundaries of these zones may also need to be changed as species alter their distributions with climate change but how will we know where to change them too, if we do not know the major components of the communities?

Given that Australia has signed the Convention, how are the relevant federal and state agencies complying. Basically, all agencies concentrate on large mega-charismatic animals. For example, the Great Barrier Reef Marine Park Authority which manages the Great Barrier Reef World Heritage Areas concentrates on whales, dolphins, dugongs and turtles. Terrestrial agencies concentrate on vertebrates with a particular emphasis on species such as koalas, kangaroos and parrots, which are conspicuous, easy to monitor and attract public attention.

Another strategy employed by federal and state agencies is to develop species and habitat management plans. They also list threatened communities and key threatening processes under the schedules of relevant threatened species legislation. Typically, nominations are received and acted upon by relevant scientific experts with additional information often being solicited. A determination is made after carefully considering the relevant criteria listed within the Act. This triggers the development of recovery plans. This takes time and resources and at least in New South Wales many species have been listed but still await the development of recovery plans. Once developed then the recovery plans need to be implemented.

If one is slightly cynical and, given that I served on the Scientific Committee established by the NSW *Threatened Species Conservation Act 1995* for seven years, even this Committee's lists are dominated by vertebrates (Dickman *et al.* 2004). While the listing process certainly raised the profile of endangered species (and also the ire of many developers), one could ask whether trying to protect endangered species is the most effective use of limited funds. Or would it better to concentrate on species or communities which have the potential to become endangered? In the latter cases perhaps extinction can be avoided, whereas in the case of endangered species or communities it is often too late to make a difference (Joseph *et al.* 2009; McDonald-Madden *et al.* 2010).

Underlying problem

There is an unwillingness across all levels of government to acknowledge that we really need to document our biota. But first I must clarify what is meant by documenting the biota. For some purposes just identifying the number of types (morphospecies) present in your sample is sufficient to answer the questions being posed (Majer *et al.* 1994). However far more information can be gained if these

morphospecies are identified to species, either ones already known or formally described by a taxonomist. This allows that suites of species in a particular habitat to be compared with other habitats, and with previous studies. In addition information may be available on their ecology or reproductive traits which may be helpful in understanding the functioning of that community.

These issues were identified by the workshop hosted by ABRS/FASTS in 2007 (<http://www.environment.gov.au/biodiversity/abrs/funding-and-research/workshops-and-forums/ntf.html>), but governments have not acted.

This workshop identified that while more funds are needed to document our biodiversity, we also need to train the next generation of taxonomists and provide a career path for students interested in pursuing a taxonomy/systematics career. Since that workshop, funding has actually gone backwards, with the Australian Biological Resources Study (ABRS) now requiring the host institution to provide co-funding for most of their grants. While this spreads the funds further it is extremely difficult for museums, where most potential recipients reside, to engage as they are already very strapped for cash. Museums are having to limit the number of applications they can support. I know of young taxonomists who have failed to be supported by a state museum and are currently unemployed and seeking alternative career options. Yet these people have been trained as taxonomists and want to continue to work on their groups.

Another issue which is reducing the amount of funding available for research within these museums is that increasing funds are being devoted to public programmes at the expense of research and collections. In part this is due to museums having to raise their own funds from exhibitions to make up the short fall from funding from their state or territory governments. This funding from consolidated revenue is failing to keep up with inflation. Museums compete with Health, Transport and Police Departments for example which have a much higher public profile than museums.

The one federal museum, the Museum of Australia, located in Canberra, is almost entirely devoted to public displays, of the history and culture of Australia. Biological displays do not feature, so it is the state and territory museums which have the main responsibility for Australia's biological collections and their documentation. CSIRO does have entomological collections in Canberra and marine collections in Hobart but by far the largest biological collections are housed in state and territory museums.

It also worth noting that often the departments responsible for museums are not the same as those responsible for conservation and managing marine and terrestrial parks. However with increasing digitising of these collections it is becoming far easier for these agencies to access the information they need.

The underlying reason why FASTS co-sponsored the taxonomy workshop was that it highlighted the loss of expertise across various scientific disciplines, and the loss of taxonomists was used as an example of this. They recorded that over 50% of Australia's taxonomists

are over 45 years in age, one third are over 60 and another third of the taxonomic workforce are volunteers according to a survey carried out by ABRS in 2003 and cited in the proceedings of a taxonomy workshop held by ABRS/FASTS in 2007 and published in 2008 by FASTS. Volunteers consist of retired museum staff who continue to work actively on their groups of interest and people who may not have any specialized training but are passionate about a group and often become extremely knowledgeable about it and undertake taxonomic studies. Despite volunteer efforts, there have been several losses of fulltime research positions in museums and, while some new appointments have been made, most if not all museums are going backwards. In 2003, four full time positions were being lost per year, with only 1.5 gained, i.e. a net loss of expertise of 2.5-3 taxonomists annually (based on data from 2003, cited in <http://www.environment.gov.au/biodiversity/abrs/workshop-forum/ntf.html>); this situation has continued and may have increased. At the Australian Museum we recently hired five new researchers but only two are permanent the others are on 3-year contracts. While the new staff are welcome, they do not in any way address the number of positions lost during the past decade. Leis *et al.* (2007) summarized the loss of practising museum fish taxonomists, recording eight who had retired between the mid 1980s and 2007 without being replaced. And this is a group for which there are considerable economic and recreational values, so this does not bode well for other groups.

So while funds for basic research are declining, funds for updating web-based directories are being made available, such as the Atlas of Living Australia (ALA). This initiative has funded an update of the Australian Faunal Directory which is being checked by ABRS staff, but this standard of checking does not always occur. While ALA can be considered as an Australian node for the Global Biodiversity Information Facility (GIBIF), several other international web-based directories are being developed, including the Census of Marine Life and its register the World Register of Life (WoRMS). According to its website, WoRMS is a contribution to the Catalogue of Life, the Encyclopedia of Life, and will serve as the taxonomic backbone of the Ocean Biogeographic Information System. WoRMS has been accepted as one of the four campaigns organised by the Global Biodiversity Information Facility. Paid staff develop the website, but it is up to individual researchers to add data after one is given the relevant passwords, and becomes a registrant, and certainly the polychaete section of WoRMS contains many mistakes. While accepting that these databases are

useful they are time demanding and I would suggest that entering such data may not be the most effective use of our time, although in the case of the AFD limited funds are available for employing technical staff to enter data. While the development of such directories is welcomed although the duplication of effort is not, we also need parallel funding for basic research as well as people who can actually use this data and interpret it.

There are two main problems that I consider most important. The first is an unwillingness of governments to fund policies for the conservation and management of biodiversity, which they claim they support. The limited funding made available is directed largely to the mega-charismatic animals and the bulk of the fauna is neglected. As all Australia's ecosystems are subjected to major anthropomorphic impacts, this means that we cannot develop management practises to minimise these impacts. We also need good natural history data as well as survey and monitoring of populations.

Secondly, this lack of funding means that we are failing to train the next generation of taxonomists to replace those who have retired or died.

We are never going to identify all our species, so we (i.e. taxonomists, ecologists, managers) should be identifying which critical groups need to be studied for reasons such as economic or ecological value, role as indicators of change. That is identifying which groups will yield the most valuable contribution to conservation management, as well as biological information in as short time as possible. Once these faunal groups are identified then the necessary funds and facilities need to be made available to achieve this. Compared with the funds that governments allocate to some programs, the funds needed to document our biodiversity are not huge and may have substantial economic and ecological value as well recreational value.

Such a program would need to have a public face, with the museums better communicating to the public the research powerhouses that lie behind the façades of their exhibitions and the outcomes of the research that document Australia's biodiversity. This would then permit all governments to show that they comply with the Convention on Biodiversity. Perhaps this is wishful thinking on my part.

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Footnote- While I have focused on Australian fauna I am led to believe that similar problems exist in documenting the Australian flora with Herbariums facing similar financial problems and research staffing issues to Museums.