The study of natural history - a PPP

Paul Adam

School of Biological, Earth and Environmental Sciences University of New South Wales NSW 2052

ABSTRACT

The history of the transition of natural history from being at the centre of western science to the periphery is outlined. The development of a divide between amateurs and professionals is discussed as is the decline in nature study in school education. It is argued that understanding, monitoring and management of biodiversity need to be based on natural history studies, and that professionals and amateurs can, and should, work together to these ends. Examples of successful collaborations overseas and in Australia are discussed. These foundations should be built upon, but a number of constraints may limit future availability of a pool of natural historians.

Key words: Historical development of natural history, education and nature study, systematic recording, atlases.

Introduction

The term 'public private partnership' (PPP) is normally used in discussion about the provision and operation of major public infrastructure projects. It is a model under which the infrastructure construction is funded by the private sector, which then recovers its costs through charging the public for use of the asset or resource. As a model for public administration it is a legacy of the Thatcher years. In the Australian context it is a model which finds favour across the political spectrum, but about which the public is far less enthusiastic. However, I want to argue that in a different context, the management and conservation of biodiversity, meeting society's aspirations will only come about if there is a strong partnership between elements of the public and governments at every level.

The dominant international paradigm for nature conservation since the Rio Convention of 1992 has been the conservation of biodiversity. The Convention represented a major shift in thinking in that it is not taxonomically constrained, and while recognizing the importance of maintaining and expanding a protected areas system also recognized the need for a biodiversity conservation regime applicable across all land tenures.

Importantly for the present discussion, the Convention obliges signatory nations to 'respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities' (Article 8(j)), and under Article 7 to identify and monitor components of biodiversity and threats to them, including (Article 7(d)) to 'Maintain and organise by any mechanism data derived from identification and monitoring activities….'.

Addressing these requirements in a meaningful way will demand a re-evaluation of how data are obtained and managed, and the forging of new relationships between natural historians and environmental management agencies.

The growth of natural history

Throughout human history a knowledge of the natural world was essential for survival. What was edible, and what was not, when would species fruit, where would prey animals be found, what species were dangerous became part of the transmitted knowledge in all communities long before any of the information could be recorded in writing. Much of this traditional knowledge is still retained within local communities but is unknown to, and not respected by, the wider community. This is the kind of information which should be maintained to satisfy Article 8(j) of the Biodiversity Convention. Some of distinctions made within folk taxonomies are very fine, such as between different varieties of crops. Rural residents in Britain for example exhibited a very deep understanding of natural history in finding, and killing, many species regarded (often erroneously) as vermin (Lovegrove 2007). Nevertheless, interest was utilitarian; taxa of no direct economic value (either positive or negative) were unlikely to be identified to other than very broad categories – thus the majority of species (and genera) of groups such as insects, bryophytes, algae, lichens and fungi would not have been recognised in pre-scientific taxonomies (although even in these groups there is a small number of species which were important as food, as pests, or, in the case of lichens, as sources of dyes).

In the western tradition a curiosity driven scientific approach to studying the world can be traced back to classical Greece, but after its first flowering there were many centuries of stasis, when the intellectual approach to natural history was kept alive, but barely so, by the herbalists, who for the most part merely plagiarised their predecessors, with each recital introducing new errors. The Renaissance brought a renewal of science based on observation of the natural world, but boundaries between disciplines were vague and practitioners often had eclectic ranges of interests. Interpretations based on these observations were often clouded by erroneous preconceptions so progress was slow. Nevertheless there were some outstandingly perceptive observers, many of whom were medical practitioners, whose interest in the natural environment was at least in part because of its

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importance as a source of drugs and other medically useful materials. (In a sense we have turned full circle – much of the current interest in biodiversity, and a major factor in the development of the Rio Convention, is as a potential source of pharmaceuticals.) One of the most outstanding of the pre-Linnean scientific natural historians was probably John Ray (commemorated in the still surviving Ray Society, and in the name of the Sydney University Herbarium) who made major contributions to botany, zoology and other sciences (Gilmour and Walters 1954). The eighteenth century saw an upsurge of interest in the natural world, partly out of curiosity but also, as more of the world was 'discovered' and colonised by the emerging European powers, because of the need to catalogue the world's resources and assess their value. Linnaeus facilitated the cataloguing of the world's biota through the development and systematic application of binomial nomenclature, but he was also a careful observer and educator, whose field excursions were a major feature of his teaching at the University of Uppsala, Sweden (Blunt 1971).

The late eighteenth and the nineteenth century saw an explosion of interest in natural history; this was a major social phenomenon (Barber 1980) exhibited across society. The interested included those who were merely collectors of curiosities, subject to fads and fashions, (Barber (1980) notes the "passion for keeping baby alligators which suddenly seized the womanhood of Southport in the 1870s"), but also many who had a genuine interest in their subject and were serious contributors to knowledge.

Amongst the collectors, their hobby may, in many instances, have been a relatively solitary pursuit, other than in trading for specimens, but amongst the more serious participants there was a camaraderie through the membership of scientific and natural history societies.

The world's oldest continuously existing scientific society, the Royal Society of London, dates from the seventeenth century, but in late eighteenth century and early nineteenth century there was a proliferation of new societies, some discipline specific, many more geographically based. Many of these societies produced journals or other publications and through these a picture of their activities can be gleaned.

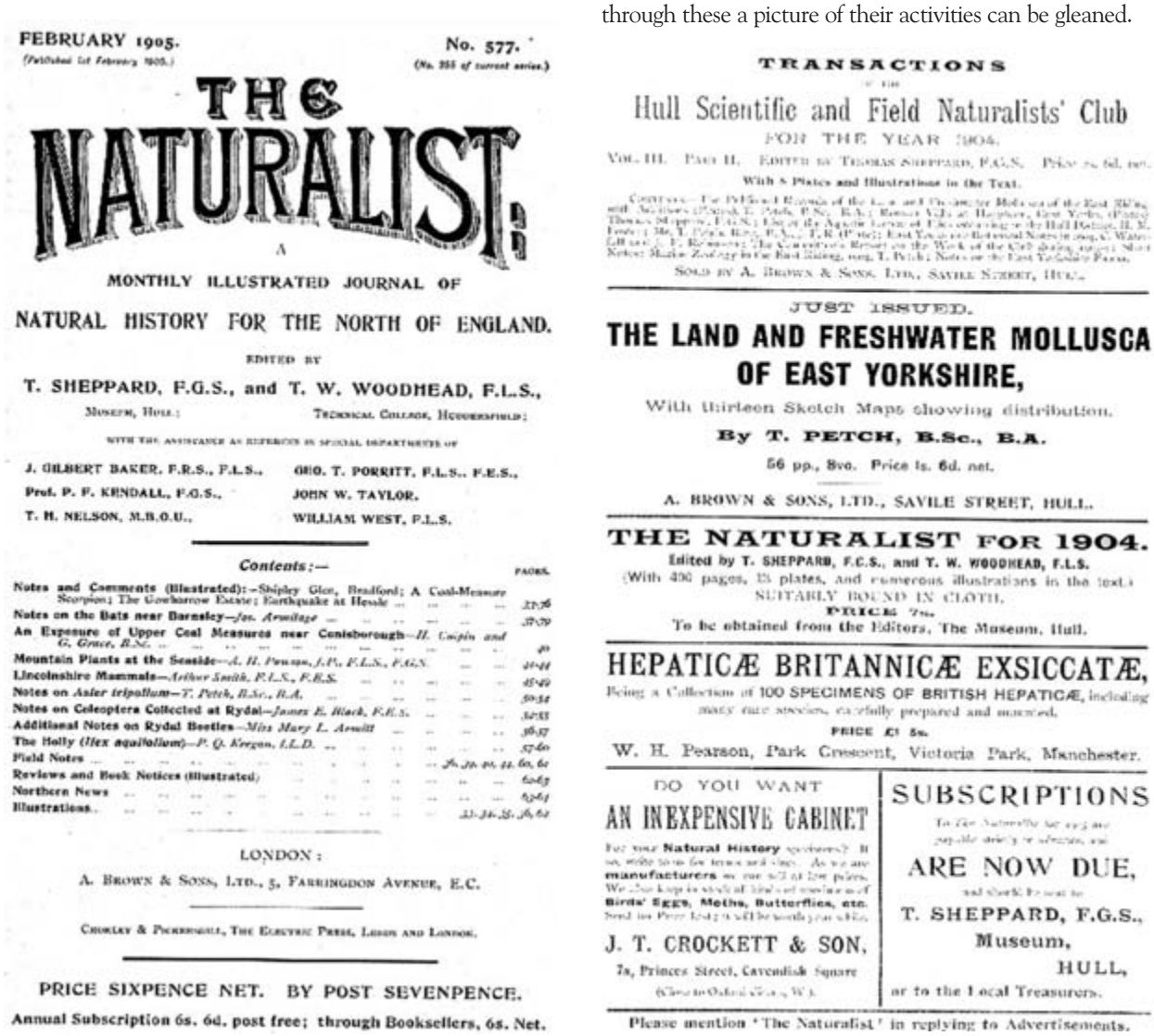

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Figure 1. The cover papers of ***The Naturalist*** issue 577. Note the diversity of topics, and the authorship of one of the papers by a woman (Miss Armitt). J.T.Crockett & Son include bird's eggs, moths and butterflies in the items for sale, while W.H.Pearson was selling collections of herbarium specimens (Exsiccatae) of liverworts. A range of publications on particular taxa were for sale. The Yorkshire Naturalist' Union is still very active (See Abbott 2005)

In its early years even a body as august as the Royal Society, now regard a one of the leading scientific academies, had a very strong element of what would now be regarded as natural history; that is, interpretations of the natural world based on observation, and there was little distinction between disciplines.

In eighteenth century the concept of scientist as a profession did not exist, indeed the term had not been invented. If there was a distinction it was more akin to that which later characterised the English cricket team, between the 'gentlemen and the players' – leading figures in the establishment, like Sir Joseph Banks, had no formal training in science and did not earn income from his scientific activities, whereas the collectors, who may have had training in trades such as gardening were more akin to the players.

The growth of the natural history movement came at a time of dramatic change in European society – colonial expansion both stimulated and necessitated the development of taxonomy and other sciences, the agricultural and industrial revolutions changed social structures, creating both the middle classes and skilled workers, the trend to urbanisation resulted in a growing population not directly connected on a daily basis with the land (while this may have led to a decline in the community knowledge of these aspects of natural history directly interacting with agriculture, it perhaps allowed the development of interest in 'non-commercial' species without attracting the opprobrium of studying something 'useless'). A consequence of the rise of the urban population was the annual holiday and the development of seaside resorts; the collection of algae and shells became a very popular activity (Allen 1976, Barber 1980), supported by numerous guides and other texts. The Victorian era was one in which self-improvement was important for many of the working classes, public libraries and working men's institutes which were means of advancing this aim in science and natural history were very much part of the self-improvement movement. Its legacy is still to be seen in the names of institutes adorning the walls of countless halls throughout the British Isles and in many older suburbs and country towns in Australia. Publications on natural history were amongst the finest, and most expensive, examples of illustrators' and printers' arts (Desmond 2003). However, the nineteenth century saw mass book production and lowering of prices so that identification manuals became accessible to a much larger market and accounts of the national history of the exotic colonies stirred the imagination. Books were still relatively expensive, but groups of individuals in the various associations could club together to purchase major works, and journals and magazines could be purchased by all ('the artisans who hoarded their pennies to buy the *Entomologists Weekly Intelligencer*' – Barber 1980) (Figure 1). It is remarkable what pioneers such as Linnaeus and

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Banks and Solander could observe using what appears to us to be very primitive early microscopes (Duyker and Tingbrand 1995) but, in the nineteenth century, microscope technology improved and advanced equipment became much more available. While it was certainly not a case that every home could have one, microscopes became affordable to wealthier individuals and to the various natural history clubs. Availability of microscopes facilitated the growth of interest in mycology, bryology and entomology – but for those not interested or capable of preparing their own material, prepared slides were available for sale. (I have a collection of commercially available slides from the 1880s – for a price of 1/- each, these include a range of botanical specimens, human anatomy and pathology specimens and remarkable oddities such as a section of the tongue of a manatee). At least in Britain the expanding railway network allowed ready access to much of the country, and the mail system allowed for the exchange of information and specimens (Barber 1980).

Who were the naturalists?

The natural history movement encompassed a broad section of society. Allen (1976) suggests that the societies based in London tended to be socially more exclusive than those elsewhere in the United Kingdom, and outside the capital, skill and expertise mattered more than social status so that the natural history clubs and societies provided some of the few opportunities for the various strata of society to mix as equals. Lawley (2008) cautioned against an overly romantic view of the past and suggest that the movement was made up of predominantly the bourgeoisie with few aristocrats and members of the working class. Nevertheless the natural history movement was particularly strong in the industrial north of England, and skilled artisans were well represented. (The natural history movement received a strong underpinning through the establishment of municipal and regional museums, an expression of civic pride and the Victorian tradition of philanthropy. Many of these museums across industrial Britain still retain natural history collections of international significance and support educational and recording programs).

Clergymen, bankers, doctors, school teachers and retired military officers were important members of natural history clubs, and provided avenues of communication for the dissemination of information and specimens. Clergymen have a long history of involvement in science and investigation. One of the immortal classics of the natural history literature is the Reverend Gilbert White's '*Natural history and antiquities of Selbourne*' (1788) and the tradition of Anglican rectors recording the natural history of their parishes was well established (Allen 1976, Armstrong 2000) although Lawley (2008) suggests their flocks were less enthusiastic and amongst the laity nonconformists were more likely to be actively involved in the study of natural history. Translated to the colonies, clergy were in the forefront of exploration of the natural history of new lands. Examples in Australia include W.B.Clarke and William Woolls (Thompson 1986), and the Catholic Julian Tenison-Woods (Borchardt 1976). Allen (1976) draws attention to the number of bankers who were leading figures in natural history in the mid nineteenth century and suggests "There was something about the counting-house mentality, with its punctilious sense of order and its skill in executing business with complete correctness and despatch, that made it well suited to the ceaseless roster of minor, yet demanding and sometimes back breaking tasks in the intellectual housekeeping that forms so large a part of the work of natural history".

The involvement of medical men with natural history is understandable because of their scientific training, as an extension of their biological interests and because of the continuing close relationship between medicine and botany. Many of the limited number of medicines available in the nineteenth century were of botanical origin, and doctors needed to be able to identify 'useful' plants. In Britain this link was further strengthened by the passage of the *Apothecaries' Act* 1815 which required that both doctors and apothecaries (pharmacists) had formal training in botany (Allen 1976, Lawley 2008). Botany was a formal part of medical training until well into the twentieth century (see Wren 1923); the nexus has now been broken, but given the rise of alternative and complementary medicine it might be advisable for doctors to again be familiar with botany in order to understand what it is their patients are self prescribing. The towering figure of Australian nineteenth century botany, Ferdinand von Mueller, was trained in northern Germany as a pharmacist and was an enthusiastic, amateur botanist; when he first came to Australia he was employed as a pharmacist, although finding opportunities to travel and to collect plants in South Australia (Maroske 2006), before Governor La Trobe appointed him Victorian Government Botanist.

One of the most interesting features of the development of natural history was the role of women; it was one of the first fields in which women could be on the same playing field as men. Natural history was a respectable hobby for young ladies (notwithstanding the sexual basis of Linnaeus' plant taxonomy), but, while for many it was a pleasant amusement, there were women who made serious contributions, as collectors (including the remarkable Mary Anning who made many important fossil discoveries on the now World Heritage listed Dorset coast – Barber 1980) and as authors of books, particularly of guides to seashores (Allen 1976, Barber 1980). In Australia many women were amongst the early discoverers and collectors of plants, (in NSW for example, Louisa Atkinson and Louisa Calvert – Fairley 2004 – many of the network of correspondents providing specimens to the Victorian Government botanist von Mueller were women). While women wrote popular books, their involvement with the 'serious' scientific natural history societies, particularly those publishing journals, was much more limited. Although many of the Field Clubs permitted, and even encouraged, women members (Allen 1976, Barber 1980) the major national societies were bastions of misogyny and did not entertain women as members or as authors of papers (Allen 1976). Lear (2007) documents the unsuccessful struggle of Beatrix Potter to persuade the Linnean Society of London

to publish a paper on the germination of fungal spores, a paper which in originality and quality was certainly up to the standard of papers by male authors published by the Society. (When the bird protection movement gave rise to formal societies in both Britain and America, they initially excluded men as members – in Britain the Society for the Protection of Birds (after 1904, the Royal Society for the Protection of Birds) originally enrolled men as 'honorary co-workers' - as Allen (1976) observes 'sweet revenge for all the years of humiliating exclusion from so many of the grander learned societies'). The situation in the learned societies in Australia was similar (Augee, these proceedings); however, by the early twentieth century female authorship of scientific papers was acceptable and major contributions were made – the paper on the rainforests of Barrington Tops by Fraser and Vickery (1938) was not only important in the Australian context but was accepted as significant by leading international workers (being discussed at some length by Richards 1952).

The one area of endeavour where nineteenth century women were given 'serious' status and where they contributed to major scientific publications was illustration. In both zoology and botany there were outstanding female scientific illustrators, and Australian material was illustrated by European female artists working with specimens sent from Australia, and by artists who either visited or were based in Australia (for example Marianne North and Ellis Rowan (Morton-Evans and Morton-Evans 2008)). Hutton and Connors (1999) provide details of a number of women who made contributions to scientific illustration in Australia.

Conservation and Environmentalism

In the later part of the nineteenth century, in both Europe and north America the natural history movement was joined by the development of an overtly pro-conservation lobby and the establishment of societies with conservation of particular organisms (with birds being prominent amongst them – Doughty 1975, Allen 1976), wild life in general, and landscape (the particular focus of the National Trust, Cannadine 1995).The established scientific societies gave both implicit and explicit support to this new movement, and the field clubs increasingly gave attention to conservation and were prominent in making submissions to councils and central government about both conservation in general and site specific issues in particular. This interest in conservation was also apparent in Australia, and the early history of the conservation movement in the country is analysed by Hutton and Connors (1999) and Mulligan and Hill (2001). Many of the early leaders in conservation came from the natural history movement, but others had an outdoor recreation background and while sympathetic to natural history did not have the same detailed interests.

The modern environmental movement can be traced to a single publication: that of Rachel Carsons's *Silent Spring* (1962). The publication heralded an era of increasing government regulation for environmental protection, and triggered the formation of national and international non-government environmental organisations (NGOs). These NGOs were not primarily concerned with the minutiae of natural history, but with a holistic approach and were much more actively political in their approach. Many traditional natural historians were uncomfortable with this new approach, but there is no doubt that the environmental lobby has considerable political clout, both in Australia and internationally.

Natural history and the broader society

Dunlap (1999) argued that at the time of colonial settlement, natural history "was the leading edge of European understanding, an immensely powerful intellectual tool that was as expansive as the visible world it studied. It shaped the settlers' understanding of nature in several ways. It, obviously, organised their local knowledge and placed the "natural productions" and curiosities of their countries in a comprehensive system that was part of European high culture".

An understanding of the new local environment was certainly essential if the colonies were to survive but many of those most closely connected with gaining this knowledge would have had little connection with "European high culture". The roots of the farmers' knowledge would have been in the rural workers' utilitarian folk natural history of the kind discussed by Lovegrove (2007) or Humber (1966). Necessity is the mother of invention and, for example, the timber getters working in rainforests in eastern Australia, a group of workers with little if any contact with high culture (European or otherwise), rapidly created a working taxonomy and vernacular nomenclature (see Francis 1929) for trees yielding useful timbers. This hard won practical knowledge remains important today, but while landholders may be repositories of knowledge, and many have a continuing genuine interest in natural history, it does not follow that farmers were the original, and are still the best, conservationists, a claim which is often made. As Shrubb (2003) concluded after a detailed analysis of birds in the United Kingdom. "Any long-term perspective shows how false the idea that farming preserves the countryside is. It is instead a catalyst for change. Farming's economic and methodological revolution during the hundred years or so after 1750 brought enormous changes in landscapes and habitats" – and similar conclusions would, after adjustment of the time frame, be equally valid in Australia. It is true that, in the UK, landscapes created during the agricultural revolution are now highly regarded, and are defended against current proposals for change; and it would be universally true that without growth and intensification of agriculture the current size of the human population would have been unattainable. While there is a need for co-operative engagement between landholders, natural historians and governments, the cultural development of thinking about natural history and the environment has gone beyond the immediate necessities of early colonial times and now informs different agendas.

The proportion of the population involved with natural history in the UK has declined from the mid-Victorian peak described by Barber (1980), but is still high. In Britain the interest also reflects a concern with "the countryside" more broadly, often associated with a bucolic ideal, which does not match the reality of country life today, or probably of any time in the past (Moore-Colyer 1999, Sheail 2002). An ambition to take up living in the country is common and even if this cannot be met, it is partly sublimated by interests in natural history. Sustaining the natural history culture is also aided by British tolerance (and even cultivation) of eccentricity – that some one has a great interest in organisms such as fleas, land snails or liverworts would be readily accepted, while an interest in birds is almost universal. (Sheail 2002 notes that on 21 January 1940 the then British Prime Minister Neville Chamberlain recorded the presence of a common sandpiper on St. James Park Lake – at a time when one might have expected him to be beset by other concerns! Throughout the war the Chief of Staff Field Marshal Lord Alanbrooke, found relief from daily pressures in bird watching and bird photography (Moss 2004). The social diversity amongst serious bird watchers was stressed by Fisher 1941, 1966 and Moss 2004).

In Australia the broader concerns of European high culture were initially met by the obligations on early governors to report to London on the resources of the colonies and to arrange for the collection and dispatch of specimens (the efforts of the British government being augmented by a number of expeditions from other European countries).

However, it was not long before scientific societies were formed in the various colonies – The Philosophical Society of Australia, which subsequently became the Royal Society of N.S.W., was first established in 1821. As in Britain (Allen 1976) there was a distinction between the scientific societies and the Field Clubs, which had a broader membership and engaged more in excursions than the societies whose meetings revolved more around the presentation of formal papers although a number of the colonial Royal Societies initiated active field naturalist sections (Hutton and Connors 1999). There were, and are, a number of strong field clubs in Australia, for example the Launceston Field Naturalists Club, Field Naturalists Club of Victoria, WA Naturalists' Club and the Dubbo Field Naturalists, although with some obvious exceptions the field club concept did not develop as strongly in NSW as it did in the other southern states. Membership was broad – Vincent Serventy described the WA Naturalists' Club in the 1940s – "we had everyone from the mayor and university lecturers to wharf-lumpers. We all worked happily together. It was like joining a big family, so that's how I became a naturalist" (quoted in Mulligan and Hill 2001).

The earliest scientific societies in Australia were, necessarily, based in the individual colonies. The first national body was AAAS (The Australasian Association for the Advancement of Science) subsequently ANZAAS): this was a general science society, but for purposes of running its congresses – which were very big events in the young Australia – was organised into discipline-based divisions. Many of these divisions subsequently became the national professional bodies for their disciplines. Many of the papers at early congresses were natural history based, and the handbooks produced to accompany congresses remain valuable guides to the natural history of the states. As science became more specialised and subdivided it is interesting that some of the major divisions in science failed to developed national societies. Thus there are national societies for ecology, mammalogy, entomology, but no national zoology society (although the RZS welcomes membership and authors from across the nation and beyond), similarly there is no national science based botany society – it was the native plant enthusiasts rather than the scientists who established the Society for Growing Australian Plants (now the Australian Plants Society).

The non-indigenous population in Australia does not have the ancestral links to rural landscapes which underlie the importance of countryside in the British psyche. Nevertheless a 'sense of place' (*sensu* Seddon 1972) developed very quickly, but the current sea change /tree change phenomenon is a reaction against urban living rather than, in most cases, a return to roots, and while its participants may have a high level of environmental awareness only a few are natural historians in a traditional sense.

Nature study and education

Nature study was an important component of school education from the early nineteenth century, starting in primary school. Collections, nature rambles and simple experiments were all part of the curriculum; as well as texts on the teaching of nature study (von Wyss 1927), there were numerous text books and guides. Many of these were very densely written, by modern standards they would be regarded as turgid but they clearly engaged many of their intended audience. Examples in Australia include Gillies and Hall (1903), Brewster *et al.* (1920), Brewster (1929), Leach (1929), Carey (1943), Harris (1945, 1956). Gillies and Hall (1903) suggested that at the time there was a world wide movement in nature study emanating from Cornell University – which involved 'seeing the things which one looks at, and the drawing of proper conclusion from what one sees'. The importance of observation was stressed in all the works mentioned above; and Carey (1943) was entitled *Botany by observation*. These early texts lack discussion of many topics which form part of the modern curriculum, particularly genetics and molecular biology, but in those areas which were included the depth of detail is probably greater than would be expected of school education today. There is a wealth of information about Australian species, information which was once common knowledge, but which would today be far less well known. (The ecology section of Brewster (1929) – which despite the title *Botany for Australian Secondary Schools* has a strong NSW bias, contains fascinating historic photographs of vegetation).

As well as textbooks, the range of other organisations provided literature and curriculum materials to support nature study. The most notable was the Gould League of Bird Lovers. The League was founded in 1909, with the specific remit to protect Australian birds and to prevent the unnecessary collection of birds' eggs. Over the years the activities of the league broadened to encompass conservation and nature study more generally. After *Silent Spring* the Gould League of Bird Lovers changed its name to simply the Gould League and was in the forefront of developing curricula for environmental education. More recently the Gould League, now known as the Gould Group, has given particular emphasis to sustainability (see www.gould.edu.au). The Gould League was particularly strong in Victoria, but was influential nationally.

Nature study now has very little place in schools, and if it were to be reintroduced there would be few teachers able to teach it. The reasons for its decline are many. There is less space in the curriculum, with topics like IT properly regarded as essential and requiring time to be taught, biology and geography which provided a niche for natural history in secondary schools now have to accommodate extra topics, field teaching is increasingly constrained by regulation, and population increase and urban consolidation have substantially reduced the ready availability of sites for fieldwork. Outside school, access to television, the development of video games and parental concern about permitting children to remain in the bush alone limit opportunities for field study. To a considerable extent the place of nature study has been taken by environmental studies, and Australia was in the forefront of developing environmental awareness in schools (Evans and Boyden 1970). The fostering of environmental awareness and education about the natural environment, in a social, political and global context is clearly essential, but in our proper concern over issues such as climate change and population have we perhaps lost touch with the local and the wonder of the watching plants grow or seeing tadpoles develop into frogs?

The decline in natural history studies may have long term consequences. Environmental education, for which strong curricula exist from the earliest school years, fosters good citizenship and promotes sustainability, but it could reduce the future numbers of observant natural historians. It could also reduce the skills of future professional scientists. The starting point for any ecology is natural history – from observations, hypotheses are developed and tested. What perhaps distinguishes the professionals from most of the amateurs is the ability to see the possibilities that emerge from observations and the skill and training to pursue further investigation. However, without a natural history background and the ability to observe there is a danger that the hypothesis developed and tested will be trite and that progress of science will be slowed. (The importance of a natural history background to the growth of science can be seen in Mabberley 1999, Ratcliffe 2000, Ehrlich and Hanski 2004).

Spreading the message

There is a long tradition of publications about natural history, and indeed the collection of books about natural history can be as much an obsession as collecting specimens. This literature has been essential not only in recording and conveying information, but also in encouraging involvement in natural history. One tradition is the great illustrated book, from the early hand-coloured prints (Desmond 2003) to today's coffee table spectacular. Of more practical use are the field identification guides which can be stuffed into a jacket pocket.

The journals of the general science journals were very broad in their scope, and their readers in many cases read and maintained an interest in the full range of topics. Papers published by the Royal Society of NSW in 1903 (a volume picked at random) included anthropology, archaeology, linguistics, hydrology, geomorphology, geology, metalogy, mineralogy, botany, zoology, physics and engineering. Even today one of the pleasures of dipping into the *Proceedings of the Royal Society of NSW* (or the journals of its sister interstate bodies), or the *Proceedings of the Linnean Society of NSW* (Augee, this volume) is their breadth.

One of the crown jewels of British natural history for the past sixty years has been the *New Naturalist* series, produced by Collins (Marren 1996). These could stand as rigorous scientific monographs but are written to be accessible to a much wider audience and are marketed accordingly. In Australia, Collins launched the *Australian Naturalist Library* based on the *New Naturalist* model, but after a few volumes (including Hughes 1974, Rowley 1974) which were of the scientific and accessibility quality of the *New Naturalist* books, the series died. Of similar concept, and surviving much longer was the Angus and Robertson *Australian Natural Science Library* (include, for examples, Frith 1973, Breckwoldt 1983 – the latter sponsored by WWF through grants from the Commonwealth Bank), although this series too now seems to be in abeyance.

There are many stand alone books some of which have become classics, and certainly have been influential in promoting a natural history culture. Any choice of examples reflects personal preferences, but see Ratcliffe (1938), Rolls (1969, 1981) and Serventy (1966, 1970) – my own interest in Australia was first aroused by reading Serventy's *A continent in danger* in my early years at secondary school. (Both Vincent Serventy and Eric Rolls died shortly before this symposium was held).

Nature notes were a feature of the quality UK daily press, and this tradition has survived its parody by Waugh (1938) (see Figure 2), and is carried on by Simon Barnes in *The Times* and Mark Cocker (and others) in *The Guardian* (See Cocker 2006). Even the popular press supported natural history – Dannreuther (1948) refers to the *Daily Mail* in 1947 publishing a booklet on butterfly migration. (Interestingly the *Sydney Daily Telegraph* produces regular double page pull outs of educational resource material which often include items of natural history). The Australian broadsheets today do not have equivalent nature notes, although they currently have environment reporters and in earlier decades natural historians like


Water Voles at Bosham

The repair works around the bridge are the first phase in a project between Chichester Harbour Conservancy, Bosham Parish Council, Chichester District Council, The National Trust, the Bosham Association, the Manor of Bosham and the Environment Agency.

Bosham Mill Stream supports a population of the nationally rare Water Vole. Their numbers have been in decline throughout the country and if this trend is not stopped they could become extinct. So, wherever possible on rivers and streams works are being undertaken to ensure that their habitat is not lost and conditions are made suitable for them to flourish.

Here on the Bosham Mill Stream the banks were starting to collapse and become unstable and dangerous. Repairs were needed, but with the Water Voles very much in mind. Phase one was the shoring up the banks around the bridge and replacing all the stones scattered on the stream floor back behind the timber rails. Phase two will be the installation of bundles of hazel (called faggots) along the church bank of the stream. This will help protect the bank from erosion, will enable silt to be trapped and will hopefully encourage plants to grow and provide habitat and shelter for the Water Voles.

Bosham Mill Stream is a very popular location – for people of all ages, dogs and ducks! However, Water Voles are sensitive to disturbance so please help to reduce this by keeping out of the water.

Thank you

Chichester Harbour Conservancy 01243 512301

Figure 2. "Feather-footed through the plashy fen passes the questing vole" (William Boot in Scoop – Waugh 1938). The water vole remains on object of affection for the British public – photograph of advisory sign at Bosham, West Sussex, June 2008.

Vincent Serventy regularly wrote for the major papers. Magazines in some cases had a nature column – see Hamilton (1937) which is a collection of articles from the *Sydney Quarterly Magazine* (a long defunct publication).

One of the great popularisers of natural history in Australia was Philip Crosbie Morrison, both in newspaper article and most particularly on radio (Morrison 1961). Mulligan and Hill (2001) discuss the influence of Crosbie Morrison – which was particularly strong in Victoria.

The advent of television brought new challenges and opportunities – on the one hand the box was a rival attraction to the outdoors, on the other it was a new medium to explain and interpret natural history to the public. Internationally the outstanding interpreter of natural history throughout the age of television has been David Attenborough (aided by the remarkable skills of the BBC's natural history unit), but as Mulligan and Hill (2001) show, Australian nature documentaries produced by pioneers like Vincent Serventy and Harry Butler were influential both within Australia and internationally.

The rise of the professionals

The ancient universities provided a limit range of courses – theology, law and medicine. Walters (1981) pointed out that "The Church, law and medicine were the three great professions for which the medieval university trained its students. To that extent the ancient universities were more akin to modern polytechnics, training men to fit the available careers in the society of the time, than to the 'liberal University' of the eighteenth century which pursued learning for its own sake" (Those who have generated the current political imperatives to concentrate on graduate outcomes and meeting of market needs perhaps failed to realise that this was what universities did five hundred years ago). A student interested in natural history would only encounter it in medicine in the form of botany, but botany narrowly confined to addressing the question "what are all these different plants growing wild, and which of them are useful to cure disease and injury" (Walters 1981).

At Cambridge the first Professor of Botany was appointed in 1725, but a zoological chair was not created until 1869 (as Zoology and Comparative Anatomy) (Walters 1981).

Prior to the nineteenth century there had been important scientific research in disciplines such as physics, chemistry and astronomy, but no training in these areas was provided by the Universities. The participants were self taught, but nevertheless in terms of approach to their investigations could be classified in retrospect as scientists. In the early days of biological exploration of Australia three categories of explorers can be recognized; scientists, such as Solander, a student of Linnaeus, (Duyker and Tingbrand 1995) and Brown, (who although he had failed to complete his medical degree, became a taxonomist and botanical scientist of the highest order (Vallance *et al.* 2001), whose natural history activities formed the basis of a career) , the professional collectors such as Caley (Webb 1995) who were often highly skilled observers, but who did not write up or interpret their findings scientifically, and the amateur natural historians who often combined many of the attributes of both the scientists and the collectors; but for whom natural history was not the basis of their careers.

With the advancement of scientific knowledge, the growth on specialisation and the establishment of new universities with a range of science departments the number of professional scientists grew rapidly (and by the second half of the nineteenth century Australia too had its own universities with science departments producing science graduates – although PhDs in science in Australia were not graduated until after World War II). The requirement for access to facilities and technology increasingly limited the scope for investigation by amateurs. Research in laboratory based disciplines such as physics, chemistry, physiology and biochemistry became the exclusive domain of professionals. Field based sciences remained accessible to amateurs, but even here amateurs became increasingly removed from the cutting edge of research (Allen 1976). These changes were not necessarily comfortable for professionals either – in 1888 Babington, the somewhat reactionary Professor of Botany at Cambridge (Walters 1981) was moved to observe "It is rare now to find an undergraduate or B.A. who knows, or cares to know, one plant from another, or distinguish insects scientifically. I am one of those who consider this to be a sad state of things. I know that much of what is called Botany is

admirably taught amongst us; but it is not what is usually known as botany outside the Universities, and does not lead to a practical knowledge of even the most common plants. It is really Vegetable Physiology and ought to be so called. It is a very important subject, but does not convey a knowledge of plants". (quoted in Allen 1976). (Were Babington alive today his criticism of modern graduates would be even stronger!).

In the late nineteenth century the divide between the growing numbers of professionals (the new universities not only required professionals across a range of disciplines, but accelerated the production of graduates to fill newly invented positions) and the traditional natural historians grew wider (Allen 1976, 1986). The amateur members of both the scientific societies and the field clubs still wished to be part of a grand collaborative scientific endeavour, but increasingly were becoming marginalised. Even in the core territory of the field clubs, the role of the amateurs came under attack, invoking a spirited defence by Sheppard (1905). The object of the counter attack was the views expressed by Professor Miall at a meeting of the East Riding Nature Study Committee (the East Riding was one of the administrative subdivisions of the county of Yorkshire) and in print (Miall 1904). Professor Miall held a chair at the University of Leeds, one of the strongest of the new generation of red brick universities. In his address to the Committee, Professor Miall had objected to the collection of plants and shells in schools but Sheppard's particular scorn' was addressed to Miall's (1904) publication in which he saw little value in natural history clubs, and offered a number of rules which would improve them – 'Let no papers be read to the club', 'let there be no lectures, as a rule', 'let no local lists be prepared, read, or printed; they are hardly ever worth the paper they are printed on'. 'It is nearly always a mistake for an amateur club to print anything, even an annual report'. The Natural History Club at the University of Leeds was a model in that it 'asks only for a shilling subscription, which is entirely spent on refreshments. We have no constitution; we have only two officers, and we never print a line', and at meetings 'discussion is preceded by a cup of tea and half-a-hour's chat'. In Sheppard's (1905) riposte he suggested that if this advice was taken, the thirty-three societies affiliated with the Yorkshire Naturalists' Union would come to abrupt end. We must remember that the real natural history society is not composed of college students taking a course in biology principally for the purposes of obtaining a degree. It is composed of men – largely artizans, who love Nature for Nature's sake, men who are pleased to see the birds and flowers and insects in their native haunts, to observe their habitats, and to leave them unmolested…' . Miall's suggestions regarding the preparation of species lists and publications attracted particular scorn. 'Annual reports frequently contain particulars of local occurrences and records which would otherwise be irretrievably lost. If no publication is issued – if no record is made – much useful material is in a few years entirely forgotten. What will the ideal society at the Leeds University have to show in a few years' time as a result of its existence? Beyond possibly a few receipts for tea and biscuits, nothing – absolutely nothing'. In a concluding observation Sheppard argued that it must be remembered that the views 'are those of a Professor of Biology, and cannot be accepted as those of a field naturalist'. Similar tensions between amateurs and professionals were also evident at this period in Australia (Mulligan and Hill 2001).

Notwithstanding the force of these arguments it seemed a real possibility that the traditions of natural history would slowly decline to irrelevance.

The discipline which continued many of the interests of natural historians into the professional arena was ecology, which itself had difficulties in becoming accepted as 'serious' by other disciplines. Early ecological studies, as reported in the *Journal of Ecology* and *Ecology* had a strong foundation in observation and description; differing from natural history studies in the depth of analysis and interpretation, but later with the increased use of technology and statistical and numerical analysis, ecology started to diverge from its natural history roots. Star (2006) suggests that ecology became a mainstream science in New Zealand considerably earlier than in Australia; in terms of the role of ecology in the universities and research institutes this appears so, but I would argue that papers in the local scientific literature exhibited an ecological understanding long before the term 'ecology' gained common currency. (It is interesting to speculate how different both world and Australian ecology would have been if Tansley had followed through with his application for the chair of botany at the University of Sydney in 1912 – Anker 2001).

The new alliance

What the traditional naturalists had been good at was exploration and collection of specimens and data. These collection data were often used as the basis of local accounts of components of the biota. (In the UK the accounts were often based on counties (or the related biogeographic units, vice-counties. See Figure 1). In the new professional era there was the opportunity to harness the amateurs to assemble data in a more systematic fashion and to analyse it to address new questions.

Allen (1976) discussed the moves to re-establish co-operative links between the professionals and the amateurs in the UK in the years between the wars. The pioneers with a number of organised surveys and recording schemes were the ornithologists, but one of the most interesting projects was initiated through the interest of a retired naval officer, Captain Dannreuther, who established an Insect Immigration Committee. Although working through his local society, the Hastings and St. Leonards Natural History Society on the south coast of England, the Committee became national in its activities (Allen 1976). Captain Dannreuther ran the scheme for over twenty years, and while the data were gathered at the Rothampstead research station for analysis and interpretation, he also wrote papers discussing some of the more interesting findings (e.g. Dannreuther 1948). Allen (1976) sees this as a period when 'the amateurs now had in their gift a new scientific tool capable of procuring certain

types of information which the professionals, working on his own, unaided, could not hope to come by. Suddenly the Amateur had become scientifically indispensable'. Nevertheless, the reprochement was not universal, some naturalists 'were frankly hostile to what they saw as the advent of a bureaucratization of the subject'. 'For some, form-filling of any kind is deeply distasteful.' (Allen 1976), but these interwar initiatives were the prelude to the post war period which Allen (1976, 1986) describes as a golden age.

The insect immigration recording scheme was later copied by the Dutch (Allen 1976), and it was in the Netherlands that the recording of the distribution of plant species on a uniform grid across an entire country commenced. Building upon maps published very early in the twentieth century, the Institute for the Investigation of the Vegetation in the Netherlands took over the mapping in 1930 and in 1935 (IVON 1935) published the first set of new maps.

In the pre war period the botanists in Britain were not involved in the new links with the professionals, being tied up with reorganisation and personality clashes (Allen 1976, 1986) but in the years after the war they became world leaders in biological recording. The Botanical Society of the British Isles established the Distribution Maps Scheme in 1954, securing grants from the Nuffield Foundation and the Nature Conservancy (the UK government conservation agency) for the employment of key staff and the purchase of them cutting edge punch card data recording equipment and map plotters. The Society had held a conference in 1950 to discuss studies of the distribution of plants (Lousley 1951) and a paper on the Dutch experience of using standardised scoring cards to record flora in the field by Kloos (1951) was particularly influential in planning for the Scheme. The decision was taken to record the flora in each of the 10 km national grid squares (a unified co-ordinate system developed during the second world war superimposed on the National Ordnance Survey maps). The Scheme involved documenting all existing records in herbaria, museums and the literature and a sustained efforts; involving many volunteers, to visit and record in every grid square. There was a rigorous quality control mechanism in place to check records which appeared anomalous. After a surprisingly short period the completed atlas was published in 1962 (Perring and Walters 1962). At the end of the project, the data and the technology were transferred to the Nature Conservancy to establish the Biological Records Centre (Allen 1986). Building on the foundations laid down by the botanists, atlases were prepared for numerous other taxonomic groups, again relying very heavily on input from amateur natural historians. An important feature of all these projects was that in addition to consolidating existing data they involved 'square bashing' - deliberately searching grid squares systematically to ensure that every square had at least a minimum search effort. Although ideally the search intensity should be equal across all squares this is not a practical goal. Squares with proximity to major population centres and ease of access will inevitably have more records than more remote locations.

The preparation of atlases is not an end in itself, but an important tool for the greater understanding of biodiversity. The intensive fieldwork for the British flora atlas revealed many range extensions, and even some species new to Britain. The data were important, not only in documenting occurrences of rare species but also in describing distribution of common species. The data permitted analysis of distribution patterns (Preston and Hill 1997) yielding new insights into the ecology of many species. The success of the national mapping revitalised the production of country floras, with consistent mapping at finer scales (generally a 2x2km (tetrad) grid - for example, see Abbott 2005).

Continued recording permitted the publication of a second edition of the British Atlas (Preston *et al.* 2002), which highlighted the extent of change over forty years, followed by a much more detailed analysis of changes over a shorter period (Braithwaite *et al.* 2006). The use of atlas data to assess change in distribution and abundance extended to other taxa, including butterflies – Asher *et al.* 2001, Fox *et al.* 2006. As might be expected the ornithologists were well to the fore, both nationally and internationally. National atlases for Britain and France were published in 1976 (Sharrock 1976, Yeatman 1976), followed by atlases in many European countries (documented by Hagemeijer and Blair 1997), culminating in the continental scale publication by Hagemeijer and Blair (1997). This wealth of data permitted the detailed mathematical modelling by Huntley *et al.* 2007, and predictions of the possible impacts of likely climate change on the European avifauna.

The task of basic recording, to ensure that there has been a consistent minimum level of sampling effort, still continues, involving combinations of both amateurs and professionals. (See Preston 2008, Kungu 2008).

As well as recording presence and absence of species on a geographic basis there is also a long tradition of recording temporal events – the arrival of the first cuckoo of spring has been recorded in the letter pages of *The Times* (of London) for more than a hundred years. The timing of flowering of particular species (phenology), or the arrival and departure of migratory species, recorded in diaries, notes in local journals and letters to newspapers can be used as evidence of climate change. In some parishes in Britain there are two centuries of records providing a detailed picture of the response of species to environmental change and indications of future changes. This type of information is only likely to be collected by amateurs, although through the accumulation of records, and statistical analysis, professional scientists can now reveal details that would be surprising to the original recorders. In Australia the collection of phenological data has now been put on a systematic basis by the Bureau of Meteorology – see Chambers *et al.* (2007).

One of the greatest threats to global biodiversity is the spread of introduced species. Australia has been particularly affected, and despite quarantine and public campaigns addressed at travellers, introductions are still occurring at a high rate. The introduction of some major

environmentally threatening exotic species has been promoted by governments very recently (for example *Hymenachne amplexicaulis* and gamba grass (*Andropogon gayanus*) – both promoted by the Queensland government). Other species may have been deliberately, but illegally introduced for example bumble bees in Tasmania and blackberry rust, whereas many of the environmental weeds are garden escapees (Low 1999), and the introduction of large numbers of species into the marine environment by shipping was accidental, but an inevitable consequence of modern technology and greater trade.

If entry to Australia cannot be prevented then the second line of defence must be detection and control (ideally eradication). There are insufficient professionals to provide a national detection programme, but with a well designed sampling strategy, natural historians would be able to contribute to the detection of potentially invasive species.

Recording in Australia

A number of distribution atlases have been published in Australia (see, for example, Ingram and Raven 1991, Rounsevell *et al.*1991). However, for the most part these involve the capture of data from museums and herbaria, or from detailed surveys of particular areas. Many specimens would have been collected by natural historians, systematic collection across an entire state or nationally has, with one notable exception, not been attempted. It is important to capture these data, but they must be assessed with care, older, and even some recent, specimens are poorly geo-referenced, collection may cover extensive time periods, but the lack of systematic recording makes detection of temporal changes problematic, and for many taxonomic groups the number of collections is so small that other than documenting the presence of species little can be learnt about either distribution or abundance.

The one great exception has been, as is the case internationally, in ornithology. The first atlas of Australian birds was published in 1984 (Blakers *et al.* 1984), the culmination of a project which commenced in 1977. The project gained its inspiration from British mapping projects, but given the size of the continent, the remoteness of much of it and the much smaller human population, the task was much more challenging. Data were recorded on a 1° latitude and longitude grid (812 grid cells for the whole continent), and expeditions were organised to ensure that data were available from every grid cell. Quality control was addressed through a rigorous vetting process (Blakers *et al.* 1984). The second atlas was published in 2003 (Barrett *et al.* 2003). The second atlas involved the co-operation of some 7000 volunteers, and 'marked the establishment of an Australia-wide bird monitoring program, where fixed effort, community-based surveys continue to provide accurate, on-going monitoring data, for the majority of Australia's bird species' (Barrett *et al.* 2003, 2007). As with the mapping projects in Britain and Europe the continuing accumulation of records overtime provides a powerful tool for monitoring changes in distribution and abundance.

Exactly why ornithology is so much in forefront of public-private partnership could repay further study. Allen (1976) suggests 'ornithology had scarcely any hope for support on the pretext of economics. It was a totally useless subject: the amateur's field *par excellence*, largely ignored by even non-utilitarian academics. No one entered it expecting to be given money and no one, for sure, had ever emerged with any. Yet despite this fundamental disability, it was here that organised natural history was to accomplish its greatest feats and the machinery of co-operative work to be brought closest to perfection.

Its secret lay in numbers. Birds had a breadth of appeal that no other branch of natural history could rival.'

Today, the situation of ornithology is slightly different. A small number of people can make a living, if not a fortune, out of bird based eco-tourism, and the utility of birds for monitoring environmental change is increasingly recognized. Canaries as monitors of conditions in mines have a long history – birds in general may be the 'canaries in the mine' for the whole environment.

Natural history in the age of biodiversity

Australia, like many other nations, is a signatory to the United Nations Convention on Biological Diversity, and has thus agreed to accept the obligations that the Convention imposes. These include documenting, managing and monitoring biodiversity.

These tasks cannot be achieved if there is reliance only on the professional work force. Although there are probably more working scientists today than the cumulative number over past ages, the number is inadequate for the task, particularly as many of the necessary observational skills are no longer taught. Professionals are also extremely constrained in what they can achieve. While the public might have a vision of ecologists spending all their time in the field, this is a privilege available to only a very few. Requirements of teaching and administration, and observation of occupational health and safety legislation substantially reduces the field time available. Short term research funding cycles limit the capacity for professionals to establish long term research monitoring and research projects.

As the bird recording scheme has demonstrated, co-ordinated projects can overcome these problems and collect data on a scale impossible by the professional workforce alone. Nevertheless groups interested in other taxa currently lack the numbers and organisational structures of the ornithologists – national recording programs would be an ambition for the future, but regional and state projects may be more achievable. We need to develop mechanisms to encourage and support natural history recording. Relationships need to reflect the skills and commitment of the participants; the amateurs are not merely cheap slave labour.

The number of species on earth is unknown; what we can be certain of is that the majority of extant species have not been collected, let alone described. It has been necessary to institute biodiversity conservation and management programs in the absence of a complete

inventory of biodiversity. However, this does not reduce the importance of describing as many species as possible. Collection of new material is the essential prerequisite for the task. Natural historians have the capacity and interests to do this collecting, but collection is discouraged. There are good reasons why collecting has to be regulated, and a return to extensive and unnecessary collecting would be very undesirable. We need to develop protocols and regulations which permit appropriate collecting without threatening conservation objectives.

Do amateurs have a role beyond being collectors – can they also become the taxonomists of the future? Globally, the number of employed taxonomists is in decline, taxonomy in tertiary institutions is close to becoming extinct so that the supply of taxonomists is dwindling. Despite recognition of the problem, and the increased understanding of the importance of biodiversity, little has been done to address the issue.

That the matter is of serious concern is acknowledged, but the solution is left to a hypothetical 'someone else'. Employment prospects in universities are determined by student demand and ability to attract large grants – taxonomy isn't sexy enough to fill large lecture theatres and grants for taxonomy are few. The public good in maintaining taxonomy does not sway senior management faced with limited resources and government demands that research should generate economic returns.

Historically many taxa have been described by amateurs, but control of access to publication in appropriate journals and to specimens led to a decline in the practice of taxonomy outside public institutions. Some techniques applied to modern taxonomy, particularly those involving molecular biology, require access to laboratories and other facilities which can only be provided within institutions. However, much alpha taxonomy can be achieved without molecular techniques. With rigorous refereeing prior to publication, and regulation to ensure that type specimens are deposited in approved institutions, I suggest that amateur taxonomists could have a growing role in documenting biodiversity.

For many groups of organisms there may be no professional experts in the future. Amateurs may provide the only avenue by which knowledge of some groups can be sustained. Access to collections by amateurs would need to be possible, and this might not be easy to arrange at understaffed institutions.

The fear of fraud underlines some of the opposition to a greater role for amateurs. Reporting misidentified records is not maliciously intended, and some sort of quality control screening will be necessary. Deliberate fraud is harder to detect; it is difficult to assess how prevalent it might be and the number of reported cases is small. From reported, or strongly suspected, cases it is clear that fraud may be perpetrated by both amateurs and professionals (Allen 1976, Sabbagh 1999, Bircham 2007).

The taint of illegality is also attached to the historic foundation of much natural history – collecting. There is a very large, if by its very nature poorly documented, illegal trade in both living organisms (including fish, reptiles, birds and mammals, cycads, cacti and orchids) and specimens (including fossils, prized beetle, butterfly, shell and birds' egg collections). Some, perhaps many, involved in this trade are in it purely for the money, but some have a natural historian's interest, but any scientific value which their collections might have is lost through false documentation and their clandestine nature. The opprobrium which hangs over collection is perhaps an impediment to developing the next generation of natural historians. Certainly no one could argue that egg collecting, for example, or the seeking out for collection of endangered species should be condoned, but generations of natural historians learnt their identification and observational skills by making collections from local habitats.

The involvement of natural historians in recording distributions reflects the survival, in an acceptable form, of the collecting urge, which in its most extreme form is represented by 'twitching', the ambition to see every possible bird, even though this may involve substantial expenditure on travel (one wonders about the future of twitching if the costs of fuel and travel continue to rise (see Cocker 2001, Dooley 2005)).

Natural historians are citizens, and while I have never seen a bumper sticker declaring 'I'm a natural historian and I vote' they represent a potentially powerful lobby group – making submission both to promote conservation and the maintenance of the institutions and their staff which provide the repositories of taxonomic data. Natural historians have an important role as the guardians of legislation protecting threatened species. In NSW, the *Threatened Species Conservation Act* permits anyone to make nominations to amend the Schedules of the Act, making the public the state-wide eyes for monitoring biodiversity (Preston and Adam 2004).

Biodiversity is not the only field in which interactions between natural historians and professionals may be mutually advantageous. While radio astronomy is at the big (i.e. very expensive) end of professional science, amateur observers still make a significant contribution to optical astronomy. Amateurs continue to make important discoveries of fossils and minerals, even if many techniques of geology (such as seismic geophysics) are the exclusive province of professionals. Even for biodiversity some habitats, such as abyssal depths of ocean basins, are out of reach to sampling by amateurs.

However, not all is rosy. The skills of patient observation underlying natural history remain an important underpinning of much science. Many leading scientists were collectors in their formative years (Macfarlane Burnet collected beetles for example – Sexton 1999) and these interests continued throughout their lives. Marren (1995) drew attention to the fact that early authors in the '*New Naturalist*' series included five knighted for their scientific achievements, a dozen Fellows of the Royal Society and a Nobel Prize-winner. The more recent volumes are no less rigorous in their scientific content nor are the authors lesser scientists, but few have been accorded the honours achieved

by their predecessors. In modern academia, natural history is not a pathway to career advancement. Marren (1995) has also expressed concern about the decline in numbers of amateur naturalists in Britain. There are still many actively engaged in recording biodiversity, and their numbers include a cross section of society, but numbers are declining. There are many competing attractions (although this had been perceived as a problem since the 1920s – Allen 1986), and many believe that time is one of the rarest commodities. Marren (1995) suggested that with the rise of environmental concerns there has been a move away from natural history – 'Field study seems in danger of degenerating into what for most people is a spectator sport. Birdwatching apart, it is becoming a passive activity in which one is lead around and shown things by the 'expert' and that 'Millions watch Bellamy and Attenborough on the telly, but how many of them can read a map or know how to use a microscope?' Marren's concerns may be a little exaggerated but I think there is a serious point to them, and that they are also applicable to Australia. Environmentalism and big picture views of conservation are important and necessary, but it would be ironic indeed if the advance of environmentalism over the past forty years, coupled with the decline in natural history in school teaching results in neither side being unable to sustain the PPP necessary for future environmental sustainability.

Coda

The history of natural history in Australia deserves an extended treatment. Hutton and Connors (1999) and Mulligan and Hill (2001) provide detailed histories of parts of the story, but areas such as natural history in schools and its lifelong consequences require more consideration. There is a tendency for the British to view the natural history movement as being based in a northern European tradition (Fitter 1963) and being one of the major contributions of the Empire to the World. Dunlap (1999) has documented the importance of natural history in the development of the English speaking colonies, but we perhaps have not given sufficient credit to natural historians from southern Europe, both at home and in their empires.

In Australia, natural history studies may appear to be the domain of those of northern European origin. There are notable exceptions (for example the Serventy brothers), but large sections of our now multicultural society are not obviously engaged with natural history. One of the challenges for the future is for natural history study to become more inclusive (not only to increase the total number involved, but because we can learn from different perspectives and sensibilities). I would hope, however, that broadening is within the mainstream and that it will not be necessary to see the formation of the equivalent of the Gay Birders Cub or the Disabled Birders Association whose establishment in the UK is discussed by Moss 2004).

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I am grateful to Pat Hutchings and Dan Lunney for their helpful advice. Dan has suggested that readers will have their own memories of how they came to be natural historians and that the *Australian Zoologist* could provide a forum for discussion of both individual and collective views , I concur and look forward to seeing some of the my ideas and speculations debunked.

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