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Careers in the environment in Australia: surveying environmental jobs

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Internationally, commentators have identified a growing demand for environmental expertise. Matching this has been an expansion in the range of environmental careers available to workers: from environment protection and bio-physical areas, to local government operations, environmental auditing, assessment, and management. However, in Australia there is no overall picture of the types of jobs graduates in this sector have undertaken, which has limited the advice that can be given about environmental careers. To redress this situation a survey was conducted with 600 respondents working in the environment professions in Australia. The results identified a wide range of professional areas; these are grouped into 12 subcategories for three main environmental employment sectors: Environmental protection (19% of respondents), Conservation and preservation of natural resources (26%), Environmental Sustainability (55%). Respondents mainly had a bachelor-level degree; however, a substantial proportion had an honours degree or postgraduate qualification. Respondents strongly recommended undertaking work experience to acquire key general skills that they identified as important for working in the environment sector. A related suggestion was for tertiary environmental courses to have a practical focus that produces 'work-ready' students. Comparison with the situations in the UK, Canada and the USA and are also offered regarding the results and trends, and suggestions for further research.

Introduction

Environmental education has the elements of education *about* the environment (providing knowledge), *in* the environment (related to current practical issues) and *for* the environment (taking action for improvements) (Greenall, 1981). A critical mechanism for students to respond to the last element and take action will be through the work they do. Likewise through education for sustainable development the expectation is that students will gain understanding of how to apply the principles of

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sustainable development in their personal and professional lives (Thomas, 2004). Consequently, to support the intentions of these areas of education it is important to assist students in finding related careers.

Since the 1970s, tertiary courses have been graduating people who have subsequently become employed in a range of environmental jobs. In the mid 1990s, there were an estimated 400 college-level environmental programs in the USA (Strauss, 1996) and by the end of the 1990s, in Australia, over 700 undergraduate and postgraduate programmes were listed by the Environmental Education Database (Environment Australia, 2001). While these courses may have monitored the employment paths of their graduates, there is no overall picture of the types of jobs these graduates have undertaken, of the demand for their capabilities, nor of whether employers' requirements are being met in terms of the availability of potential employees, and the expertise the employees bring to their jobs. Nonetheless a broad picture of these requirements has been available (for example, Department of Education, Training and Youth Affairs, 1998, 2000; Thomas & Nicita, 2003).

To complicate the picture, with the development of environmental education and training there has been the evolution of 'jobs our parents never heard of' (Everett, 1999). Across a wide range of industrial, commercial, community and government operations a plethora of jobs have been developed aimed at environment protection and management. On the international scene discussion of 'green jobs' began over a decade ago. The Council for Environmental Education (1989) indicated that there were many job possibilities in the government and NGO (non-government organisation) sectors. Harris (1990) identified a range of commercial organisations employing environmental scientists, and MacPherson (1992) identified the 'growth in jobs with a green tinge' (p. 437) across the spectrum of organisation. The growth in these jobs is further also highlighted by Bezdek (2001). Expansion in the range of environmental careers has surpassed the traditional bio-physical focus to include local government operations and more:

> New areas of expertise are developing, such as environmental auditing and assessment, environmental management and environmental engineering. They in turn generate the formation of new professional bodies or associations to represent them, such as the Society for the Environment. They create more recognised qualifications and career structures, so reinforcing the status of environmental careers. Environmental Careers (2005a, unpaginated)

Australia experienced increased demand for environmental scientists in the 1980s (Industry and Occupational Studies Section, 1990) and, from a North American perspective, Cook (1993, p. x) was able to comment that 'today, environmental careers are big business.' A decade later the demand for environmental workers remains strong (Karvelas, 2001). Specifically referring to the USA, Bezdek (2001, p. 168) comments that the environment protection industry is already larger than most corporations, and 'it is likely that the environmental industry will continue to grow rapidly in the foreseeable future.' The latter point is supported by the Bureau of Labor Statistics (2002), which sees a strong growth to 2010 in most fields of environment professions.

In the British context, an early 1990s survey of environmental managers suggested that education and training were not keeping pace with the growing responsibilities of those in environmental positions (Barrett, 1993). However, this situation has apparently been turned around; in a feature article titled 'Survey Reveals Improvement in Environmental Career Prospects', Fuller (2002) reported 'a dramatic increase in salaries for environmental professionals' (p. 1) and an overall growing demand for environmental expertise. This trend has continued:

> The number of environmental graduates in the UK continues to increase year on year.... It is also important to recognise that all jobs and careers can practice and promote sustainable development. Environmental management and resource efficiency will be included in the work of other more traditional careers. (Environmental Careers, 2005a, unpaginated)

To emphasise the point, following an informal review of employment in the environmental fields, especially related to private industry, Bonner (2005, unpaginated) concluded 'the environment sector is suffering from its own success, growing too fast to meet its skills needs.' With no information to the contrary, it is probable that these employment trends are also being experienced in most countries where economic growth and environmental management standards are strong.

To help employers fill these jobs, services have been developed which are specifically designed to bring environmentally-related careers to the notice of those who are interested (Barrett, 1993; Castellas, 1998; Environmental Careers, 2005b; Environmental Careers Organization, 2005; Environment Institute of Australia, 2000; Executive Recruitment Services, 2000; Sustainable Business, 2000; University of East Anglia, 2005). For over two decades our higher education institutions have had graduates emerging from tertiary programmes and making use of these career services. Yet, in Australia at least, there has been little indication of where these graduates have been working, or whether their education and training has prepared them for their employment. In other words, we have little information about the opportunities for people wanting to enter the environment profession in Australia.

Over the years there have been some attempts to gain understanding of employment in environmental fields. The report by Industry and Occupational Studies Section (1990) undertook a brief survey in Victoria to assess the extent of employment in the field of environmental science (which was broadly defined). More recently, the 2001 'Report on Victoria's Environmental Management and Renewable Energy Industries' identified the evolution and growth potential in these environmental areas; however, the report is based on submissions rather than any comprehensive survey of the industries. In other states there have been similar audits of environmental industries, such as the 2000 audit of the Environment Industry in Tasmania (Department of State Development, 2000).

At the national level, McGill *et al.* (2002) have assessed the growth potential of the renewable energy industry. The Australian Bureau of Statistics (2001) noted that key information has come from 1998 and 1999 reports undertaken by R. Genoff (University of South Australia) titled 'Environment Management, Products & Services Industries', but that these data mainly focused on business expectations. In

response to these efforts, the Australian Bureau of Statistics proposed a national survey of the environment industry, but as of 2005 the survey had not proceeded owing to its having a lower priority for funding than other work (Vardon, M., 2005, Centre of Environment and Energy Statistics, Australian Bureau of Statistics, personal communication 12 December p. 5). Planning of the survey focused on the collection of a small range of data (see Figure 1), at a regular interval for trend analysis (Australian Bureau of Statistics, 2002). As with the other surveys and reports of environment activity, the Australian Bureau of Statistics survey emphasises the collection of information about the industry (business characteristics and economics) but did not intend to provide any information related to the employees, or the activities they engage in. Yet there is a clear need for data related to employees if we are to understand the opportunities and trends in environmental careers.

In Australia, the Environment Institute of Australia and New Zealand is the professional association for people working in the range of environmental fields, but apart from data about its members, it has no firm understanding of the jobs filled by people who are not members. Likewise the Environmental Jobs Network (based in Melbourne), and similar organisations that identify environmental jobs, have very

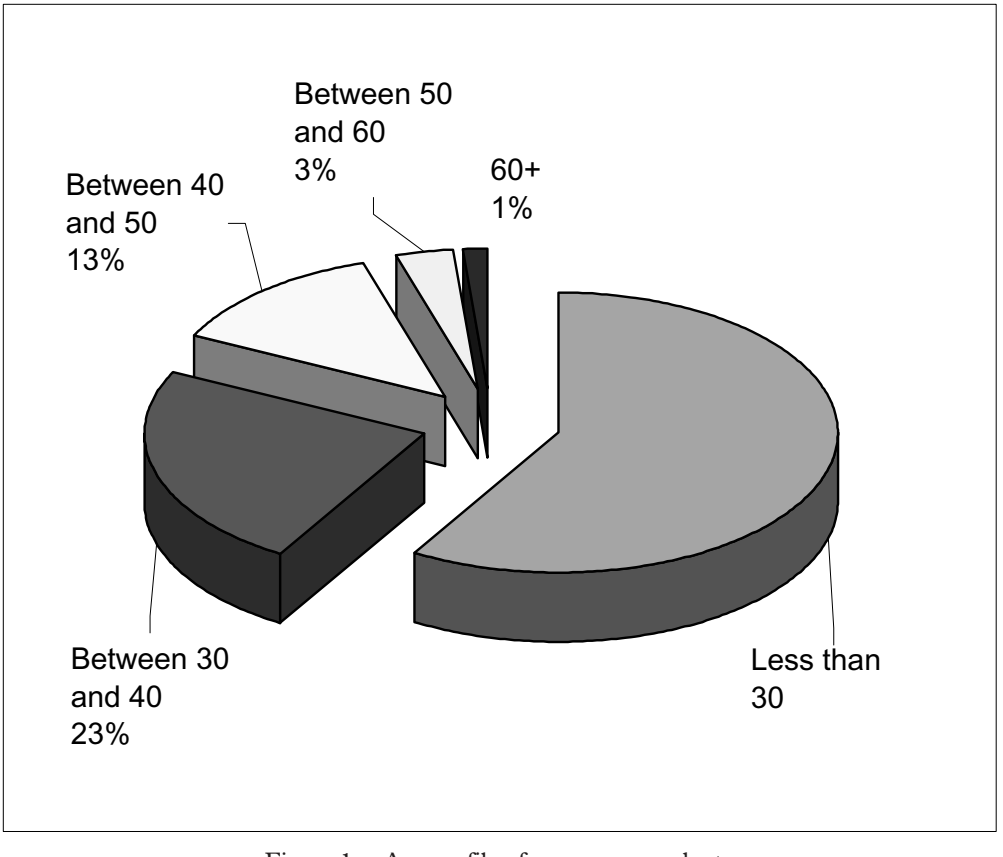

Figure 1. Age profile of survey respondents

limited information on which to base their advice for jobs seekers. This lack of data about environmental employment can be contrasted with the greater extent of information in the USA. The regular publication of 'The New Complete Guide to Environmental Careers' has provided a source of employment data for a decade, and the Bureau of Labor Statistics has assembled data to make predictions about the trends in employment in several environmental fields (Bureau of Labor Statistics, 2002).

The dearth of data for Australia is a limitation on being able to advise people wanting to gain access to employment in environmental fields, and for assisting any workforce planning in these fields. Equally importantly, the lack of data also affects the delivery of educational programmes that prepare people for these areas of employment. In this context there is little information flowing back from employers about the effectiveness of programmes in meeting the needs of employers, so the programmes have little guidance about the knowledge areas and skills that will be expected in current and future graduates.

In order to redress some of the data deficiencies, in 2004, the Department of the Environment and Heritage provided funding for a survey of a sample of people working in the environment professions in Australia. The remainder of this paper discusses the development and the results of this survey.

Developing the survey

In his discussion of the environmental protection industry in the USA, Bezdek (2001) points out that many of the jobs in the fields of environmental protection and management do not have an environmental 'tag', in that the work is undertaken as part of a broader job description. This makes the definition of 'environmental employment' difficult. To illustrate the difficulty of identifying 'green' jobs Bezdek proposes that they can be thought of as on a spectrum. At one end are the jobs that at first glance seemed to promote environmental protection, but may lead to an aggregate disadvantage (for example jobs in a recycling plant, where the plant generates a substantial amount of pollution). At the other end would be those jobs that lead to a reconfiguration of processes so that pollutants are not generated (possibly involving 'cradle to cradle' operations). In the middle would be those jobs that provide (usually) technical solutions to specific pollution or resource consumption issues ('end of pipe' type approaches). Across the spectrum all the jobs can be called 'environmental', but some, which lead to greater overall environmental improvement, could be classed as 'greener'. The evolution of jobs adds to the complexity (ibid., p. 173):

> Jobs can be considered to be 'green' relative to the way the job was performed previously. In a production process, a change in technology which reduces waste emissions or energy consumption makes the jobs in that process greener than before. But are such jobs still counted as environmental jobs when newer technology makes available ways of further reducing energy consumption?

This level of sophistication in categorising environmental jobs in Australia would require a substantial database of who is doing what in the wide range of environmentally-related jobs. Currently we do not have that type of data. As indicated above we

have very little data covering Australian jobs in the environmental fields. Hence, our survey was envisaged as a first stage towards a more comprehensive database. Specifically we were seeking to obtain information about:

- the range of environmental positions available in Australia
- what these positions entail
- the skills and qualifications needed for these positions
- the likely trends in the employment fields.

With this information we would have a base to provide students and professionals with an understanding of the environmental careers available to them.

Past surveys and forecasts (above) have been able to work with the complexity of job categories and while it may mean that an initial Australian survey will not encompass the entire scope of environmental jobs, the survey was designed to build on the experience of others, and can evolve over time to improve its coverage. Specifically the framework for classification of environmental employment that was developed for the survey drew on an internationally recognised models developed by Canadian Council for Human Resources in the Environment Industry (CCHREI). This framework consists of three sectors of environmental activity, each with four subcategories. The sectors as well as the subsectors can be considered distinct but interrelated given the complex and integrated nature of environmental issues. The framework for classification of environmental employment is presented below.

1. Environmental protection
    - air quality protection
    - water quality protection
    - land quality protection and site restoration
    - waste management
2. Conservation and preservation of natural resources
    - fisheries and wildlife
    - forestry
    - national parks and protected areas
    - energy and climate protection
3. Environmental sustainability
    - education
    - research and development
    - policy and legislation
    - communications and public awareness

For each of these employment categories, data collection was guided by the earlier work of: National Occupation Standards developed by the CCHREI and the 'Complete Guide to Environmental Careers in the 21st Century' (Doyle, Heizmann & Stubbs, 1999). This led to the survey participants being asked about:

- Most common activities—instances of the types of activities that the respondents in each category were engaged with
- Common position titles—the title by which the respondents' positions were designated
- Education and skills—the types of educational qualifications obtained by the respondents, and the skills that they considered to be most useful
- Employment—sectors in which they were employed
- Personal profile—for each employment category, one survey respondent was asked to provide a summary of the structural factors of their position (such as salary), their personal comments on the job, and suggestions for anyone wanting to enter the field of employment.

In addition to providing responses to the 'quantitative questions' (such as what type of degree they had), the respondents were asked to elaborate on their responses, and to provide their suggestions about what can assist people to gain employment in the environmental fields.

The survey and the sample

Practitioners were surveyed in relation to their positions, career paths and knowledge and skills. Distribution of the questionnaires was by email following a 'cascade' or 'snow-ball' approach to identify the sample from the contacts available through the Environmental Jobs Network and relevant groups identified during the project.

Over 600 environmental practitioners responded to the survey, providing valuable qualitative and quantitative data. Most of these respondents were recent graduates. Figure 1 indicates that approximately two-thirds of the respondents were less than 30 years of age (60%). The second largest age demographic was respondents between 30 and 40. Only a small percentage of respondents were over 40.

The survey respondents were employed by three main employer types. The majority, 59%, were employed in government (Local, State and Federal). Otherwise, 32% of respondents were employed in private organisations, and 9% were employed in not-for-profit organisations. Figure 2 identifies the main employment classification subsectors that the survey respondents were involved in across the three employer types. The main subsectors were: communications and public awareness, policy and legislation, and research and development.

Results from the survey responses

A key finding is the range of position titles used by the respondents in relation to the framework of classification of environmental employment (Appendix 1). In total 258 titles were noted by the 600 respondents, providing little opportunity to identify trends in the titles.

Equally broad is the range of 'most common activities', as illustrated by just two examples in Table 1.

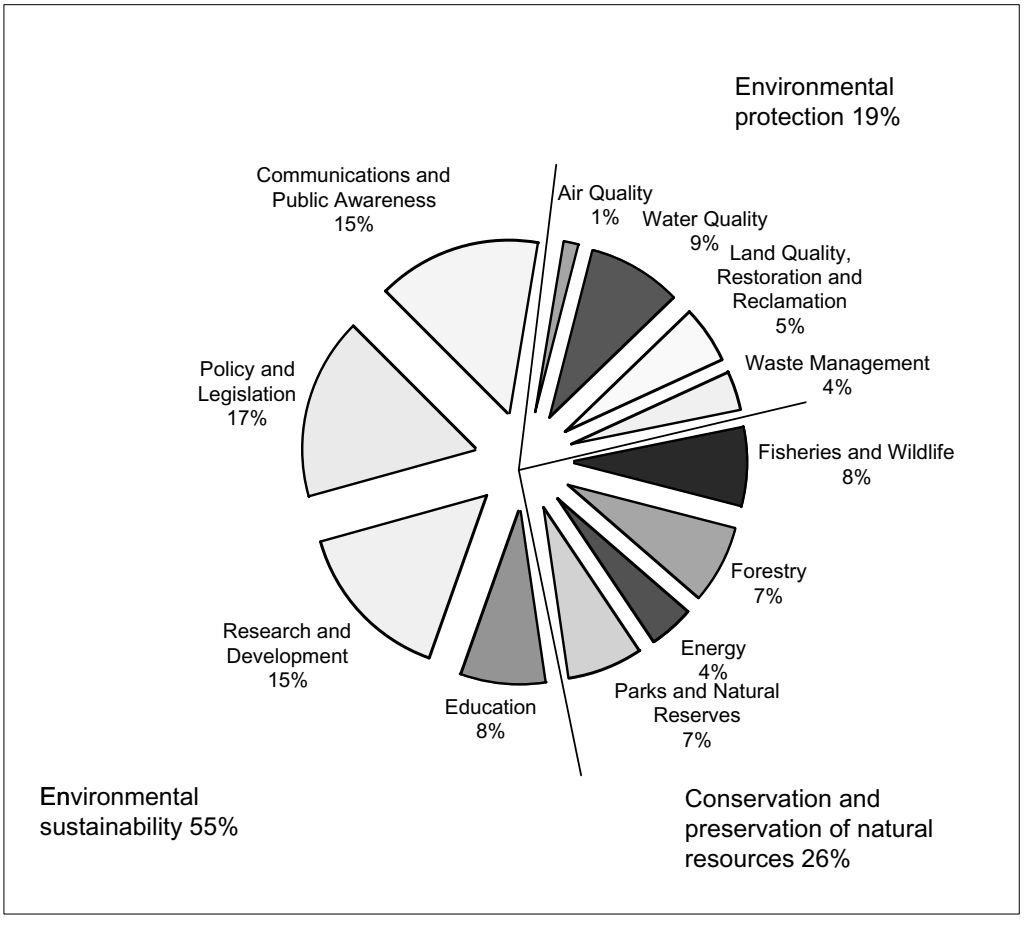

Figure 2. Percentage of survey respondents employed in various environment industry sections and subcategories

As would be expected for data that range across such a diverse spectrum of employment, there are no particular trends that stand out in regard to the respondents' experiences and skills. A consolidated version of what constitutes an environmental career was not the purpose of the research. Rather, it has been to identify and explore the range of possibilities available.

Associated with that range of positions was a more easily classified grouping of skills that the respondents noted as being required for the positions (Figure 3). The results on general skill levels illustrate that the majority of survey respondents believe it is necessary to be highly competent in the range of general skills. This indicates that in order to gain employment, or be successful in many environmental positions, well-developed general skills are required in addition to academic qualifications. Undertaking work experience, paid or unpaid, was uniformly noted as the way to develop these skills.

Table 1. Examples of most common activities listed for employment sub-categories

Employment sub-category	Most common activities
Education	Assessment of needs for new environmental education programmes
	Design, delivery and evaluation of environmental education programmes
	Marketing of educational courses
	Planning and delivery of modules, courses, seminars and lectures
	Research
	Development of working relationships with industry and government
	Consultation sessions with community groups
	Development of education materials
Water quality protection	Research and analysis of drinking water, stormwater, ground water, waste water and coastal water quality
	Drinking water, stormwater, ground water, waste water and coastal water quality
	Compliance, permit issuing, remediation and reporting
	Design and operation of waste-water treatment plants
	Biological assessment of rivers and streams
	River health and habitat assessment, river rehabilitation plans, ecosystem monitoring
	Impact assessments of waste water in streams
	Impact assessments on different water bodies
	Research on water governance
	Development of legislation and regulations for water quality protection
	Development of guidelines and standards for water quality protection
	Engagement of civil and corporate communities to improve water quality advocacy for river health
	Community consultation and education
	Development of stormwater infrastructure and maintenance
	Design calculations for stormwater control devices (e.g. sedimentation ponds)
	Support for schools and community groups with water quality monitoring
	Operation of Environmental Management Systems (EMS) and international certifications like ISO14001

Academic qualifications of respondents fell into well-defined categories. As shown in Figure 4, 26% had postgraduate qualifications. While the greatest portion (47%) had a ordinary (unclassified) degree, 19% had an honours degree. These results indicate that postgraduate qualifications are not essential for entry into many environmental careers. It may be that an undergraduate degree or educational diploma gives the technical knowledge required for certain careers. Although not canvassed in the survey, some environmental careers may require postgraduate qualifications as specialist knowledge and training, whereas for others work experience may be more valued.

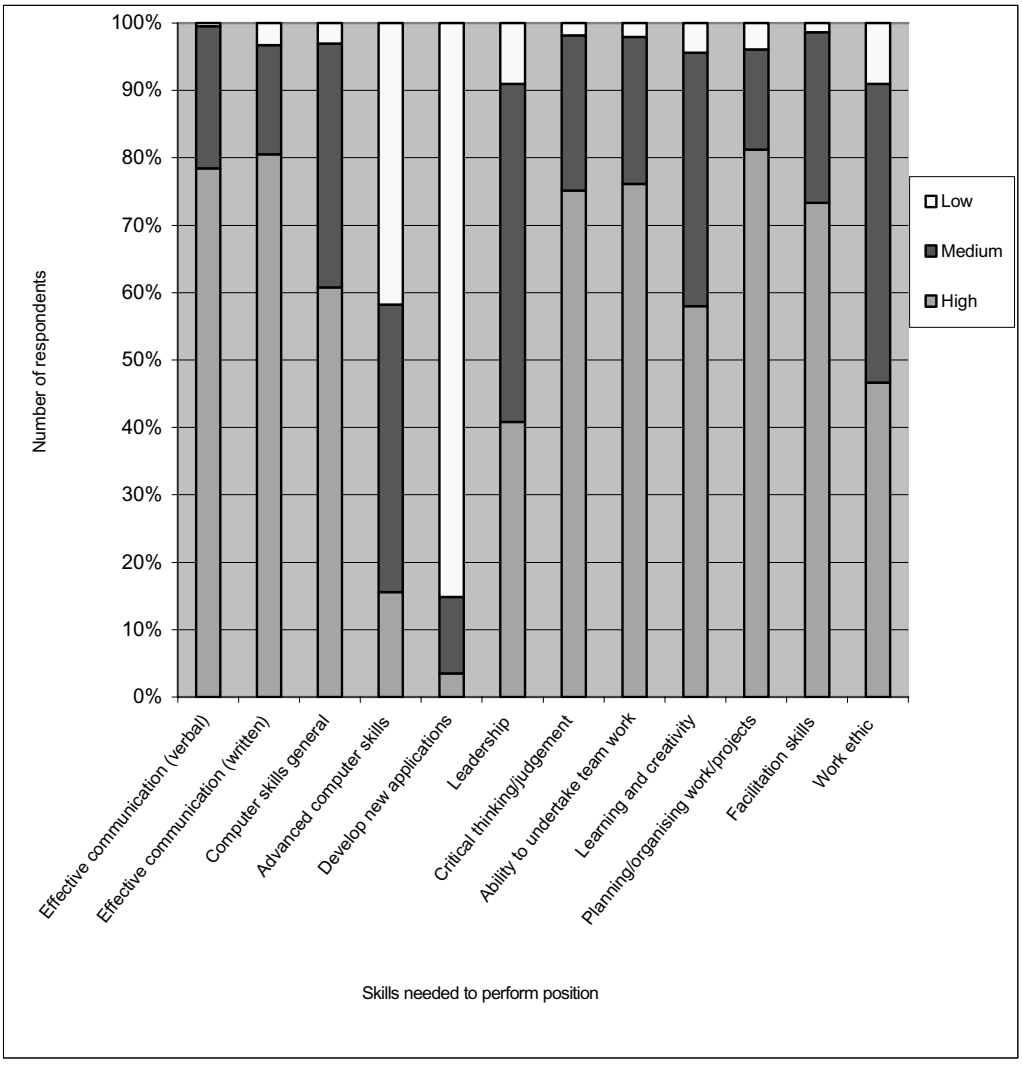

Figure 3. General skills ranked by respondents needed to perform environmental positions

Generally, a broad undergraduate degree was considered suitable for a range of environmental positions, afterwards enabling the employee to learn specific skills on the job. Comments from some of the respondents regarding their experiences of undergraduate degrees were:

- 'Do a well-rounded undergraduate degree, rather than a specific one.' Environmental Engineer and Ecologist
- 'Don't specialise too much at university as most jobs require a broad range of skills and knowledge. The more specialised stuff can be learnt on the job.' Graduate Trainee

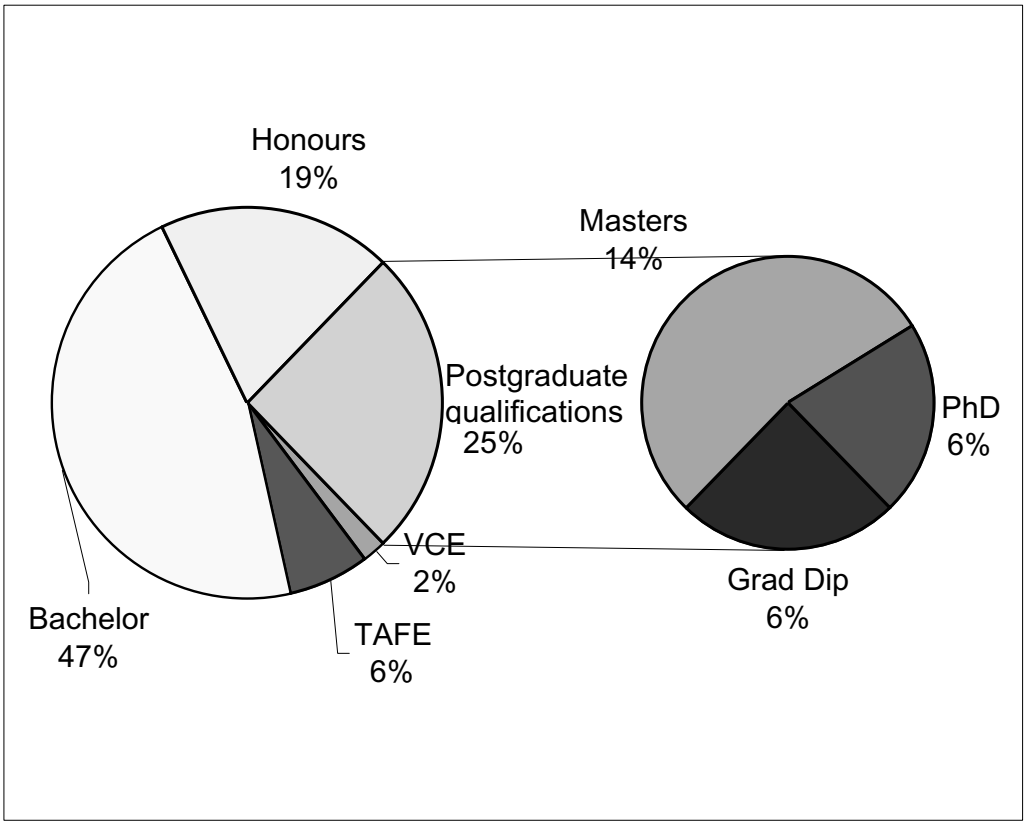

Figure 4. Profile of survey respondent qualifications

- 'An environmental qualification is often not required in environmental work, but the general skills from a bachelor degree (e.g. humanities, science or social science) are crucial.' Senior Policy Officer

Those who had undertaken an honours degree felt that completing honours can provide a point of difference to an employer. An honours year can enable the student to gain greater knowledge in a specialised area, gain practice in supervising others, and develop both written and oral communication skills. The greater depth of subject knowledge gained, as well as the discipline required to complete a research project, makes graduates with an honours degree in science particularly valued by the consulting industry. The survey did not attempt to assess the role of postgraduate qualifications, but in general they can provide people with more detailed knowledge for their field of employment, and opportunities to move into different areas with their new understanding.

In addition to formal education, respondents very strongly advised that access to the environmental sector would be assisted by any work experience (paid or unpaid) that students do to enhance their employability—the vast majority of respondents had

been involved in some form of work experience. The suggestion was that throughout the time they are studying, those interested in environmental careers use spare time and holiday periods to secure intern or volunteer work experience. This is considered to improve their employment prospects once they graduate, as it demonstrates to employers that the applicant has a relevant degree, working knowledge and experience in the specified area. Intern and volunteer work experience were considered invaluable ways of getting the experience all environmental employers demand. Below are some respondent's comments on the benefits volunteering and internships.

- 'Lots of experience, even if it's volunteer or paying under what you think you are worth. Just getting in to the field can go a long way!' Senior Project Officer.
- 'Undertake a relevant degree or further study but keep in mind that volunteer/paid work with government agencies or NGOs will often be the deciding factor because you need to demonstrate how you have applied your environmental knowledge to solve problems.' Project Officer
- 'Volunteer work! Make your own opportunities to gain experience.' Self-employed
- 'You must have excellent communication skills. The rest is really learnt on the job. Volunteer work is the only way to do that, to get your foot in the door.' Water-use Efficiency Officer

In addition to the discussion of their experiences related to gaining employment, the respondents were also asked about the trends they felt were emerging for environmental professions. Summaries of these points are provided below under relevant headings:

- Definitions of the environment industry—currently these are both changing and diverse. No two respondents held the same definition of the environment industry, and many different terms were used to represent or define the industry.
- Education programmes for environmental professionals—lack of practical skills among graduates entering the environmental fields was mentioned, and it was considered difficult for many graduates to enter the environment industry. Many respondents believed that university environmental programmes needed to be re-examined for their structure, content and appeal. Importantly, in the views of all respondents, sustainability practices and/or environmental classes needed to be incorporated into all fields of tertiary study.
- Public interest—all respondents viewed this as a significant motivator for companies and government to engage with environmental issues. However, the majority of respondents felt that public interest in environmental issues had waned in recent years.
- Economics (including market forces and consumption)—general economic conditions act as key stimulants to the growth of the environment industry. Respondents also identified that the goal of economic growth was increasingly but controversially being seen as compatible with sustainability. It was commented that a growing number of companies are implementing some form of environmental reporting – a practice that encourages, and is encouraged by, a growth in socially responsible investment.

- Growth in environmental employment—the main fields were seen to be: water, air quality, issues arising from climate change, legislation, waste disposal and reuse, land management (including general agriculture, organics, and solutions to degradation and salinity), and sustainable energy. By contrast, most respondents believed that conservation was one area that was likely to stay the same or to decline in funding, legislative development, and employment.
- Community education - most respondents felt that legislators and the general public need to have a better understanding of environmental issues and sustainability and, in particular, that society as a whole needs to take a longer term perspective in decision making.
- Expectations for the next few years—some respondents commented on their general thoughts for the next five to ten years, including: changes in transportation; progress in water issues; technological development and innovation in industry; and improved education in sustainability for younger people

Finally, respondents were asked to complete a profile of themselves, in relation to their employment. One such profile is that provided by an employee in the water quality field (Appendix 2). Again it was not possible to identify specific trends in this information, nor was that the purpose of the exercise. Rather, the intended purpose of the profiles was to have personalised information available to assist people entering environmental careers.

Discussion

While our survey was not designed as a definitive review of the environment profession, its results provide a substantial 'snap-shot' of the situation in Australia in the early 2000s. Also, the results show a close compatibility with other work. In particular, the trend identified in some of the literature regarding the growth in environmental positions is echoed by the survey respondents. The employment experiences of the participants also support the comments of Bezdek (2001) and Renner (2000) regarding the wide range of positions that are available in the environmental fields.

The people who come to work in these environmental fields do so mainly with an 'ordinary' (unclassified) bachelor degree. However, a substantial proportion of people have entered the field with an honours degree, or a post-graduate qualification. While those with secondary or technical and further education (TAFE) qualifications were in the minority, their existence serves to highlight the variety of opportunities in the environmental sector. We can speculate that as the sector matures, the proportion of employees with tertiary qualifications will increase, but whether postgraduate qualifications come to be the more important remains to be seen. In any case, there will be a need for ongoing research to monitor the trends in all aspects of the employment sector.

Generally the results of the survey demonstrate the great range of jobs in the environmental sector, as identified by several sources (for example, Environmental Careers, 2005a, Everett, 1999; and MacPherson, 1992). However, in providing

advice to those aspiring to enter environmental employment, respondents were almost unanimous. There was a very clear message that gaining practical experience by securing intern or volunteer work experience was essential. Such experience can be of assistance for several reasons (such as understanding of the technical aspects of the work, general work skills), but the respondents especially emphasised the acquisition of practical skills that were usually considered to be missing from academic programmes.

While our research has not been closely related to the educational experiences that environmental graduates receive as part of their tertiary education, there are clearly links between these experiences and the graduates' abilities to perform their jobs. In this context results from the survey provide some issues that should be noted by those involved in tertiary environmental courses. Foremost among these are the general skills that the respondents considered important in their employment, such as communication; critical thinking; facilitation and organisational skills; team-work; and learning and creativity. Also identified was the need for courses to have a practical focus, to develop 'work-ready' students. The point that courses needed to be re-examined for their structure, content and appeal can be considered a general warning to educators to monitor their efforts to ensure that their courses are generally 'in line' with both the aspirations of the entering students, and the anticipated requirements of the graduates' potential employers.

We have not sought to make comparisons with the educational aspects of other disciplines, or general education. However, we suspect that the comments related to environmental courses will also apply in other disciplines, and levels of education. It may be that some of the general skills identified by the respondents can be provided through secondary education, as indeed schools aim to do. Nonetheless these skills are ones that improve with practice, so continuing their coverage in tertiary courses would be beneficial. Further, if they are not practiced at the tertiary level, students would be given the unspoken message that they are not valuable.

The results of our survey are primarily related to the environment profession, and environmental education in Australia. However, from the material we have discussed from the UK, Canada and the USA, it appears that there are many similarities with environmental professions in these countries. While the tertiary education systems are not direct equivalents, there are also similarities. Consequently, we expect that the insights from our survey are likely to be applicable to those involved in environmental education and careers in these, and possibly other, countries with a 'western' context. However, additional research would be required to test this assertion.

Finally, while it has not been the focus of this report, we note that the personal profiles and qualitative data also revealed something of the considerable optimism held about employment in the environmental sector in Australia. Due to the limitations of the scope and availability of historical data we do not know if this optimism is new, or has dropped off. Consequently, we would like to encourage more, regular research projects that will monitor the environmental employment sector in relation to the variables we have outlined. This will help to provide us all with a better understanding of the sector, and opportunities for advising those wanting to enter the environment profession.

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Charley May has a background in Biological Science and has undertaken many projects in the environmental education sector, with a specific focus on developing career advice resources for graduates and environmental professionals, through research and television presentations for the Environmental Jobs Network

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Appendix 1
Common position titles within the 12 subcategories of environmental employment

Table A1. Environmental protection

Air quality protection	
Air quality engineer	Air quality officer
Air quality modeller	Environmental auditor
Environmental engineer	Environmental manager
Environmental officer	Environment protection officer
Atmospheric chemist	Environmental scientist
Environmental policy officer	Meteorologist
Water quality protection	
Water policy officer	Aquatic scientist
Biologist	Chemist
Civil engineer	Education officer
Environmental consultant	Environmental engineer
Environmental health and safety officer	Environmental manager
Environmental officer	Environmental policy officer
Environment protection officer	Environmental scientist
Freshwater scientist	Freshwater technician
Healthy rivers campaigner	Hydrogeologist
Hydrologist	Recycled water officer
Risk analyst	Sustainable water programme officer
Waste water engineer	Water quality officer
Watershed officer	
Land quality protection and site restoration	
Agricultural engineer	Agronomist
Biologist	Chemist
Civil engineer	Decontamination officer
Environmental auditor	Environmental consultant
Environmental engineer	Environmental planner
Environment protection officer	Environmental scientist
Geologist	Hydrogeologist
Irrigation officer	Risk analyst
Remediation officer	Soil systems analyst
Toxicologist	
Waste management	
Chemist	Civil engineer
Chemical engineer	Environmental engineer
Environmental health officer	Environmental officer
Environmental planner	Environmental policy officer
Environmental technician	Geologist
Geotechnical engineer	Hazardous waste engineer
Hydrogeologist	Industrial engineer
Landfill manager	Mechanical engineer
Operations manager	Process engineer
Recycling coordinator	Solid waste manager
Risk analyst	

Table A2. Conservation and preservation of natural resources

Fisheries and wildlife	
Animal control officer	Aquaculture development officer
Aquaculturist	Biologist
Botanist	Computer modeller
Conservation officer	Ecologist
Endangered species biologist	Environmental impact analyst
Environmental officer	Field or laboratory technician
Fish and game warden	Fisheries assessment officer
Fisheries biologist	Fisheries management officer
Fisheries manager	Limnologist
Marine biologist	Marine ecologist
Naturalist	Policy officer
professor	Public aquarium director
Research assistant	Research officer
Research scientist	Toxicologist
Wildlife impact and protection officer	Wildlife biologist
Wildlife consultant	Quarantine inspector
Zoo director	
Forestry	
Arborist	Biodiversity officer
Biologist	Botanist
Bushland regenerator	Civil engineer
Consulting forester	Ecologist
Environment protection officer	Environmental resource manager
Farm forestry officer	Forest entomologist
Forest hydrologist	Forest officer
Forest policy officer	Forest standards coordinator
Forest worker	Forester
Forestry technician	Horticulturalist
Native forest officer	Natural resource officer
Nursery officer	Soil conservationist
Vegetation management officer	Wildlife biologist
National parks and protected areas	
Administrator	Biologist
Botanist	Bush regenerator
Curator	Customer service ranger
District programme manager	Ecosystem restoration officer
Ecotour guide	Education programmes manager
Environmental educator	Environmental officer
Geologist	Heritage officer
Historian	Landscape architect
Maintenance officer	Marine ranger
Museum officer	Natural resources manager
Naturalist	Outdoor recreation officer
Park assistant	Park planner

Table A2. *(continued)*

Planning officer	Ranger
Risk management coordinator	Team leader
Warden	Wildlife biologist
Energy and climate protection	
Analyst	Chemist
Climate change campaigner	Climatologist
Communicator	Civil engineer
Efficiency officer	Efficiency designer
Electrical engineer	Energy efficiency analyst
Industry adviser	Modeller
Planner	Policy officer
Research associate	Technical advisor

Table A3. Environmental sustainability

Education	
Catchment education officer	Coastal educator
Community affairs officer	Community education programme officer
Education for sustainability officer	Education officer
Environmental affairs officer	Environmental education consultant
Environmental education officer	University lecturer
Park ranger	Professor
Primary or secondary school teacher	Teaching technician
Research and development	
Community involvement officer	Environmental scientist
Geographic information systems research officer	Lecturer
Research analyst	Research fellow
Research assistant	Research associate
Research economist	Research geographer
Research scientist	Research officer
Senior policy officer	Senior research scientist
Soil systems analyst	
Policy and legislation	
Environmental liaison officer	Policy officer
Forest policy officer	Marine environment policy officer
Water policy officer	Research fellow
Research analyst	Threatened species officer
Legal officer	Biodiversity trends officer
Research economist	Compliance and enforcement officer
Project officer	Recycled water advisor
Technical advisor	Project manager (water and catchment)
Inland waters officer	Greenhouse officer
Conservation officer	Regulatory affairs officer

Table A3. *(continued)*

Environment protection officer	Urban and coastal campaigner
Rangelands scientist	Freshwater scientist
Research officer	Marine biologist
Ozone and synthetic gas officer	Policy and economic analyst
Communications and public awareness	
Campaigner	Communications officer
Community affairs officer	Community involvement officer
Education officer	Environmental advocate
Environmental campaigner	Environmental journalist
Environmental officer	Filmmaker
Information officer	Interpretation ranger
Liaison officer	Nature journalist
Natural resource officer	Media advisor
Photographer	Programme delivery officer
Project officer	

Appendix 2
Example of practitioner profile: water quality sub-category

Name: Susan
Organisation: URS Australia
Position title: Graduate Environmental Engineer
Yearly salary: $31 000–40 000
Employment conditions: Full-time, ongoing
What was your initial motivation for undertaking environmental work?
Trying to improve environmental management in Australia.
Outline your career path
Currently working as a graduate in a consulting firm. I have undertaken a range of vacation work positions (e.g. research and consulting) which helped me to define what types and areas of work I was interested in.
What are the main activities of your current position?
Undertaking design calculations for stormwater management devices, writing reports, environmental management plans and some site work, such as odour monitoring at landfills, landfill management site inspections, and ground water and gas monitoring.
What are the most interesting aspects of the position?
The variety of work and opportunities to try new tasks.
What are the hours you work and how do you manage the workload?
Standard 40 h per week, sometimes more if there are deadlines. I try to leave at a reasonable time and ensure that supervisors know of my workload so that it remains under control.
What do you gain personally from your job?
Satisfaction in undertaking and completing tasks independently and learning new skills and gaining knowledge.
How much of what you know has been picked up on the job?
A lot of information and skills have been picked up on the job, most of which builds on what was learnt at university.
What advice would you give to someone wanting to pursue your career?
Try a range of work types before choosing one to pursue. Be open to learning and trying new things in the work place and do not be afraid to ask questions.