EDITORIAL

What role should ecology play in the management and conservation of inland water resources?

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It is natural for each of us to perceive problems from the point of view of our own disciplines and specialities, and we usually reckon that there is not enough attention being paid to our area. Yet it is salutary to detach ourselves and see the problem from an overall perspective.

I am, or at least have been for the last 15 years of my professional life, a benthic ecologist. I am primarily an ecologist, and because I work in streams and rivers where the organisms tend to be attached or on the bottom, I am an ecologist of the benthos. However, I incorporate other aspects of stream ecosystem functioning into my studies as the need arises, and I try to project the results of my work into questions of management and conservation of fluvial systems. I think benthic ecology has many important things to say about river conservation and management, but I need to temper my chauvinism to view the question objectively.

In this editorial, I will use as an example the newly formed Brazilian ‘Agência Nacional das Águas’ (National Water Agency, ANA). I do not have the space or the expertise to analyse ANA comprehensively here, but I will use the example to provoke the question of my title and to reflect how benthology and ecology in general interact with larger scale water management. As we will see, the question of ‘conservation’, with a big or little ‘c’, inevitably confronts us.

The basis for ANA was the Federal ‘Water Law’, ‘Lei das Águas’, which was passed on 8 January 1997 (Lei 9433/97) and included provision for a national water authority. The Federal Government subsequently called for submissions from the community for the structuring of ANA. Limnologists and ecologists were caught napping and, as far as I am aware, they made no articulated response. (I should say, ‘we’ made no response, because I am a member of both the Limnological and Ecological Societies of Brazil.) The engineers were wide-awake to the opportunity and apparently participated in the formulation of the agency. For many of us, the first real evidence of ANA appeared with the public announcement and call for job applications in April 2001. One hundred and ten job contracts on offer at three levels with salaries that made an academic’s eyes bulge — in various areas of expertise: various categories of engineer (sanitary, hydrological, civil), various categories of earth science (including geography and hydrology) and a category ‘other’. It was a great shock for a person like myself who espouses the importance of bentholgical research and teaches applied ecology, ecological modelling and river ecology to see that I had no particular professional space in these plans. Where were ecology, environmental management or even biology as professions in the plans for managing the nation’s water? Were they so insignificant that they could be relegated to ‘other”? How could I justify to my undergraduate and postgraduate students that the qualifications they were receiving apparently had no specific recognition by the Federal agency?

Shortly after this unsettling experience, I attended the 49th Annual Meeting of the North American Benthological Society in LaCrosse, WS. The president, Joseph Culp, chose for the theme of his presidential address ‘The Role of Freshwater Benthologists in Translating Science to Decision-Makers.’ He recounted the example of the Canadian Northern River Basins Study. He emphasized the importance of vertical
communication — of scientists to decision-makers and the public, and the lateral integration between disciplines such as benthology, hydrology and engineering. It was significant that our president had chosen this topic, we were stimulated by the talk and pleased that the Canadians were making progress and listening to the input of benthologists. Yet for my existential dilemma with ANA there remained two outstanding questions: (1) How can benthology/ecology be recognized and incorporated into a multi-disciplinary governmental initiative? and (2) Just what can we offer as our professional property within the framework of water quality, water allocation, pollution, navigability or fisheries?

Later, in August–September 2001, I went to Brisbane, Australia, where the annual River Symposium and the 3rd Australian Stream Management Conference were held concurrently, including a day’s joint session (www.riverfestival/2001). Both meetings were a great eye-opener for me. It was interesting to be a benthic ecologist amongst hydrologists, planners, sociologists and water managers. The international presentations ran the gamut of the most engineered aquatic restoration scheme (e.g. the Kissimmee River Restoration Project in Florida, Whalen et al., 2001) to the most transnational (e.g. session on the Mekong River) and the bleak news of Asian river conservation (Dudgeon, 1999, 2000, 2001). Many of the presentations had to do with water allocation and specific aspects of water management (e.g. weirs, floodplain control). Other presentations were of multi-disciplinary programmes or reported specific aspects of a multi-disciplinary programme. Benthic ecology had a strong presence.

There are some striking examples of multi-disciplinary programmes in Australia, incorporating vertical dimensions of government, management, applied research and public participation, with lateral integration of questions of flow, sedimentation, nutrient dynamics and biology. The Murray–Darling project is perhaps the best known (Goss, 2001; Young, 2001). In terms of aquatic restoration and public participation, the projects in the Goulburn–Broken catchment in Victoria and Blackwood River in Western Australia gained prizes at the River Symposium, but it was our hosts who most impressed me: the Southeast Queensland Regional Water Quality Management Strategy has the most seamless integration of government authorities, research institutions and public that I have witnessed (www.healthywaterways.env.qld.gov.au). They have the runs on the board from their first two phases of operation in terms of establishing critical links between agencies, improving water quality of the Brisbane River and initiating environmental recovery in Moreton Bay. The public have been brought into the debates and the action, with plenty of publicity and a system of ‘report cards’ which score environmental/ecological integrity. Most impressive for me was the role of university research, which appears to be truly integrated into the dynamic of conservation and management. Within this, I believe it significant that the newer Griffith University makes a very important contribution. Griffith was set up in 1975 as a university without the traditional divisions of Arts, Science, Physics, Chemistry, Biology, etc., but with a Faculty of Environmental Sciences and Australian School of Environmental Studies. I believe them when they say that this facilitates the multi-disciplinarity needed for applied ecological research.

The Centre for Catchment and In-stream Research at Griffith University has developed an innovative programme of environmental monitoring for the Southeast Queensland region (Smith and Storey, 2001). This ‘Ecosystem Health Monitoring Program’ integrates five functional and descriptive parameters: (1) ecosystem processes (Gross Primary Productivity, 24-h respiration and ratio of stable isotopes of carbon, δ13C), (2) nutrient cycling (algal growth and ratio of stable isotopes of nitrogen, δ15N), (3) physico-chemical measures (24-hour dissolved oxygen, temperature, pH, conductivity), (4) aquatic invertebrate bioindicators, and (5) fish bioindicators. The use of functional parameters for characterizing the impact on ecological processes and coupling them to description of fauna and flora, is something that I have been pushing out of our research in Rio de Janeiro, although our approach and the parameters we measure are quite different (Moulton, 2001).

My overall feeling of the Brisbane events was that, if not as ‘comfortable’ a place for me to be as was the NABS meeting, the science of benthology was nevertheless well represented and considered important by the water managers.
So, what of this experience, if anything, could I potentially bring back to Brazil? First, we have to recognize the individual nature of the problems. We cannot and should not expect that a programme set up for the Australian fluvial, social and political environment would be appropriate for Brazil. Even within Australia, the river basin authorities function in different manners depending on the circumstances. We can note, however, that vertical communication and action (from government to community) is emphasized in many plans, and horizontal integration of authorities at the organizational level and scientific disciplines at the research level appears important.

With this in mind, let us take a look at the progress that ANA is making. First, the intake of staff was not as biased towards engineers as one might have feared from the job announcement. The lack of representation of biology and ecology had more to do with a serious lack of professional organization, coupled with the ever-present difficulty of pigeon-holing environmental science (problems that are by no means restricted to Brazil).

Brazil is confronting some huge questions in terms of water management. It might have the largest river in the world, but that does not ensure adequate supply for the whole country. Far from it, in the Northeast and Southeast regions we experienced energy cuts during 2001 because drought reduced hydroelectric capacity. The Sobradinho lake/reservoir on the San Francisco River was down to 5% of its normal area during the worst part of the drought. The Northeast region suffers regular drought and insufficiency of water for irrigation. In the Amazon region itself there are plans for 40 more dams which have doubtful social value and potentially disastrous conservation consequences (Fearnside, 1999, 2001). ANA has just put out a compact disc compiling data on 100 rivers in the South and Southeast regions, and they claim that 80% of the rivers show serious degradation. The world’s largest wetland, the Pantanal, is under threat from a scheme to make an industrial waterway, ‘hidrovia’, of the Paraguay River (Hamilton, 2000, 2001).

So, ANA has its work cut out. Does it have the teeth? Well, Brazil is known to have relatively good environmental legislation, but has a history of difficulty in enforcement. The National Water Resource Policy Law (Lei 9433/97) provides for the creation of River Basin Committees and Water Agencies. ANA provides the centralized authority and incentive for the formation of the committees. It also promotes specific programmes, such as water quality remediation (‘de-pollution’) in rivers. The model of decentralizing water control into regional basins with a large degree of autonomy appears to be a good one. In its literature, ANA calls this the French model, but it is much more universal than this. Within the model there is emphasis on the ability to charge for the use of water. The legislation is in place, the funding so far appears good and the mandate for action has been given. We wait in hope.

What about ‘conservation’? The strong emphasis of the Water Resources Policy Law 9433/97 is on regulating the supply of water and the quality of that water. In the literature of ANA the ‘functioning’ of rivers is mentioned in the context of supplying water. The question of ecological functioning is touched upon, but concepts such as ‘environmental flows’, which are so much part of the preoccupation in Australia, are not (yet?) part of the Brazilian philosophy. The question of ‘conservation’ as we have come to use the term for conservation of species and biodiversity is all but absent in the ANA literature. The 88-page manual on de-pollution does not mention the word ‘biodiversity’, nor does it incorporate biomonitoring or ecological criteria.

What of the vertical communication and horizontal integration of research that I mentioned earlier? The formation of the River Basin Committees calls for participation of all relevant local authorities and interests. The de-pollution manual, amongst other things, includes standards for public outreach, slogans and visual media. Perhaps it is with this top-down approach that they need to commence their work, but I would like to see more emphasis in the development of public consciousness and empowerment at the beginning of the campaign.

As for applied research into how to set standards, how to monitor results, how generally to understand the ecological processes of rivers — we are eagerly waiting to see how ANA will act. There are few, if any, indications in the legislation and initial literature. However, the agency has a great deal of autonomy, and
we can hope that it will incorporate applied research. Brazil has a strong tradition of limnological research, especially in reservoirs (Tundisi et al., 1995; Henry, 2001), so ANA has a reasonable amount of information at its disposal. However, although basic research is fundamental to applied research, we know that the process of adapting and using it is not simple. I maintain that, for research to be effective, it needs to be incorporated into the system it is studying at the outset, such that the managers and users participate in the formulation of the objectives interactively with the researchers and accompany the research progress and implementation. To my mind, the mistake that ANA could make would be to parcel out grants to areas of interest, but not integrate the research with the River Basin Committees and the players in the system. We have many examples worldwide of research decoupled from its objectives and failing to serve those objectives, and we have examples, such as in Southeast Queensland, which can serve as models.

As for the overall tenor of ANA’s incorporation and manifestations to date, I recognize the great value of a well-funded, autonomous and powerful national agency for the management of Brazil’s water resources. I recognize that structuring of water basin frameworks, including payment for the use of water, is fundamental for rational management of water resources. The tasks of supplying water and improving water quality involve engineering, hydrology and other aspects of physical and chemical sciences. These appear to be well formulated within the structure of ANA. I have misgivings about the lack of an ecosystem framework in the plans for water management, and following from this a lack of ecology and its important component, benthic ecology. There is enough evidence to show that the ecological functioning of rivers and other water bodies is intimately associated with management such that management practices need to be studied and developed with as full an understanding of ecology as possible. Conservation of biological resources forms an integral part of such a scheme and must not be considered a separate or a side issue.

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