# Why are taxonomists often regarded as second class citizens? a misclassification that threatens the basic infrastructure of biodiversity

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ABSTRACT

Systematics is fundamental to biology, one must know what one is studying, otherwise how can they be conserved. A discussion is provided on the declining systematic base here in Australia. This is because as the population of Australian systematists ages and becomes grey they are not being replaced. Some comments are provided as to how this trend may be reversed.

**Key words:** systematics, funding, career opportunities, biodiversity

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## Introduction

All governments in Australia profess the concept that biodiversity must be conserved. In reality this refers to conserving whales, koalas, and other soft furry animals. For example, the biodiversity unit at Great Barrier Reef Marine Park Authority is almost solely concerned with the conservation of iconic megacharismatic animals, such as whales, turtles, dugongs, corals, and some species of fish, and ignores the bulk of the diversity found on the reef. On their website they mention that the Great Barrier Reef is a refuge for many species of conservation concern and that they work to protect species which are threatened, iconic or at risk. Another strategy which they have used, is the declaration of green zones (sanctuary zones) in each of bioregions identified on the Great Barrier Reef. These zones are "no take" zones and it is assumed that the biodiversity of them is representative of the entire bioregion and as all exploitation is prohibited their biodiversity will be conserved. This extrapolation has not been tested. Tests on the efficacy of surrogates in terrestrial systems (McMullen-Fisher 2008; McMullen-Fisher *et al.* 2010) have shown that the relative proportion of the diversity of mosses and macrofungi which would be conserved if only the number of higher plants were considered is low. Selection of reserves should use higher plants, mosses and macrofungi in order to adequately the total biodiversity present. In this case surrogacy was not an effective tool. Such studies need to be repeated in the marine environment.

The agencies responsible for the conservation of Australia's biodiversity use surrogacy by declaring marine and terrestrial national parks and reserves, but make little attempt to document what is in these reserves or to monitor the effectiveness of conservation reserves for biodiversity conservation. Baseline surveys of these parks/reserves are rarely done, so how would they develop monitoring programs? In the case of the Great Barrier Reef (GBR), an extensive survey was carried out around the time of the rezoning, the GBR Seabed Biodiversity Program was undertaken during 2003–2006, and mapped the distribution of seabed habitats (including mud, sand and gravel flats; algae and seagrass beds, sponge and gorgonian gardens, hard and shoal grounds) and their associated biological diversity of more than 7000 species, many new to science, across the GBR Marine Park. This was accomplished with extensive trawling and video transects enabling the epibenthic communities of the inter-reefal areas to be well-characterised along with patterns of sediment distribution (Pitcher *et al.* 2007). However, the infauna was not sampled, as it was deemed too difficult and costly given the lack of expertise in identifying this fauna. The irony is that, if some funds had been made available, this could have supported some taxonomists and perhaps some students to acquire the necessary skills.

Under various government legislation, species are listed as endangered or vulnerable, as well as ecological communities and populations. This listing –then triggers recovery plans for species whose populations are already declining for example by loss of habitat and one could argue that the funding allocated to this could be used more effectively elsewhere to conserve biodiversity (Recher, 2013).

Another argument widely used is that iconic species have value as flagships to raise the awareness of the need for conservation of their habitats and with it the suite of species which live there; in reality this rarely happens. For example, people get very excited about the loss of koalas yet this does not lead to the principal reason why they are declining– loss of habitat? This makes me grumpy as agencies mislead the public that they are conserving biodiversity when they are in fact being very selective.

Pp 26-30 in *Grumpy Scientists: the Ecological Conscience of a Nation*, edited by Daniel Lunney, Pat Hutchings and Harry F. Recher. Royal Zoological Society of New South Wales, Mosman, NSW, Australia. 2013.

Why do such agencies only consider a few species? Is it too difficult? Or are they unaware of the other 99% (Ponder and Lunney 1999). I suggest that they believe that it is difficult as so much of this fauna is undescribed and their importance is not understood (Beattie 2013). Invertebrate scientists have failed to communicate the importance of invertebrates and other micro-organisms to ecosystem functioning. While Australia is a leading player in the establishment of marine parks, declaration of a park is only the first stage. Zoning plans must then be developed and put into place. The next stage is the development of monitoring plans, which must be implemented and the results used to modify and improve management. Positive results from such zoning can help convince skeptics of the value of marine parks. Recent news that coral trout are larger and more numerous in sanctuary zones than elsewhere on the Great Barrier Reef, and that there is an overflow effect into neighbouring areas has convinced some recreational fishers of their value (Harrison *et al.* 2012; Russ *et al.* 2008; Williamson *et al.* 2004). Another question which needs to be answered is do the green zones on the Great Barrier Reef contain a subset of the regional diversity? Currently we just do not know, compounded by the lack of detailed knowledge of their biodiversity. Originally it was thought that the GBR Seabed Biodiversity Program would provide these data, but as already outlined, this survey ignored a substantial part of the biodiversity, the infauna (Pitcher *et al.* 2007). Unfortunately, it is now impossible to obtain permits to sample the infauna in these sanctuary or green zones.

What is the way forward, so that agencies charged with conserving biodiversity can find out what occurs in a particular area? Theoretically they could consult the *Atlas of Living Australia* (ALA) to obtain this information or as much as is available. Where do these data come from? – It comes from the state natural history museums, there being no Federal natural history museum. It is in these museums where most taxonomists reside. Here lies some of the problem, museums are funded by state governments whose highest priorities are health, police, and education, and not the environment or biodiversity conservation (Recher and Pyke 2012). As museum systematists age and retire, they are no longer being replaced (Hutchings 2012a; Leis *et al.* 2007). For example, by the beginning of 2014, the Australian Museum will no longer have a taxonomist studying fish. Yet new species of Australian fish continue to be described indicating the need for on-going taxonomic research on this economically, as well as ecologically, important taxon. As shown in Figure 1, the number of the number of researchers at the Australian Museum has declined significantly since 2001. This follows an era of significant growth commencing in the late 1960's that led to the Australian Museum becoming an international leader in taxonomic and environmental research (Recher and Pyke 2012). During this time of growth and heightened research activity, the museum was a respected and effective advocate of biodiversity conservation, not only in Australia, but globally (Recher and Pyke 2012). Currently the Australian Museum has only 12 permanent research scientists and 2 are to be redundant and no contracts for temporary research scientists are to be renewed. This will mean that in the past 10 years research staff have been cut by 50%. Of these remaining scientists a significant proportion is over 60. In addition researchers lost their technical staff supporting research during this period thus cutting their productivity and effectiveness. It should be noted that research scientists undertake a range of activities of which research is only one aspect. Reducing the number of research staff has a major impact on collection enhancement as well as reducing externally focused programs and revenue. Also this means a loss of mentoring capability of young researchers by well established researchers.

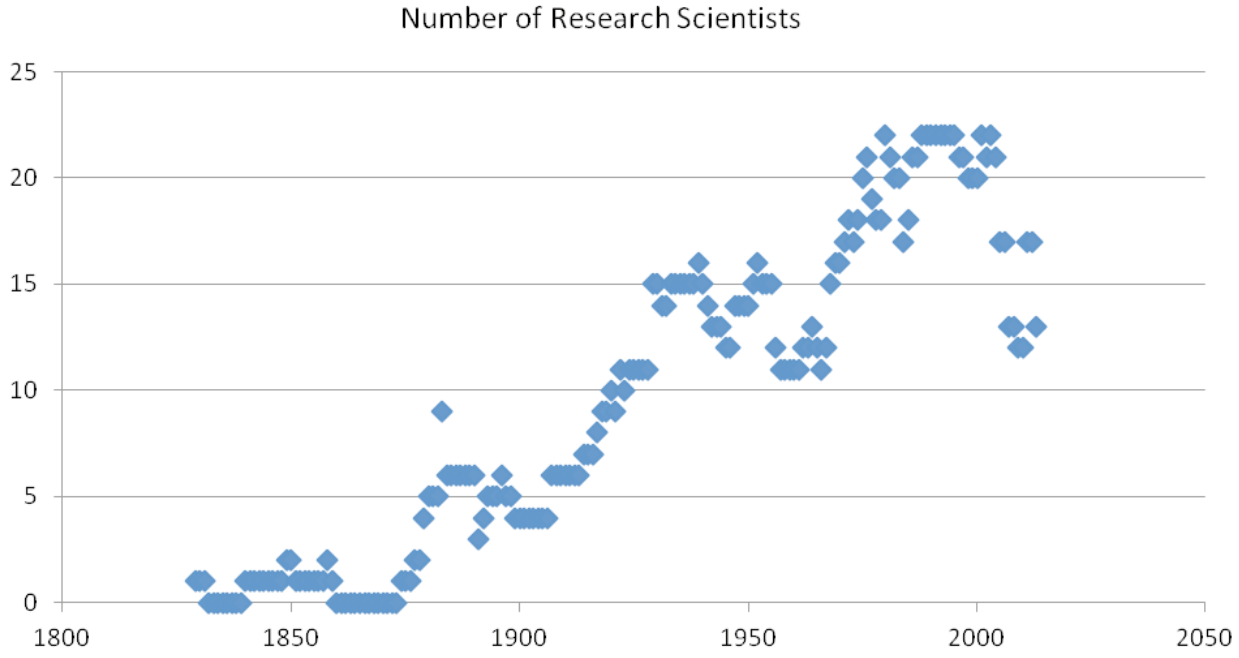


**Figure 1.** The number of people employed at the Australian Museum specifically to undertake research.

Similar declines have occurred in the other Australian natural history museums. The West Australian Museum lost several positions through retirement and is using industry funds to support short term contracts. While government funds allocated to museums have fallen compared to inflation, there is competition within museums for these funds between public programmes (displays, education) and research and collections. Many people within government seem unaware of natural history museums having a research function, so in an era of declining resources the more public education and display values of museums are protected, the more funds for research decline. This shift in resources ignores the reality that museums can only provide education opportunities and displays through the research findings generated by the scientific community, and systematists in particular.

Increasingly we are not only seeing the non - replacement of researchers, but lack of support for collection managers who are critical for maintaining the collections and making them available to organisations such as ALA. Collection managers have an immense knowledge of their groups and are responsible for loans and highlighting gaps in the collections which need to be filled. Even so, they are being filled by short term appointments in the same way as research positions. Such practises are unlikely to encourage new graduates to become systematists or collection managers.

The response from museum management to these problems is to suggest museum scientists obtain outside funding for research. For many years Australian Biological Resources Study (ABRS) was the major source of funding for systematics, but over the years since its founding 40 years ago, the funds available have declined. More recently ABRS instigated a policy whereby the home institution must supply a percentage of the funds requested. This policy of co-funding restricts applicants to those already employed at a museum and restricts the number of applications a museum with limited funding can submit. Funding for taxonomic research has been restricted in other ways. For example, from 2012, museum researchers were no longer eligible to apply for ARC Discovery Grants, a decision made without consultation with museums. Following discussions those researchers whose salary includes a component from a university can apply, but this excludes the majority of museum researchers.

Thus, federal and state support for systematic research is now severely limited, which makes me very grumpy. Worse is my feeling that we have little support from our peers. Universities are unwilling to appoint systematists and, as Hutchings (2012b) outlined, they are teaching less and less whole animal biology needed to stimulate students to undertake taxonomic research. It is my opinion that universities do not appoint systematists because they do not bring in large grants or publish in high profile journals. Since Departments have become obsessed with ERA rankings based on who publishes where, we do not get a look in (Adam 2013; Recher 2013; Calver 2013). As Recher (2013) discusses, the decline in whole animal biology preceded the obsession with rankings.

Systematics is not seen as trendy science, and too many biologists do not even consider it relevant. I would go as far to say some of our peers think of us just as stamp collectors. Those days are gone. Modern day systematists use morphological and molecular techniques to develop hypothesis as to the relationships between species and genera and their higher classification.

Systematists find it difficult to publish in high ranking journals, which often have page limits while systematic papers are often by necessity lengthy. For example, *Zoologica Scripta* (citation index 2.913) has a page limit of 15 printed pages that includes tables, figures and references. This means formal descriptions of taxa as part of a phylogenetic paper have to be relegated to electronic appendices. I realise this is also a problem with ecological data.

Other factors, are that while our colleagues want their fauna identified for their own studies or for students, they often fail to acknowledge us in the resultant paper and more importantly they do not cite the papers used for identification (Wägele *et al.* 2011). Hence, H indices for even highly productive systematists may be severely compromised. Unfortunately such indices are widely used as an assessment of an individual for promotion, tenure, and grants (Calver 2013). I suspect many people think that the role of museum researchers is to identify other people's material and fail to recognise that identifying material may necessitate extensive research. Even in Sydney Harbour, we continue to find new species, not just invertebrates, but even fish (Hutchings *et al.* 2013). Wägele *et al.* (2011) further suggest " whenever a species name is used, the author(s) of the species hypothesis be included and the original literature source cited, including taxonomic revisions and identification literature - nothing more than what is done for every other hypothesis (sic)or assumption (sic) included in a scientific publication". While I support this, I do not believe this will be taken up given current attitudes towards taxonomic/systematic studies.

Another real gripe that I have is that expensive benthic cruises are undertaken with numerous samples collected often from areas previously poorly sampled. The samples are returned to the agency and perhaps sorted to morphospecies or to major groups. Subsequently specialists in particular taxa are asked to identify them to species, but there are no funds to even partially cover the time and effort required to do so. For my group, polychaete worms, it may be necessary to undertake a complete revision of the genus in order to identify them to species. Even if there are funds available, it is not easy to estimate the time required. A better and fairer solution is for the person requesting the identifications to indicate the amount of funding available, so you do as much as you can for this amount. This requires a good working relationship and trust between the parties. This was my method of working when identifying material from Queensland Port Surveys for introduced species. The then Professor at James Cook University, Howard Choat, who was co-ordinating these surveys, understood the problem. He was a fish ecologist who had spent time resolving the systematics of scarids and knew how difficult it was to accurately estimate the time needed to identify material.

How can this situation be resolved? Ideally systematists need to be involved in the initial planning of survey expeditions. If nothing else, this should ensure that the material is properly preserved for both molecular and morphological studies, which facilitates identification.

While the bulk of the costs of the expedition will be taken up with ship time, allocating funds for identification will value add and make the data far more useful. This allows for comparisons between sites, locations, access information such as what else is known re that species, and other ecological studies. Just identifying species to family means a lot of data is lost and may adversely impact on comparisons between sites. Similarly just identifying to species 1, 2, or 3, for example, means that comparison with other studies is impossible. It is also critical that this material is deposited in the relevant state museum and so that over time the collections will be more fully described and new species identified. Such collaborative work ensures that the ecologists obtain extra information (often unpublished) about that species helping in the analysis of the data.

All these problems clearly indicate that we need to raise the profile of systematists (FASTS 2008). While I do not profess to have all the answers especially at a time when state governments are reducing funding to environmental agencies, I have some ideas which could improve the situation.

## Promotion

We need to promote the importance of systematics and to reverse the trend in Australian universities of what I call the death of life sciences (Hutchings 2012b). This means working with university departments and offering to participate in life science courses and field trips, giving guest lectures, and encouraging students to undertake research projects involving whole animals. Seeing animals alive is important. Face to face contact is critical not only to convey our enthusiasm for animals, but to comprehensively introduce students to their amazing diversity. Another avenue is to run specialised workshops during university breaks. The University of Wollongong has run mollusc workshops for several years that have been well attended and could serve as a model for other Australian universities to follow. Mollusc specialists, including those from museums, teach this course and introduce students to all aspects of mollusc biology including their systematics.

## Role of Museums

We need to ensure that museums are recognised not just for exhibitions and school excursions, but as research centres and the first point of call for any agency undertaking biodiversity studies. We need to cater not just for the professional biologist, but for the interested members of the public. They need to be able to search the website and find keys and illustrations of the fauna likely to be encountered as they walk along the beach or go for a dive. The Australian Museum website (http://www.australianmuseum.net.au/Find-a-fish) allows people to identify fish they may catch or see when diving. They can also email the collection manager for help in identification. This leads to greater interaction between the public and the systematist and informs government that the research function of a museum is relevant at all levels.

## Engaging the community

We need to engage the younger members of the public by showing them the wonders of the natural world (Adam 2010). If this can be maintained through University, we will encourage more people to study whole animals including their phylogeny and their systematics.

## Career paths

We also need to ensure that there is a career path for budding systematists. It breaks my heart to see highly competent and enthusiastic graduate students undertake several years of productive postgraduate studies to be unable to find a permanent job. I have witnessed this and have seen a promising systematist go off and become a computer programmer; she needed a job! This is happening not just in Australia, but also in Europe. Systematists need to promote the value of knowing what we are trying to conserve when we profess to be conserving biodiversity. The timing is critical and, as experienced systematists retire, we need to facilitate them acting as mentors for the next generation. This will only happen if there is a career path for young systematists. While we as senior systematists can do our part, we need the support of the managers above us and we need to develop collaboration at all levels. While at times I am not hopeful, this should not be the reason for not trying. Time is running out and we cannot afford to fail to support the next generation of systematists.

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