

Urgent need for a systematic expansion of freshwater protected areas in Australia

A scientists' consensus statement

This document is available from www.onlyoneplanet.com.au.

Revised 18/8/2005

Assoc Prof Paul Adam, University of New South Wales
Dr Leon A. Barmuta, University of Tasmania
Dr Nick Bond, Monash University
Mr Frederick Bouckaert, Environmental scientist, ACT
Prof Gary Brierley, University of Auckland
Ms Yung En Chee, Melbourne University
Dr Neville Crossman, University of Adelaide
Dr Elizabeth Daley, University of Tasmania
Mr Tim Doeg, Environmental Consultant
Ms Louise Duxbury, Green Skill Inc
Assoc Prof Brian Finlayson, University of Melbourne
Prof Arthur Georges, Canberra University
Dr Ascelin Gordon, RMIT University
Mr Hedley Grantham, University of Queensland
Mr Marcel Green, environmental scientist, NSW
Dr John H. Harris, Harris Research Pty Ltd
Dr Bill Humphreys, Western Australian Museum
Mr Christopher Irons, Griffith University
Ms Liana Joseph, University of Queensland
Prof Jamie Kirkpatrick, University of Tasmania
Prof Richard Kingsford, University of New South Wales – group spokesman
Dr Tony Ladson, Monash University
Prof Sam Lake, Monash University
Mr Simon Linke, University of Canberra
Dr Mark Lintermans, Cooperative Research Centre for Freshwater Ecology
Prof Ian Lowe, Griffith University
Dr Tara Martin, CSIRO Sustainable Ecosystems (St Lucia)
Dr Alison Mitchell, Murray Darling Freshwater Research Centre
Mr Jon Nevill, OnlyOnePlanet Australia
Ms Penny Paton, Environmental consultant, Adelaide
Dr Topa Petit, University of South Australia
Dr Winston Ponder, Australian Museum
Prof Hugh Possingham, University of Queensland
Dr Naomi Rea, Charles Darwin University
Dr Paul Reich, Monash University
Mr Julian Reid, Australian National University
Assoc Prof Alastair Richardson, University of Tasmania
Dr John Russell, LaTrobe University
Ms Krystyna Saunders, University of Tasmania
Mr Robin Saunders, Environmental consultant, Melbourne
Mr Matthew Stanton, Editor 'Australia and New Guinea Fishes Association News'
Ms Janet Stein, Australian National University
Mr Rick Stuart-Smith, University of Tasmania
Mr Jim Tait, EcoConcern Consultants
Dr Peter Unmack, Arizona State University
Dr Robyn Watts, Charles Sturt University
Dr Chris Wilcox, CSIRO Marine Research
Dr Kerrie Wilson, University of Queensland

Corresponding author:

Jon Nevill, jon_nevill@yahoo.com.au; phone 0422 926 515. PO Box 106 Hampton Victoria 3188 Australia.

1. Abstract

Although freshwater protected areas are regarded as an essential component of biodiversity conservation programs, a systematic approach to their development in Australia has been slow, and is hindered by incomplete ecosystem inventories at State and national levels. We review this situation and examine avenues for action. While there is no shortage of relevant policy in Australia, some protective mechanisms have not yet been used (many years after their development). In other cases 'protection' has been only partially applied without regard to important issues of hydrologic connectivity – with species extinction¹ as a direct

consequence. The most urgent initiative is to identify those ecosystems most at risk. A comprehensive national assessment of the conservation status of freshwater ecosystems should be undertaken immediately. Such an assessment would provide both a platform and an impetus for the systematic expansion of the nation's freshwater protected areas.

2. Introduction

Most Australians are familiar with the protection provided by national parks in terrestrial environments, and marine reserves in our oceans. However the concept of protected rivers is seldom discussed – or the more general concept of freshwater² protected areas. This is the case despite evidence that freshwater biota are particularly imperilled both globally and in Australia³.

According to the international *Convention on Biological Diversity 1992*, (CBD) the conservation of biodiversity⁴, including aquatic biodiversity, requires the protection of representative examples of all major ecosystem types, coupled with the sympathetic management of ecosystems outside those protected areas. These twin concepts underpin, in theory at least, all Australian biodiversity protection programs.

3. The importance of protected areas

Protected areas are the single most important tool used in biodiversity conservation programs throughout the world (ESA 2003). They also support ecosystem functions beyond their boundaries, and have other economic and cultural benefits (Nevill & Phillips 2004). Systematic conservation planning approaches are now accepted as an essential tool in protected area identification and selection (Margules & Pressey 2000) and have been used in Australia for 30 years and 15 years in terrestrial and marine environments respectively. Such approaches are essentially aimed at getting the best value (in terms of biodiversity conservation) from a reserve system which comprises a relatively small part of the total landscape. At this stage they have *not* been applied to the establishment of freshwater protected areas in a cohesive and focused way by Australian State agencies⁵.

Protected areas, as defined by the World Conservation Union (IUCN 1994) are areas of land or water “especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means”. The IUCN definition has three key elements. The area should be under defined management (i.e. having an agreed management plan). Secondly, actual management arrangements should effectively reduce at least one major threat to the area's values (i.e. value and condition should be monitored and reported over time). Thirdly the area should have secure tenure (preferably through statute). The IUCN lists 6 categories of protected area, from full protection through to multiple use.

The long-term benefits of creating freshwater protected areas far outweigh short term costs⁶. Many marine protected areas have been shown to enhance fisheries outside the protected zone (Gell & Roberts 2003, Ward & Hegerl 2004), and some freshwater protected areas will have similar effects, with consequent benefits for recreational fishers. Australian hunter's organisations have helped fund the purchase of freshwater areas to provide breeding grounds for ducks and other waterbirds. Tourism in Canada has benefited from the Canadian Heritage Rivers System, and is now one of the key drivers of system expansion. Australian tourist operators will benefit from healthy and impressive rivers and wetlands. Farmers will benefit from the protection of aquifer recharge areas. Indigenous groups supported the formation of the first listed Ramsar site in the world: Coburg Peninsula in the Northern Territory. All Australians will benefit from the protection of our living freshwater environments – which have huge economic, cultural, recreational, educational, spiritual and scenic values.

Freshwater ecosystems supply major (often unprotected) ecosystem services such as water supply, flood mitigation and groundwater regulation⁷. Fully protected ecosystems provide essential environmental benchmarks by which the management of utilised ecosystems may be measured and refined. The cost of rehabilitating such areas after degradation far exceeds the cost of protecting these services (according to Bernhardt et al. 2005, over US\$14 billion has been spent rehabilitating degraded streams in the USA since 1990).

4. International initiatives

The Ramsar *Convention on Wetlands 1971* created the world's largest and most widely applied protected area system for freshwater habitats globally, with 145 member countries. In its decisions and guidance, to which the Australian Government is party, it has committed to (among other things) a 'Strategic Framework for the Ramsar List'⁸ based on criteria that include 'representative wetland types'⁹. The potential of the Ramsar framework to provide protection to all types of aquatic ecosystem has not been fully developed in Australia (see below).

The Conference of Parties to the CBD, meeting in February 2004, developed a revised program of work on inland waters. The adopted measures include Goal 1.2: "to establish and maintain comprehensive, adequate and representative (CAR) systems of protected inland water ecosystems within the framework of integrated catchment/watershed/river-basin management" (Conference of the Parties 2004). This measure was in part to meet the 2002 World Summit on Sustainable Development's implementation target of "a significant reduction in the rate of loss of biodiversity" by 2010.

This emphasis on freshwater ecosystems was reinforced by the World Conservation Congress, meeting in November 2004, which recommended that all nation-states "establish protected areas representative of all freshwater ecosystems, including but not limited to riverine, lacustrine, wetland, estuarine and groundwater-dependent ecosystems, in cooperation with local communities and resource users, so as to safeguard the biodiversity of each of their freshwater ecosystems...". For the full text see www.iucn.org.

Other countries have made significant advances in protecting freshwater ecosystems, with some of the most notable developments relating to rivers. The United States passed their *Wild and Scenic Rivers Act* in 1968 after a vigorous public campaign to stop the damming of several major rivers (172 rivers are now listed). In Canada, the *Canadian Heritage Rivers System* (1984) is now so popular that nominations for further protected rivers come entirely from community pressure (40 rivers are listed) (www.chrs.ca).

The 1968 USA legislation helped support a 'wild and scenic rivers' campaign starting in New Zealand in 1976, and resulted in *Water Conservation Order* legislation being passed in 1981. With minor amendments, National WCOs have been investigated and gazetted as 'protected waters' since then. To date 13 river catchments and 2 standalone coastal lakes are largely protected. Ramsar candidate sites (i.e. meeting Ramsar criteria) in NZ total 103 at this stage and include many rivers, some of which are already protected in WCOs and/or terrestrial reserves and other protected areas. New Zealand embarked on a *Waters of National Importance* project in 2003, with a stated objective: "water bodies with nationally significant natural, social and cultural heritage values are protected". A major study (Chadderton et al. 2004) has identified nationally significant rivers for biodiversity protection. This study has no Australian equivalent.

The European Union has recently promoted freshwater ecosystem protection as a component of its wide-ranging 'water framework directive'¹⁰ and 'water initiative'¹¹ programs, which complement the earlier *Nature Conservation and Biodiversity Directive 1992*. At this stage it is too early to judge the success of these endeavours (which lean heavily on river basin management for improved water quality) but they seem likely to re-enforce commitments within the *Convention on Biological Diversity 1992* towards the protection of 'comprehensive, adequate and representative' aquatic ecosystems (Conference of the Parties 2004).

5. Australian freshwater ecosystems

Australia is the driest inhabited continent, and southern river systems have been extensively degraded by water extraction and regulation, and by other forms of habitat destruction. Many major river systems are in a state of ecological crisis, and their inhabitants (like the iconic Murray Cod¹², colonial waterbirds, floodplain eucalypts, and Tasmania's giant freshwater crayfish¹³) are in decline. Increased protection for the ecosystems of Australia's

rivers (and lakes, wetlands, springs, subterranean ecosystems and estuaries) is long overdue¹⁴.

Of special concern are those ecosystems typically supporting short-range endemic taxa (eg. groundwater systems and mound springs). Australian subterranean aquatic ecosystems and other groundwater dependent ecosystems (GDEs) have been comparatively neglected, both by scientists and by planning frameworks. Biodiversity in some Western Australian aquifers is high by world standards (Humphreys and Harvey 2001).

The National Audit reports 2001 show extensive and continuing degradation of Australia's rivers and estuaries. Existing water planning, land use planning, and development assessment frameworks are not providing adequate protection for Australia's freshwater ecosystems (Nevill 2001, Morton et al. 2002, Wentworth Group 2002, 2003). Although all governments are committed (on paper) to the precautionary principle, there is little evidence of its application in practice (Stein 1999; Coffey 2001).

Apart from the issues of over-allocation¹⁵, protected areas and alien species, the most serious concern is a failure (principally on the part of State governments) to effectively control the cumulative effects of incremental water infrastructure development - particularly farm dams, levee banks, agricultural drainage¹⁶, extraction of groundwater and surface water, and GDE matrix removal¹⁷ (Nevill 2003, see also 'comprehensive water accounts' in Wentworth Group 2003). Nevill has proposed five key management principles which warrant further discussion.

Australian farmers, fishers, hunters, indigenous groups and conservationists generally support river and wetland protection; however they are often suspicious of each other's motives, with the result that (to date) there has been no united voice for protection which can be clearly heard at the level of national politics. Threats are compounded in Australia by the relative scarcity of freshwaters and the low commercial value placed on their biota in comparison with other continents – making the development of a strong 'river protection' constituency more difficult than in other countries such as New Zealand or Canada.

6. Overview of aquatic protected areas in Australia

The history of freshwater protected areas in Australia is, in large part, a story of good intentions not carried through.

Australia's three-tiered government system places most resource management responsibilities in the hands of the eight States and Territories (hereafter referred to as 'States'). The Australian (Commonwealth) Government is responsible for international treaty obligations, and consequently seeks the cooperation of the States as well as local government (where most land use planning responsibilities lie) – and, where they exist, regional resource management planning bodies.

Australia signed the international Ramsar Convention on Wetlands in 1971, which requires the conservation and 'wise use' of all wetland types – which, under the Ramsar definition of 'wetlands', includes rivers and groundwater ecosystems. After 34 years, few Australian rivers have been directly protected under Ramsar provisions, although some have been listed in the *Directory of Important Wetlands in Australia*¹⁸ (DEH 2001). The DIWA contains State-by-State lists of nationally (and internationally) important wetlands, including Australia's 64 Ramsar-listed wetlands¹⁹.

Australia's obligations under the Ramsar convention include the preparation of ecosystem inventories. Although none of the State-wide inventories are comprehensive in the sense of containing up-to-date information on value and condition, work is progressing slowly. New South Wales has digital coverage of all wetlands (including floodplains) and their protective status (Kingsford et al. 2004). Victoria, Tasmania and the Australian Capital Territory also have reasonably good State-wide inventories of wetlands, with floodplains variously mapped. Other jurisdictions are preparing State inventories, apart from Western Australia and the Northern Territory where the focus is on regional inventories (Nevill & Phillips 2004). Queensland has embarked on the most comprehensive inventory yet attempted in Australia.

State governments have listed²⁰ some wetlands as Ramsar sites or (more often) included them within the Directory of Important Wetlands. Ramsar sites receive limited protection under the Commonwealth's *Environment and Biodiversity Protection Act 1999*, as well as some State legislation such as Victoria's *State Environment Protection Policy (Waters of Victoria) 2003*. DIWA listing constitutes a referral trigger in Queensland's *Integrated Planning Act 1997*²¹. While the DIWA itself is not formally linked to any Commonwealth or State protection policies other than in Queensland, it is taken into account by many local government and regional resource planning bodies in making land use planning decisions. However, it does not yet include rivers or underground ecosystems in a comprehensive way, despite the Ramsar Secretariat's broad 'wetland' definition.

The most comprehensive data analyses in New South Wales (NSW) show that about 0.8% of wetland area is listed under Ramsar, 3% lies within terrestrial protected areas²², and 20.7% is listed in the Directory of Important Wetlands (Kingsford *et al.* 2004). A similar situation may be expected in other States. By far the bulk of wetlands lie outside formal protective frameworks, thus relying on State government provisions for 'sympathetic' management – largely within land and water planning mechanisms. Here serious problems in the delivery of environmental flows²³ need to be addressed (Ladson & Finlayson 2004).

Several discharge springs from the Great Artesian Basin (GAB) and some other aquatic ecosystems are listed as 'threatened ecological communities' under the EPBC Act – another protective mechanism albeit not very effective at present. While in theory the EPBC Act can protect against major new developments that may constitute a threat to an area's values, it cannot force proactive biodiversity management, nor can it control a multitude of small widespread activities draining water flows from a site. Many GAB springs, known to include endemics (Ponder 2004) are already extinct as a result of drawdown resulting from over-use of artesian water²⁴. Failure to effectively control the cumulative effects of incremental water development is causing major problems for biological reserves worldwide (Pringle 2001).

Australia's existing reserve system has some profound achievements (particularly with respect to the protection of terrestrial biodiversity) but inherent limitations now demand new approaches to ensure adequate representation of freshwater ecosystems. While many reserves in Australia were created to protect lakes and wetlands but also some rivers (e.g. Shannon River National Park and Prince Regent River Nature Reserve in WA), these areas constitute only a small proportion of the total protected area estate. An additional limitation is that many terrestrial protected areas provide little protection to enclosed freshwater ecosystems – for example from hydroelectric regulation, beyond-boundary water diversion, or recreational fishing (including the introduction of alien fish such as trout). Lake (1978) drew attention to this issue many years ago. For example in Kosciusko National Park rivers or creeks are not protected, with the result that the Snowy Mountains Hydroelectric Scheme damaged seven major rivers and left only two medium-sized rivers unregulated²⁵. A similar situation applies to Tasmania's Southwest World Heritage Area.

We are not protecting all of our most important aquatic ecosystems. Certainly the existing reserve system includes some important freshwater areas (e.g. Ramsar sites) and other freshwater ecosystems are contained within large terrestrial reserves. However the reserve system has not been created with the benefit of a systematic analysis of wetland types, and **little published information is available on the extent to which representative freshwater ecosystems are protected within existing reserves**. Here it is worth noting the exception of studies such as those in the Wimmera²⁶ (Fitzsimons & Robertson 2003) and in NSW where there is an analysis of the conservation status for broad wetland types (Kingsford *et al.* 2004). A comprehensive assessment would identify the original²⁷ extent of different ecosystem types at a finer level, their current extent, and the degree to which they are now protected (Fitzsimons & Robertson (in press)). The methodology for such studies is well established as similar investigations were undertaken for forest ecosystems some years ago, as part of the Regional Forests Agreement (RFA) process²⁸.

7. Bioregions: issues of representation

One could argue that the existing terrestrial bioregionalisation is adequate to guide freshwater ecosystem protection. This would be flawed on two grounds. The biodiversity elements that would underpin a freshwater bioregionalisation would be different from, and would not necessarily have the same boundaries as, terrestrial bioregionalisation. Secondly, freshwater systems are by their nature more connected than terrestrial systems. The connections are largely linear and directional, whereas terrestrial connections tend to be non-linear and weakly directional. Selecting priority sites for freshwater protected areas needs to accommodate these, and other, unique aspects of freshwater biodiversity, ecology, and system function. The need to develop agreed surrogates and units to map and measure freshwater biodiversity is an important related issue²⁹. Issues of ecosystem process and scale need to be taken into account, particularly when selecting taxa as biodiversity surrogates³⁰.

Wells and Newall (1997) found that the terrestrial *Interim Bioregionalisation of Australia* (IBRA) was “not effective in representing aquatic ecosystem patterns across Victoria”, and suggested an approach to delineating aquatic bioregions based partly on physical and biological data, and partly on expert opinion. Abell et al. (2000 & 2002) have developed ecoregions for North America for conservation assessment purposes.

The most significant gaps in the existing reserve system probably relate to river, floodplain and subterranean ecosystems³¹. Tait et al. (2002) and Tait (2004) have recommended the development of an “interim freshwater bioregionalisation of Australia”. Such a regionalisation would provide a platform for a national conservation status assessment of freshwater ecosystem types. Systematic conservation planning approaches will need to be modified to take account of the connected nature of rivers in particular. The identification of Australian freshwater biodiversity hotspots is also important, and is now proceeding.

8. State programs

All States are, in theory at least, committed to the establishment of systems of protected areas which contain representative examples of *all* major ecosystem types, including aquatic ecosystems. Victoria holds the earliest of these commitments (1987) and South Australia the most recent (2003) (Nevill & Phillips 2004). Such programs are in line with Australia’s obligations under the *World Charter for Nature 1982* (a resolution of the United Nations General Assembly) and the *Convention on Biological Diversity 1992*. However, it is the *timing* which is at issue. With respect to freshwater protected areas, these obligations have not yet been carried through in a systematic way in any Australian jurisdiction³² other than the Australian Capital Territory³³.

Protection measures for entire rivers can be devised, but are poorly implemented in Australia. The Victorian government identified 15 ‘representative rivers’ for protection in 1992; 13 years later, four of these rivers remain without management plans (Nevill & Phillips 2004). Victoria passed a *Heritage Rivers Act* in 1992, nominating 18 rivers and 25 ‘natural catchments’³⁴ to be protected. The Act established a management sequence: (a) preparation of draft management plans, (b) public comment and review, (c) ministerial endorsement of the plans, and (d) implementation. However, again after 13 years, all river management plans remain as drafts without the required ministerial endorsement³⁵ (Nevill & Phillips 2004).

Several States have legislation in place aimed specifically at the protection of threatened species and ecological communities; however such provisions have been rarely used to protect freshwater environments. The ‘critical habitat’ provisions of Victoria’s *Flora and Fauna Guarantee Act 1988*, for example, have not yet been used to protect freshwater habitats (Nevill & Phillips 2004). It is however worth noting that Victoria is the only State so far to extend the concept of ‘no net loss’ to ‘net gain’ in relation to developments impacting on important areas of native vegetation – including wetland vegetation (Nevill & Phillips 2004:A3.15).

In line with the international *Code of Conduct for Responsible Fisheries* (FAO 1995:6.8) Queensland, New South Wales, Victoria, South Australia and Tasmania all have fisheries

legislation providing for the establishment of aquatic protected areas. However (in spite of progress in the marine environment) none of these provisions have been used to protect freshwaters (Nevill & Phillips 2004).

Both Western Australia and New South Wales considered legislation similar to Victoria's *Heritage Rivers Act*, but there was inadequate parliamentary support in the face of opposition by farmer and fisher groups. Western Australia developed a *Wetlands Conservation Policy* in 1997 which covered rivers using the Ramsar definition; however, seven years later, the protective provisions foreshadowed in this policy have not yet been put in place in a comprehensive way (Nevill & Phillips 2004). In the mid-1990s New South Wales amended the *National Parks and Wildlife Act 1974* to provide for the declaration of 'wild rivers', however to date this provision has not been used. An internal discussion paper was prepared by the NSW National Parks and Wildlife Service in 2004 on the Act's wild river provisions. It canvassed listing rivers only within existing terrestrial protected areas.

The Queensland Government started work on a rivers policy in 2000. Nineteen rivers were proposed for immediate consideration in 2004, and a policy implementation paper was provided to stakeholders. In May 2005 the State government introduced draft legislation to parliament; it is to be hoped that this will be fully implemented and effective. The recent history of native vegetation protection legislation in several States³⁶, as well as Victoria's *Heritage Rivers Act*, has indicated that effective implementation can be a major stumbling-block.

South Australia and the Northern Territory both have government policy statements committing to the protection of representative examples of all major freshwater ecosystems, however at this stage neither jurisdiction has funded a program to carry these commitments through in a systematic way (Nevill & Phillips 2004). The NT's draft *Parks and Conservation Masterplan 2005* reinforces earlier commitments.

In the Northern Territory, as in northern Qld and WA, significant areas of land (around 50% in the case of the NT) are under the custodianship of Indigenous groups. The Commonwealth's long-standing Indigenous Protected Area (IPA) program has achieved successes, and could be extended to assist Indigenous groups protect freshwater ecosystems. The recent Tropical Rivers Program (a Commonwealth initiative under Land and Water Australia) is providing increased knowledge of tropical freshwater ecosystems and measures needed to protect them .

Tasmania's *Nature Conservation Strategy* and the subsequent *State Water Development Plan* established a commitment to develop comprehensive protection for all freshwater ecosystem values, and so far the program is moving in a systematic way. The Conservation of Freshwater Ecosystem Values (CFEV) Project has undertaken the design phase of this work, which, when completed, will establish the scientific basis for the identification and selection of freshwater protected areas across the State, as well as providing information for regional natural resource planning initiatives. The CFEV project is expected to produce its final report in late 2005. No specific funds were allocated for implementation in the 2005/6 State budget, in spite of the fact that the project is expected to identify priority sites for protection. The above discussion indicates that excellent scientific preparation and good policy development do not guarantee effective implementation.

9. Concluding comments

There are solutions. Techniques are available for managing highly connected linear reserves (Saunders et al. 2002). Australia should implement existing State policies to establish systems of representative protected areas for freshwater ecosystems, in line with our international commitments under the *Convention on Biological Diversity 1992* (Dunn 2000, Nevill 2001, Georges & Cottingham 2001). Furthermore:

- a) Major rivers where ecosystems remain substantially intact should be protected (Morton et al. 2002; Wentworth Group 2002, 2003). Models of protection have been proposed. These include the establishment of a four-tiered river classification, including 'heritage rivers' and 'conservation rivers' which would both receive special protection (Cullen 2002; Wentworth Group 2003). Alternatives could include a river

protection system loosely based on the *Canadian Heritage River System*, or the inclusion of rivers within the Ramsar framework could be promoted (Nevill & Phillips 2004).

- b) The 2004 Sydney *Conference on Freshwater Protected Areas* (WWF Australia and the Inland Rivers Network) recommended that all Australian jurisdictions accelerate the development of freshwater protected areas.
- c) Ecosystem inventories also need accelerated development, partly to underpin protected area identification and selection, and partly to support 'sympathetic' management of biodiversity values within regional resource planning frameworks. Classification and mapping techniques must be used thoughtfully in reserve design and selection (Fitzsimons & Robertson (in press)) to ensure an adequate CAR protected area system. Inventories should be constructed to support a variety of classification methods (Ramsar Secretariat 2002³⁷, Finlayson et al. 2002, Blackman et al. 1992).
- d) The control of cumulative effects, particularly within catchment-scale management, needs much greater attention (Pringle 2001, Nevill 2003, Collares-Pereira & Cowx 2004).
- e) The rehabilitation of significant aquatic sites should remain a priority (Koehn & Brierley 2000, Rutherford et al. 2000).
- f) Stakeholders with common interests need to start building consensus and raising awareness. Adequate stakeholder consultation in the selection of protected areas is essential to allow for the inclusion of local and regional values, and to build community support for protected area programs and the wider sympathetic management of utilised ecosystems.

The National Reserve System (NRS) *Directions Statement* (NRMMC 2005) signalled a new emphasis on freshwater ecosystems (Direction 7): "*Review the current understanding of freshwater biodiversity in relation to the NRS CAR [comprehensive, adequate and representative] reserve system, and finalise an agreed approach, which may include future amendments of the NRS Guidelines, to ensure freshwater ecosystems are appropriately incorporated within the NRS.*" This initiative needs strong support, as does the Murray Darling Basin Commission native fish strategy (MDBMC 2003).

The need to establish comprehensive and representative freshwater protected areas is urgent, given increasing concerns about limited water availability for Australia's cities, industries and agriculture - and the ongoing degradation of aquatic ecosystems. This should be accompanied by effective land and water management that pays more than lip service to the environmental requirements of aquatic ecosystems. State governments should act with the support and collaboration of the Commonwealth.

The most urgent initiative appears to be a national reserve system 'gap analysis' which would identify those ecosystems most at risk. A comprehensive national assessment of the conservation status of freshwater ecosystems should be undertaken immediately. Such a study would provide a platform for the systematic expansion of the nation's freshwater protected areas, as well as a catalyst for innovative 'bottom-up' conservation approaches driven by local stakeholders.

10. Keywords:

Inland aquatic, freshwater, protected areas, biodiversity, reserves, biodiversity conservation, governance, representative, ecosystem.

11. Acknowledgements:

Many thanks to Max Finlayson (IWMI), Peter Bayliss (DEH Canberra), Chris Richmond (New Zealand Department of Conservation) and Jamie Pittock (WWF International) for helpful comments on the text and assistance with references.

12. Citation: this document may be cited as:

Kingsford RK et al. (2005) *Urgent need for a systematic expansion of freshwater protected areas in Australia*. From <http://www.ids.org.au/~cnevill/freshwater.htm>, accessed [insert date].

13. References

- Abell, Robin A, Olson DM, Dinerstein E, Hurley PT, Diggs JT, Eichbaum W, Walters S, Wettengel W, Allnutt T, Loucks CJ, and Hedao P (2000) *Freshwater ecoregions of North America: a conservation assessment*. Island Press; Washington (for WWF United States).
- Abell, Robin A, Thieme, Michele, Dinerstein, Eric, and Olson, David (WWF-US Conservation Science Program) (2002) A sourcebook for conducting biological assessments and developing biodiversity visions for ecoregion conservation. Volume II: Freshwater ecoregions. WWF, Washington USA.
- Balmford, A, Bruner, A, Cooper, P, Costanza, R, Farber, S, Green, RE, Jenkins, M, Jefferiss, P, Jessamy, V, Madden, J, Munro, K, Myers, N, Naeem, S, Paavola, J, Rayment, M, Rosendo, S, Roughgarden, J, Trumper, K & Turner, RK (2002) 'Economic reasons for conserving wild nature', *Science*, vol. 297, pp. 950-3.
- Barmuta, LA (2003) Imperiled rivers of Australia: challenges for assessment and conservation. Special Issue Freshwater Biodiversity in Australia. *Aquatic Ecosystem Health & Management* (6):55-68).
- Bernhardt, E. S., Palmer, M. A., Allan, J. D., Alexander, G., Barnas, K., Brooks, S., Carr, J., Clayton, S., Dahm, C., Follstad-Shah, J., Galat, D., Gloss, S., Goodwin, P., Hart, D., Hassett, B., Jenkinson, R., Katz, S., Kondolf, G. M., Lake, P. S., Lave, R., Meyer, J. L., O'Donnell, T. K., Pagano, L., Powell, B. and Sudduth, E. (2005) Synthesizing U.S. River Restoration Efforts. *Science*, 308, 636-637.
- Blackman JG, Spain AV & Whitey LA (1992) Provisional handbook for the classification and field assessment of Queensland wetlands and deepwater habitats. Department of Environment and Heritage, Queensland; Brisbane.
- Boulton, A.J. and Brock, M.A. (1999) *Australian freshwater ecology: processes and management*. Adelaide: Gleneagles.
- Chadderton, WL, Brown, DJ, and Stephens, RT (2004) *Identifying freshwater ecosystems of national importance for biodiversity – discussion document*. Department of Conservation New Zealand, Wellington.
- Coffey, F (2001) Assessment of Water Resource Plans under the Water Act 2000 (Queensland) with consideration of ecological outcomes and environmental flow objectives in the context of the precautionary principle and sustainable management. *Environment and Planning Law Journal*, Vol. 18.
- Cowx IG & Collares-Pereira MJ (2002) Freshwater fish conservation: options for the future. In: Collares-Pereira, M, Cowx, IG & Coelho, MM (eds) *Conservation of freshwater fishes: options for the future*, Blackwell Science, Oxford.
- Collares-Pereira, M & Cowx, IG (2004) 'The role of catchment-scale environmental management in freshwater fish conservation', *Fisheries Management and Ecology*, vol. 11, pp. 303-13.
- Commonwealth of Australia (1995) *National forest conservation reserves: Commonwealth proposed criteria*, Australian Government Publishing Service, Canberra.
- Commonwealth of Australia (2001) *Directory of important wetlands in Australia; third edition*, Department of the Environment and Heritage, Australia, Canberra.
- Conference of the Parties (2004) Report from the 7th Conference of Parties to the Convention on Biological Diversity: resolution VII/4: biological diversity of inland water ecosystems. United Nations Environment Program website: <http://www.biodiv.org/>, accessed 22/11/04.
- Cowx, IG (2002) 'Analysis of threats to freshwater fish conservation: past and present challenges', in M Collares-Pereira, IG Cowx & MM Coelho (eds), *Conservation of freshwater fishes: options for the future*, Blackwell Science, Oxford.
- Cullen, P (2002) *The heritage river proposal; conserving Australia's undamaged rivers*. Paper presented to the World Congress on Aquatic Protected Areas, Cairns Australia, August 14-17 2002.
- DEH Department of the Environment and Heritage, Australia (2001) Directory of important wetlands in Australia; third edition. Published at <http://www.deh.gov.au/>. Accessed January 2005.
- Dunn, H (2000) *Identifying and protecting rivers of high ecological value*; LWRDDC Occasional Paper 01/00. Land and Water Resources Research and Development Corporation, Canberra.
- ESA Ecological Society of Australia (2003) *Protected areas: a position statement by the Ecological Society of Australia*. ESA website accessed 12/4/05 www.ecolsoc.org.au.

- FAO (1995) *Code of conduct for responsible fisheries*, Food and Agriculture Organisation of the United Nations, Rome.
- Finlayson CM, Davidson NC, Spiers AG and Stevenson NJ (1999) Global wetland inventory - current status and future priorities. *Marine Freshwater Research* (50)717-727. CSIRO, Melbourne.
- Finlayson CM, Begg GW, Howes J, Davies J, Tagi K and Lowry J (2002) *A manual for an inventory of Asian wetlands*. Wetlands International, Kuala Lumpur.
www.wetlands.org/awi/AWI_Manual.pdf.
- Fitzsimons, JA, and Robertson, HA (in press) Freshwater reserves in Australia: directions and challenges for the development of a comprehensive, adequate and representative system of protected areas. *Hydrobiologia*.
- Fitzsimons, JA, FitzSimons P and Ashe, C (2004) Further strategic additions to Victoria's public protected area system. *The Victorian Naturalist* 121(5):215-225.
- Fitzsimons, JA, and Robertson, HA (2003) Wetland reservation status and reserve design in the Wimmera, Victoria. *Ecological Management and Restoration* (2)4: 140-143.
- Gell, FR & Roberts, CM (2003) 'Benefits beyond boundaries: the fishery effects of marine reserves.' *Trends on Ecology and Evolution*, vol. 18, no. 9, pp. 448-55.
- Georges, A. & Cottingham, P. (2001) *Biodiversity in inland waters: Priorities for its protection and management*. Recommendations from the 2001 Fenner Conference on the Environment. Cooperative Research Centre for Freshwater Ecology Technical Report 1/2002; University of Canberra.
- Goulder, LH & Stavins, RN (2002) 'Discounting: an eye on the future', *Nature*, vol. 419, no. 17 October, pp. 673-4.
- Humphreys, W.F. and Harvey, M.S. (eds.) (2001) Subterranean biology in Australia 2000. *Records of the Western Australian Museum, Supplement No. 64*. 242 pp.
- IUCN (1994). *Guidelines for protected area management categories*. Commission on National Parks and Protected Areas with the assistance of the World Conservation Monitoring Centre. IUCN, Gland, Switzerland.
- Joint ANZECC/MCFFA National Forest Policy Statement Implementation Sub-committee (JANIS) (1997) *Nationally Agreed Criteria for the Establishment of a Comprehensive, Adequate and Representative Reserve System for Forests in Australia*. Commonwealth of Australia, Canberra.
- Kingsford, R. T., Brandis, K., Thomas, R. F., Crighton, P., Knowles, E. and Gale, E. (2004) Classifying landform at broad spatial scales: the distribution and conservation of wetlands in New South Wales, Australia. *Marine and Freshwater Research* (55) 1-15.
- Koehn, John and Brierley, Gary (2000) *A framework for river restoration*. Land and Water Resources Research and Development Corporation; Canberra.
- Ladson, A. R. and Finlayson, B. L. (2004) Specifying the environment's right to water: lessons from Victoria. 23(3): 19-28 *Dialogue* (Journal of the Academy of Social Sciences in Australia).
- Lake P.S. (1978) On the conservation of rivers in Australia. *Australian Society for Limnology Newsletter* 16:24-28.
- Master LL, Flack SR, Stein BA (eds)(1998) *Rivers of life: critical watersheds for protecting freshwater biodiversity*. Special publication of the Nature Conservancy. NatureServe; Arlington, VA.
- Margules CR and Pressey RL (2000) Systematic conservation planning. *Nature* (405) 243-253, 11 May 2000.
- MEA Millennium Ecosystem Assessment (2005) *Ecosystems and human well-being: biodiversity synthesis*, World Resources Institute, Washington DC.
- Meyer JL, Kaplan LA, Beilfuss R, Carpenter Q, Newbold D, Semlitsch R, Strayer DL, Watzin M, Woltemade CJ, Zedler JB, Zedler PH (2003) *Where streams are born: the scientific imperative for defending small streams and wetlands*. 23pp. Sierra Club; Washington.
- Morton S, Cristofani P, Cullen P, Possingham H and Young M (2002) *Sustaining our Natural Systems and Biodiversity: An independent report to the Prime Minister's Science, Engineering and Innovation Council*. CSIRO and Environment Australia, Canberra.
- MDBMC Murray-Darling Basin Ministerial Council (2003) *Native fish strategy for the Murray-Darling Basin 2003-2013*. June 2003. Murray-Darling Basin Commission, Canberra ACT
- Myers, N & Knoll, A (2001) 'The biotic crisis and the future of evolution', *Proceedings of the National Academy of Sciences USA*, vol. 98, no. 5389-5392.
- National Land and Water Resources Audit (2001) *Australian water resources assessment 2000*. Commonwealth of Australia: Canberra.
- Nevill, J (2001) *Freshwater biodiversity: protecting freshwater ecosystems in the face of infrastructure development*. Water Research Foundation, Canberra.

- Nevill, J (2003) Managing the cumulative effects of incremental development in freshwater resources. *Environmental and Planning Law Journal* 20 (2) 85-94 (April 2003). Available from www.onlyoneplanet.com.au.
- Nevill, J and Phillips, N (2004) *The Australian freshwater protected areas resourcebook*. OnlyOnePlanet, Hampton Melbourne. Available from www.onlyoneplanet.com.au.
- Nevill, J (2005a) *Counting Australia's protected rivers*. From <http://www.ids.org.au/~cneville/freshwater.htm>, accessed 29 May 2005.
- Nevill, J (2005b) *Assessing the effects of freshwater protected areas*, OnlyOnePlanet Australia, viewed 26 September 2005, <www.onlyoneplanet.com.au>.
- NRMCC Natural Resource Management Ministerial Council (2005) *Directions for the National Reserve System - a partnership approach*. Department for the Environment and Heritage, Canberra.
- O'Meally, D & Colgan, DJ (2005) 'Genetic ranking for biological conservation using information from multiple species', *Biological Conservation*, vol. 122, no. 2005, pp. 395-407.
- Ramsar Secretariat (2002) *Resolution VIII.6 on wetland inventory*. RS, Gland Switzerland. www.ramsar.org/res/key_res_viii_06_e.htm.
- Ricciardi, A & Rasmussen, JB (1999) 'Extinction rates of North American freshwater fauna', *Conservation Biology*, vol. 13, no. 5, pp. 1220-2.
- Robertson, HA, and Fitzsimons, JA (2004) Hydrology or floristics? Mapping and classification of wetlands in Victoria, Australia, and implications for conservation planning. *Environmental Management* 34(4)499-507.
- Rutherford, Ian, Jerie K, and Marsh N (2000) *A rehabilitation manual for Australian streams*. Volume One: Concepts and Planning. Volume Two: Rehabilitation Tools. Land and Water Australia; Canberra.
- Pollard, D and Scott, TD (1966) *River and Reef*. In: Marshall AJ (ed.) (1966) *The Great Extermination*. Heinemann; London.
- Ponder, WF (2004) Endemic aquatic macroinvertebrates of artesian springs of the Great Artesian Basin – progress and future directions. *Records of the South Australian Museum Monograph Series*, 7: 101-110.
- Pressey, RL, Watts, ME & Barrett, T (2004) 'Is maximizing protection the same as minimizing loss? Efficiency and retention as alternative measures of the effectiveness of proposed reserves', *Ecology Letters*, vol. 7, pp. 1035-46.
- Pringle, CM (2001) Hydrologic connectivity and the management of biological reserves: a global perspective. *Ecological Applications* 11(4):981-998.
- Saunders DL, Meeuwig JJ and Vincent ACJ (2002) Freshwater protected areas: strategies for conservation. *Conservation Biology* 16(1):30-41.
- Stein, P (1999) *Are decision-makers too cautious with the precautionary principle?* Paper presented to the Land and Environment Court of New South Wales Annual Conference, 14-15 October 1999.
- Tait, J, Choy, S, and Lawson, R (2002) *Bioregional frameworks for assessment of freshwater biodiversity in Australia*. Paper presented to the World Congress on Aquatic Protected Areas, Cairns Australia, August 14-17 2002.
- Tait, J (2004) *Bioregional frameworks for assessment of freshwater biodiversity in Australia*. Paper presented to the Conference on Freshwater Protected Areas, Sydney, September 2004, WWF Australia and Inland Rivers Network.
- Ward, TJ & Hegerl, E (2004) *Marine protected areas in ecosystem-based management of fisheries*, Department of the Environment and Heritage, Canberra.
- Wells, F and Newall, P (1997) *An examination of an aquatic ecoregion protocol for Australia*. Australian and New Zealand Environment and Conservation Council (ANZECC); Canberra. Available from <http://www.deh.gov.au/water/rivers/nrhp/ecoregion/> accessed 20 April 2005.
- Wentworth Group of Concerned Scientists (2002) *Blueprint for a living continent: a way forward*. Worldwide Fund for Nature (WWF); Sydney.
- Wentworth Group of Concerned Scientists (2003) *Blueprint for a national water plan*. Worldwide Fund for Nature (WWF); Sydney.

More information on Australian freshwater protected area policy can be obtained from www.onlyoneplanet.com.au.

14. Endnotes:

¹ Freshwater invertebrates – see Ponder (2004) and discussion below.

² The term 'freshwater' here is short-hand for 'inland aquatic', recognising that many of Australia's inland ecosystems are brackish or saline. 'Freshwater' is a commonly used keyword.

³ see: Master et al. 1998, Boulton & Brock 1999, Ricciardi & Rasmussen 1999, Myers & Knoll 2001³, Cowx 2002, Barmuta 2003, MEA 2005.

⁴ The critical nature of the biodiversity crisis facing the planet was acknowledged when representatives of 190 countries at the 2002 Johannesburg World Summit on Sustainable Development committed themselves to "...achieving by 2010 a significant reduction of the current rate of biodiversity loss at global, regional and national levels..." UNEP, "Report on the Sixth Meeting of the Conference of the Parties to the Convention on Biological Diversity (UNEP/CBD/COP/6/20/Part 2) Strategic Plan Decision VI/26" (CBD 2002); available at <http://www.biodiv.org/doc/meetings/cop/cop-06/official/cop-06/20-part2-en.pdf> (2004).

⁵ The literature assessing the effects of freshwater protected areas suggests that the size of the protected area, and the management of the surrounding catchment are critical factors. Some groups of biota, such as fishes, do not appear to have benefited greatly from existing protected areas (Nevill 2005b).

⁶ The ubiquitous use of 12-month accounting cycles based on readily measurable financial attributes and current interest/discount rates under-values important ecosystem services, which in many cases are difficult to calculate, and operate on time-scales of decades or centuries. Where they are calculated, long term benefits are systematically undervalued by the use of standard discount-rate accounting procedures (Goulder & Stavins 2002). Attempts to measure the value of long-term ecosystem services accurately often show that the conservation of natural ecosystems yields higher overall benefits than their destruction for short term gains (see the examples discussed on MEA 2005 p.39, and Balmford et al. 2002).

⁷ Including major salinity mitigation functions.

⁸ Refer: http://www.ramsar.org/key_guide_list_e.htm, accessed 20/4/05.

⁹ Refer: http://www.ramsar.org/key_criteria.htm, accessed 20/4/05.

¹⁰ See http://europa.eu.int/comm/environment/water/water-framework/index_en.html, accessed 30/4/05. Note however that the European Council Directive 92/43/EEC (21.5.92) *Conservation of Natural Habitats and Wild Fauna and Flora* does not require the *comprehensive* protection of *representative* ecosystems. This Directive precedes national commitments to the Convention on Biological Diversity 1992, which would thus appear to require an expansion of the scope of the Natura 2000 programs currently funded under the older EC Directives. Cowx & Collares-Periera recommend an extension of the Natura 2000 programs (2002:448).

¹¹ See http://europa.eu.int/comm/research/water-initiative/index_en.html, accessed 30/4/05.

¹² *Maccullochella peeli*.

¹³ *Astacopsis gouldi*.

¹⁴ Calls such as those by Pollard & Scott (1966) and Lake (1978) for the protection of Australia's freshwater ecosystems continue to be ignored. Lake wrote in 1978: "...the conservation of rivers in Australia needs urgent and effective treatment".

¹⁵ "Over-allocation" refers to the over-allocation of available water supplies by State water management agencies (see Nevill & Phillips 2004 section 4.2.1). Both surface waters and groundwaters are often over-allocated and used with excessive waste.

¹⁶ Agricultural drainage includes drainage of wetlands and their surrounds, as well as land levelling and reshaping.

¹⁷ Groundwater dependent ecosystem (GDE) matrix removal includes, for example, the extraction of river gravels and groundwater calcretes.

¹⁸ Australia has hundreds of rivers, but only a handful are protected (Nevill 2005a). The largest Ramsar-listed river is the South Alligator River in the Northern Territory, where 91% of the river catchment lies within the Kakadu National Park and associated Ramsar site. Within the Murray-Darling Basin, the Ramsar sites on rivers such as the Paroo and the Murray provide a measure of legal protection against new deleterious developments, and form five of the six 'significant ecological assets' that underpin the Murray Darling Basin Commission's *Living Murray Initiative* action program to restore some measure of environmental health to the Murray River.

¹⁹ Australia's 64 Ramsar sites (2004) are viewed as 'internationally significant' and cover a total of approximately 7.3 million hectares. More info: <http://www.deh.gov.au>.

²⁰ Strictly speaking, State governments do not 'list' Ramsar sites. While in practice State governments recommend areas to the Commonwealth Government, who then recommends to the Ramsar Secretariat, this is the result of the Commonwealth's policy of bilateral cooperation. Legally the only role of State governments (under EPBC Act) is to be consulted by the Australian Government on proposed listings. Only the Australian Government can 'declare' Ramsar sites which the Ramsar Secretariat then lists.

²¹ See Schedule 8 of the *Integrated Planning Regulations 1998*.

²² Most of the Ramsar areas are within State terrestrial protected areas. Note however that Ramsar wetland listing does not constitute 'protected area' status in its own right. A small number of Ramsar sites are declared over constructed wetlands not managed for primarily for biodiversity conservation (e.g. the Western Sewage Treatment Plant at Werribee, Victoria).

²³ In some cases, agreed environmental flows have not been delivered as a direct result of poor management arrangements and inadequate State funding.

²⁴ Many GAB stock bores have a wastage rate of 90% or more (see <http://www.gab.org.au/about/managementgab.html#key>, accessed 20/4/05)

²⁵ An additional complication is created by secrecy surrounding key management information. According to A/Prof Brian Finlayson (pers. comm. 13/5/05): "All the river gauging in the Kosciusko National Park is now done by the newly 'corporatised' Snowy Hydro and all the data they collect are 'Commercial in Confidence' and they will not release it to anyone. So we have the situation where all the flow data for rivers in one of our major national parks (a 'protected area') is kept secret."

²⁶ The Wimmera lies in north-eastern Victoria.

²⁷ "Original" in this context means pre-European (prior to 1750).

²⁸ According to Pressey et al. (2004): "Recent Australian guidelines for expanding forest reserves [Commonwealth of Australia 1995; Joint ANZECC/MCFFA National Forest Policy Statement Implementation Sub-committee (JANIS) 1997] stipulated a baseline conservation target of 15% of the pre-European extent of each forest type. The guidelines also recognized that larger targets would be necessary for rare and/or threatened types and that reductions below the 15% baseline might be appropriate for extensive, secure types."

²⁹ Robertson and Fitzsimons (2004) found that different surrogates for the same ecosystem can produce very different results for measuring and mapping representation.

³⁰ O'Meally & Colgan (2005): "... single taxa are not usually good surrogates for the prediction of genetic value in other groups".

³¹ Here "river" is defined as including headwater streams. The minor spring-fed tributaries of many coastal rivers contain significant invertebrate endemism – quite different and often arguably more significant than the rivers themselves (W. Ponder, pers. comm. 19/4/05, Meyer et al. 2003).

³² Victoria was an early leader in respect to representative terrestrial ecosystem reservation, with its *Reference Areas Act 1978* and the program of systematic reservation commenced under the Land Conservation Council. Victoria's *State Conservation Strategy 1987* and its biodiversity strategy 1997 both contain commitments to the development of a fully representative reserve system. Although implementation problems have dogged freshwater protection under these policies, the commitments themselves were repeated again in the *Healthy Rivers Strategy 2003* (Nevill & Phillips 2004). There is a clear gap between rhetoric and reality in relation to freshwater ecosystem protection; nevertheless many significant wetland additions to Victoria's Nature Conservation Reserves have occurred through land purchases over the last decade (Fitzsimons et al. 2004).

³³ Conservation in the ACT has some unusual aspects, including the large proportion (~50%) of the total land area under some form of protective management (Nevill & Phillips 2004).

³⁴ Largely headwater catchments already protected by large national parks or reservations within utilised forests.

³⁵ According to A/Prof Brian Finlayson (pers. comm. 13/5/05): "The Thomson River is a Heritage River yet the Victorian government apparently had no qualms about reducing the scientifically determined environmental flow allocation. The Thomson Expert Panel process recommended an environmental flow regime of 47 GL annually. The Task Force (made up of water managers and water users) eventually agreed to an environmental flow of 12 GL/yr

initially rising to 25 GL/yr in 5-6 years. The fact that it was a Heritage River appeared to carry no weight in this decision and was not mentioned in the Task Force report.” According to Jon Nevill: “The Thomson River feeds one of Melbourne’s major water supply dams. Given that the Victorian Government has never reported on the management of Victoria’s Heritage Rivers, there appears the possibility that the 13-year delay in implementing protective management is not an administrative oversight”.

³⁶ The substantial failure of the NSW government to enforce its native vegetation protection legislation was documented on the Australian Broadcasting Commission Radio National *Background Briefing* of 14/9/2003.

³⁷ See clause 37.