

VIEWPOINT

Community participation in conserving and managing inland waters

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ABSTRACT

1. Many international and national bodies have stressed the need for community participation in the conservation and management of inland waters. Community participation is needed for three basic reasons: to implement management measures difficult to enforce without community support; to act as a mechanism in protecting inland waters through support of conservation bodies; and, through voluntary actions, to monitor, restore and rehabilitate inland water-bodies.

2. It is important to conserve and manage inland waters because of their many values and uses. To participate fully in conservation and management measures, the community needs to (a) recognize the importance of inland waters as a part of the global hydrological cycle, (b) have some knowledge of the nature and effects of major human impacts on inland waters, and (c) be aware of certain legal issues.

3. The 'community' is heterogeneous in nature but community groups of similar interest can be recognized. They vary from small, local action groups, through national groups to international bodies. They provide advice to and support government actions; others oppose and seek to change government actions. Community involvement can be at various levels, from the relatively inactive to the vigorously proactive.

4. Environmental education of the community should begin in childhood, continue at school and other educational institutions, and last throughout life. Information on the conservation and management of inland waters is available from many sources, but a powerful, modern source is the World Wide Web.

5. Four case studies are discussed with particular reference to community participation: Lake Washington and Mono Lake in the US (successful outcomes), the Aral Sea in central Asia and Lake Pedder in Australia (unsuccessful outcomes).

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INTRODUCTION

The need for community participation in managing and conserving the world's inland waters has long been stressed and widely accepted at all levels of government—international, national and local—though not by all governments. At the international level, for example, *The Rio Declaration on Environment and Development* (UNEP, 1992) stated: 'environmental issues are best handled with the participation of all concerned citizens, at the relevant level...' (Principle 10). One of the four principles put forward at the

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influential Dublin Water Conference in 1992 was that 'Water development and management should be based upon a participatory approach. . .', and the World Water Vision (Cosgrove and Rijsberman, 2000) noted the need for public participation if its 'vision' were to be effectively implemented. None of these statements, however, spelled out what 'community participation' meant or how it could be implemented. Even so, at the national level, many governments (but not all) now recognize the need to involve the community if water resources management is to be effective. Indeed, there is often legislation which requires water management boards to include members of the community in decision-making. The same situation applies at the local government level.

In the absence of detailed documents strongly advocating community participation (a notable exception being Showers, 2000) and less than explicit accounts elsewhere (see Evans and Birchenough, 2001), this paper explores why community participation in the management and conservation of inland waters is considered important: why lakes, rivers and streams, if they are to survive as natural assets sustaining mankind, need community participation to protect them; why they need not only the protection of governments and official organizations but also the protection of individuals, communities and unofficial organizations. As the World Water Vision (Cosgrove and Rijsberman, 2000) noted recently: 'The real revolution in water resources management will come when all stakeholders, where possible, have the power to manage their own resources'.

The paper explores the following issues: why it is important to protect inland waters; why community participation is needed to protect them; who the 'community' is; what the community should know; when and where the community should be informed; how the community can be informed; and what the community can do.

The paper considers four case studies where community participation (or lack of it in one case) has led to success and failure in managing and conserving lakes: there are two success stories (Lake Washington and Mono Lake in the USA) and two failures (the Aral Sea in central Asia, Lake Pedder in Australia). Important lessons can be learned from these case studies. The paper is illustrated by reference to a number of Australian community groups, since they are most familiar to and have provided direct experience of community participation to the author. Some non-Australian examples of community participation familiar to the author are also mentioned.

WHY IT IS IMPORTANT TO CONSERVE AND MANAGE INLAND WATERS

Inland waters have a great many uses and values, but all inland waters are subject to human impacts which cause loss or degradation of uses and values. Protection from these impacts is therefore important. The nature of these impacts is dealt with later; here, discussion focuses upon the uses and values of inland (and mostly fresh) waters.

The most obvious use of fresh waters is an economic one: principally for domestic, agricultural and industrial supplies. Because these economic uses are essential for the support of human populations, because large volumes are needed, and because it is reasonably easy to price the volume of water used, the economic use of fresh waters overshadows the many other uses and values of fresh waters. Indeed, at a recent international meeting convened to discuss water 'issues', the Second World Water Forum (The Hague, March 2000), the extent to which the economic uses of fresh water were considered completely overwhelmed consideration of other uses and values. Perhaps of even more concern was the extent to which fresh waters were viewed as an economic asset to be traded, exchanged and sold as a commodity. Several authors have argued against such 'commodification' (see especially Barlow, 2001). One of the arguments used by them is that water has a large number of non-economic uses and values of considerable significance which have not been taken full account of by economists.

A brief summary of the major uses and values of inland waters will be helpful in this context. Before providing it, however, note that both water quantity and quality are important. Human activities not only consume large quantities of water (consumptive use), they also profoundly and adversely affect water quality.

Economic uses: Water is needed by human beings to drink, wash, cook and for sanitation. The recommended basic requirement for domestic purposes is about 50 L d^{-1} . Given a world population of almost 6 billion, the total annual volume of fresh water needed for domestic use is at least $110 \times 10^9 \text{ m}^3$. To this amount must be added the volume of water needed by agriculture to feed the population. It is much greater since between 600 and 1800 m^3 is needed each year to grow the food for one individual. Industry also uses large volumes of water. For all economic uses (including hydropower, navigation and fishing) more than 6000 km^3 of water are used at present each year (estimates vary) of which about 67% is used by irrigated agriculture and less than 3% domestically.

Recreational uses: Many fresh waters are used for fishing, boating, sightseeing, swimming, photography and other recreational pursuits, passive or active.

Aesthetic values: Often termed 'inspirational' or 'spiritual' values, these are impossible to put a price on yet priceless! Such values have long attracted the attention of poets, artists and writers.

Cultural values: Many lakes and rivers have played a critical role in human history and form an integral part of our common cultural heritage. Again, these values are difficult to put a price on.

Educational uses: As relatively discrete, biologically comprehensive and accessible habitats, lakes, rivers and other bodies of inland water represent unique educational 'tools' by which to inform and educate the public. How bleak and impoverished, by contrast, are aquaria, computer programs and TV screens.

Scientific values: The biota of inland waters, and the ecological processes in which they play a role, have long attracted attention from a number of scientific disciplines and been the subject of many investigations. These investigations above all are important because they tell us how parts of the living world are structured and function, and what the past and perhaps future world will be like.

Ecological values: As integral parts of global hydrological cycles, pathways for the circulation of essential elements, and repositories for a significant fraction of the world's biodiversity, inland waters have an important ecological role to play in sustaining the planet's life-support systems. This role, so-called 'ecosystem services', like many other non-economic values, is difficult to put a price on but can scarcely be overvalued. One brave estimate is that the annual value of ecosystem services provided by wetlands, lakes and rivers is US \$6.6 trillion.

WHY COMMUNITY PARTICIPATION IS NEEDED

To manage human impacts on inland waters, restrictions are needed. They often take legal form, but to be effective restrictions on many activities require active community acceptance and voluntary implementation. Legal restrictions, e.g. the imposition of discharge criteria, can be applied to point source industrial discharges of waste water and can be enforced without much difficulty. Voluntarily implemented restrictions usually apply more widely, often to small and diffuse impacts (which, even so, may be more important in total impact than point source discharges), and are difficult to enforce; to be effectively implemented, the willing and active cooperation and support of the community is essential.

Another reason is because members of the community can often be important in changing government views when these are 'blinkered', driven by vested or sectoral interests, or simply 'uninformed'. In a sense, the community acts as the 'conscience' of the government. A case in point is provided by the Mono Lake Committee, a small group of conservation-minded citizens who banded together to change the views of the Los Angeles water authority on the values of Mono Lake in California. They did—and so saved one of California's most beautiful lakes from the fate that Owens Lake downstream suffered: complete

desiccation. More details are given later as one of the case studies. Intra- or inter-governmental committees are rarely as effective. The Lake Eyre Basin Agreement between certain Australian state governments, for example, ostensibly set up to protect Lake Eyre, essentially has no teeth. The same, unfortunately, may also be said of some international conventions, e.g. the Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Helsinki, 1992). Even the Ramsar convention, though better than no convention, leaves much to be desired in its implementation in many countries.

A third reason is that community groups can be environmentally active and undertake conservation and management measures that governments are unwilling, incapable or financially unable to undertake. These may include the removal of introduced and unwanted species of biota, planting desirable vegetation, monitoring environmental features, and habitat rehabilitation and restoration.

Thus, three clear answers to the question of why community participation is needed to conserve and manage inland waters are:

- it is needed to implement management measures that are difficult if not impossible to enforce without it;
- community participation, through its support of conservation bodies, has been and is a strong mechanism in conserving the natural aquatic environment; and
- community groups can undertake conservation and management activities that governments cannot or are unwilling to undertake.

Looked at from the perspective of governments and water resource managers, community participation also makes good sense because, amongst other reasons:

- in democracies, government policy agenda are fundamentally defined by the community;
- policies and decisions arrived at after community participation (consultation) are to some extent publicly 'owned' (common references here are to community 'ownership' and 'empowerment');
- it enables governments and water managers to use local knowledge;
- nobody affected by decisions can feel that their views have not been considered (even if they have not been accepted);
- the community represents a source of inexpensive labour for environmental projects;
- in many countries, large areas of the catchments of lakes and reservoirs are privately owned by the community (i.e. by individuals and not the state);
- following community participation, decisions can be made more rapidly (there are likely to be fewer, time-consuming objections);
- it makes good business sense to give the customer (i.e. the community) what it wants; and
- best practice environmental management (BPEM) recognizes the good sense of proactive community consultation.

WHO THE 'COMMUNITY' IS

A broad definition of a *community* is that it is the people within a country or locality, or the public within a specified region. Accepting this definition, it is clear that a community is not an homogeneous group of people; rather it comprises people of diverse interests and attitudes, and groups of people distinguished on the basis of common interests. People have different cultural, ethnic or religious backgrounds, different family and social values, and different educational and social levels. Groups include residents, business people and industrialists, environmentalists and farmers. Not all have the same concerns with respect to the management and conservation of inland waters—indeed, many people and groups may be in conflict on this issue. Many may have no interest or concern at all (but should not be forgotten). So far as the management and conservation of inland waters is concerned, however, a 'community' may be taken in the

first instance to be all those people and groups in the local population with an interest in the management and conservation of inland waters, whatever their views, supportive or otherwise.

The diversity within a community makes it very difficult to generalize about the attitudes of its members toward the protection of inland waters. A few characteristic types, even so, can be discerned. One comprises those who oppose management and conservation on principle: they see management and conservation as activities intruding on personal freedom, life styles or as limiting 'progress'. Such views need to be acknowledged and addressed. Another likely critical type comprises those with vested interests: those who are advantaged by the lack of management and conservation. A third type comprises well-informed members of the community who have the ability to acquire and develop relevant expertise, consider benefits and costs objectively, draw rational conclusions, and take effective action (often political). Articulate and opinion-leaders, this type is the most influential and its participation is the most needed to protect inland waters. This division into three types is, of course, arbitrary and disguises the wide variety of community membership.

A central question is how to identify the various characteristic types, especially the third one, and, within this, the so-called 'actives', i.e. those people who are very concerned, very interested and already active on related issues. Ways to do this include talking to community leaders, by advertisement, and by reference to past similar issues.

Notwithstanding the broad definition of a community given above, it can be argued that it should be even broader; people outside as well as inside a country or local region should be considered as interested members and part of the community since the management and conservation of inland waters have broad-scale, global effects. Difficulties arise when proximate communities (the local public) are advantaged or disadvantaged by activities protecting inland waters whereas the opposite situation may apply for distant communities (the wider public). Such difficulties are increasingly part of international discourses on inland waters, particularly since they may lead to conflict. The Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Helsinki, 1992), mentioned above, is relevant here. An important part of the Convention obliges states to take all appropriate means to prevent harm to other states. The extent to which obligations are accepted and acted upon is, however, an issue of ongoing concern for the conservation and management of many lakes and reservoirs. For example, the conservation of many water bodies in the lower reaches of the Tigris and Euphrates rivers in Iraq is now imperilled by upstream impacts on these rivers in Syria and Turkey.

WHAT THE COMMUNITY SHOULD KNOW

For the community to participate fully and effectively in the protection of inland waters, it should be aware of, understand or have some general knowledge of three things. Two have already been hinted at. First, it should be aware that fresh waters are an integral part of our planet's life-support systems. Second, it should understand the nature of major impacts on inland waters and their effects. Third, it should know something about legal matters appropriate to the water body needing management or protection. Community knowledge about these three things does not have to match that of scientists, engineers and lawyers; all that is required is a firm grasp of principles, a confidence that these can be understood by the ordinary citizen (they can), and a determination not to be overwhelmed by technical or legal jargon. The following explanations should provide the essential basis for required knowledge.

Inland waters as integral parts of the planet's life-support systems

All inland waters exist because more water evaporates from the ocean than falls back on it. The difference falls over land as rain or snow and gives rise to lakes and rivers (and reservoirs when rivers are dammed).

Some penetrates the earth's surface to form groundwater. Although some rain may be temporarily held in 'closed' lakes (that is, in lakes without surface outlet to the sea), ultimately all the water that has fallen over land reaches the sea again. The global pathway followed by water is, therefore, essentially circular and is termed the hydrological cycle. It is often referred to as the earth's *plumbing system*.

Yet lakes and rivers contain not only water and its dissolved and suspended materials: they also contain plants and animals which fix, transform and transport energy from the sun. Photosynthesis, respiration and decomposition are key processes here. In a sense, then, inland waters form part of the earth's *energy system*.

The types of plants and animals in inland waters are many and varied: inland and particularly fresh waters are amongst the most biodiverse of natural habitats. This too is important globally since high biodiversity is usually regarded as an effective way of coping with or compensating for natural disturbances. The high biodiversity of inland waters, therefore, forms part of the earth's protective or security system.

Considered like this, inland waters are important elements in the earth's plumbing, energy and security systems. Without them, our spaceship could not sustain us and we meddle at peril! The first law of the tinkerer should be recalled here: Save all parts. It is continually ignored by many with the responsibility for managing water resources.

The nature of major impacts on inland waters and their effects

Overall, human impacts of human beings on inland waters have been profound, comprehensive, often irreversible, and almost always adverse. The effects include significant loss or degradation of values and uses, including decreased biodiversity, lowered water quality, unhealthy conditions and changes to the natural character of water bodies. Six major types of impact can be distinguished, with some subdivision helpful to understanding (Table 1).

Legal matters

A key element of what the community should know is knowledge of relevant local planning ordinances, national laws and international conventions. Many environmental battles have been won not on the strength of ecological arguments or even commonsense, but on the basis of legal technicalities. This point is not developed here, but note that many laws have been enacted to protect the environment, yet remain unused or untested; many lawyers are prepared to provide information *pro bono*, but are not asked.

Of important international conventions, special note is made of the Convention on Wetlands of International Importance especially for Waterfowl (Ramsar, 1971), the Convention concerning the Protection of the World Cultural and Natural Heritage (Paris, 1972), the Convention on Biological Diversity (1992), the Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Helsinki, 1992), and the Convention on the Access to Information, Public Participation in Decision Making and Access to Justice in Environmental Matters (Aarhus, 1998).

WHEN AND WHERE THE COMMUNITY SHOULD BE INFORMED

The accumulation of information (initially, the development of environmental awareness) cannot begin too soon. The first steps in the process should go hand in hand with the development of other fundamental forms of human information such as the distinction between right and wrong, an awareness of what is safe and what is not, and the recognition that other human beings have rights. Knowledge that human survival depends upon the protection of the natural world should be seen as the common thread binding human cultural, ethnic and religious diversity. In previous times, such teachings were often embedded in many cultures, such as those of indigenous peoples in North America and Australia. The modern difficulty is that many (most) humans now live in urban situations, and lack any direct contact with the natural

Table 1. Major types of human impact on inland waters

Pollution. Many substances are pollutants. The most common are:

- Non-toxic organic substances
- Inorganic substances
- Plant nutrients
- Toxins, both inorganic and organic
- Inert substances
- Radioactive wastes
- Heat

Catchment changes. Amongst the most significant are:

- Urbanization
- Deforestation
- Irrigation
- Burning of natural vegetation
- Overgrazing
- Soil erosion (thus higher sediment and silt loads)
- Salinization
- Altered run-off patterns
- Elevated plant nutrient concentrations in run-off.

Direct hydrological impacts. Involved here are principally:

- Drainage of natural water bodies
- Construction of unnatural water bodies (dams and impoundments)
- Changes to natural water levels (both absolutely and over time)
- Diversion of lake inflows
- Linkage of river systems

Exploitation of aquatic plants and animals

Introduced plants and animals.

Climate and atmospheric changes.

- Global increases in temperature
- Decreases in the concentration of ozone in the stratosphere
- Acid rain

environment. To forget that human survival depends upon environmental health is a trap easily fallen into. Compensation can only be by education.

Environmental education, therefore, should be part of all curricula—primary, secondary and tertiary. Within schools, and with regard to the conservation and management of inland waters, curricula should:

- outline general ecological principles;
- emphasize the interdependent, causal relationships between land, inland water and the marine environment;
- develop students' abilities to observe, study and obtain and interpret data;
- indicate the importance of environmental conservation and management; and
- stress concepts of sustainability.

Activities to promote these educational aims include contact with local government officers, practical activities to improve (rehabilitate) local water bodies, monitoring nearby waters, simple 'research' projects, organization of and attendance at meetings, the holding of exhibitions, camps, excursions, field trips, etc. The list is limited only by the imagination and enthusiasm of teachers and students. Some organizations have addressed school environmental education with a view to increasing student awareness of the need to conserve and manage inland waters. Thus, ILEC has undertaken environmental

awareness programs in Argentina, Ghana and Denmark (Joergensen *et al.*, 1998). A less focused environmental programme—designed basically to foster community conservation of biodiversity but involving schoolchildren—was that funded by the Australian Government as an aid project to India (AusAid). It involved the local community in a small village, Mehli, a few kilometres north of Shimla, Himachal Pradesh, India. An outstanding feature of this small community was its receptiveness to and comprehension of ideas.

Within tertiary institutions, courses should build upon school curricula and above all be multi- and inter-disciplinary (Committee On Inland Aquatic Ecosystems *et al.*, 1996) Available courses should cover social, legal, ethical, economic and political issues as well as the more strictly environmental ones.

Environmental education should also extend beyond the time of formal education: getting information about the natural world in general and about the need to protect fresh waters in particular should be a lifelong preoccupation involving both the community (in getting the information) and those who can provide it (teachers, scientists, engineers, politicians, etc). Responsibility in this area is two-fold.

The answer to the question of where should the community be informed is self-evident from what has been written above: the home, the school and other educational establishments, the workplace, the wider community. This statement may seem like environmental zealotry, but how else can the global urgency to protect inland waters and the natural environment be conveyed to a public whose attention is increasingly suppressed by a plethora of diversions, to a public increasingly informed by local and immediate news only, the here and now?

HOW THE COMMUNITY CAN BE INFORMED

There are many ways for the community to obtain information about inland waters and impacts upon them. A modern, powerful source of information for those with access to a computer and telephone connection is the World Wide Web (Internet). Web searches immediately produce large amounts of information of local, national and international interest. Bear in mind, however, that much that is useful is not on the web, and much that is on the web is not useful! Table 2 provides a listing of the most important web addresses from which information can be obtained.

The web can also be used as a way of linking or connecting members of the community. Data can be exchanged, shared and spread, collaborative arrangements can be made, and mutual support groups can be developed. In this way, the web can facilitate two-way communication within the community.

More traditional sources of information include libraries, government and non-governmental organizations (GOs and NGOs), research centres, and, of course, individual teachers, lecturers, scientists and other professional persons. A simple expression of interest to an organization often elicits the regular receipt of newsletters, bulletins, magazines, fact sheets and update pages. Donations, if required, are usually small. Radio and TV programmes should not be forgotten as sources of information although less useful in this context (albeit powerful as a means of influencing the community).

WHAT THE COMMUNITY CAN DO

The community can be involved in the protection of inland waters at a variety of levels, ranging from the relatively inactive to the vigorously proactive. For example, the community can be involved:

- by influencing the attitudes of friends, family and associates;
- by conserving water in the home and garden;

Table 2. Some international sites (URLs) of interest for the conservation and management of inland waters

Global Environment Monitoring System (GEMS)	www.cciw.ca/gems
Global Water Partnership (GWP)	www.gwpforum.org
International Lake Environment Committee (ILEC)	www.ilec.or.jp
International Rivers Network	www.irn.org
International Association for Limnology (SIL)	www.limnology.org
International Water Management Institute	www.iwmi.org
LakeNet	www.worldlakes.org
Ramsar	www.ramsar.org
Stockholm International Water Institute	www.siwi.org
United Nations Environment Program	www.unep.or.jp
World Conservation Monitoring Centre	www.wcmc.org.uk
World Conservation Union (IUCN)	www.iucn.org
World Water Council	www.worldwatercouncil.org
Worldwide Fund for Nature (WWF)	www.panda.org

Note: URLs often change. Those listed above were correct as of June 2001.

- by obeying both the spirit as well as the letter of any law relating to the protection of inland waters (and making sure others do);
- by making a donation to an appropriate organization (or, perhaps, including it as a beneficiary in a will);
- by seeking information on the relevant policies of political parties, and voting appropriately;
- by writing to local politicians to make a view clear. Politicians know that one letter expressing an opinion is the opinion of 100 constituents (99 of whom have not written);
- by writing letters to newspapers on topical issues of interest and concern;
- by using other sorts of communication (TV, radio, the web) to communicate views;
- by writing articles for magazines (or books);
- by responding to government requests (advertisements) for public participation in consultative committees, steering groups or management boards;
- by joining or forming non-governmental organizations concerned to protect inland waters and by volunteering to serve as an executive member of such organizations;
- by monitoring the status of nearby water-bodies; and
- by being involved in local efforts and groups rehabilitating aquatic habitats. The Ramsar Convention has detailed guidelines on the involvement of local communities in wetland management, supported by case studies.

Grouping of community members with similar interests is often the first and most important step in developing proactive community involvement. Such community groups are diverse and vary from small, local groups, through larger national ones to international ones, from those with narrow to those with global aims, and from those designed to advise and implement government policy to those opposing and aiming to change government policy. There are many examples in Australia, a situation which can be repeated in most developed, if not developing, countries.

Many small local action groups (LAGs) exist throughout Australia with the aim of restoring or rehabilitating local wetland habitats. Many fall within the umbrella of a non-governmental national organization, Wetland Care Australia, whose overall aim is on-going, practical wetland management and rehabilitation. Both LAGs and Wetland Care Australia are supported by small government grants. Stream Watch is an Australia-wide consortium of local community groups which target the monitoring and restoration of streams. Of international community groups which focus upon the conservation and management of inland waters, note is made of the International Lakes Environment Committee (ILEC)

which hosts biennial conferences, publishes a journal (*Lake and Reservoirs: Research and Management*), newsletter and Guideline Books on Lake Management, and trains water managers from developing countries. The most recent conference hosted by ILEC (in Otsu, Japan, November 2001) stressed community participation in the conservation and management of lakes and reservoirs. LakeNet and Living Lakes are two other community groups with an international base.

With regard to Australian community groups set up to advise and implement government policy, note the River Management Boards now in place in most if not all states. Thus, the Barwon–Darling River Management Board in New South Wales was set up in the late 1990s to advise the state minister for water resources on how best to manage these rivers and implement a ‘cap’ on diversions of water from them. The board comprises representatives from several stakeholder groups (including irrigation farmers, conservationists and an ‘independent scientist’). Note also state Fisheries Research Advisory Boards. These comprise representative stakeholder groups (e.g. commercial and recreational fishers, conservationists) and, though exact terms of reference vary from state to state, are designed to provide advice to government and a national body (Fisheries Research and Development Corporation, FRDC) responsible for funding research on marine and inland waters.

Fewer community groups exist that are critical of government policies, and focused on issues concerning inland waters. Mostly, such groups have wider conservation interests. Several have arisen in direct response to particular local government actions. Thus, plans to permit housing development within the crater rims of scientifically important salt lakes in the Western District of Victoria immediately encountered protests from concerned individuals who have now banded together and mobilized scientific and other interests (S. and F. McCallum, personal communication, July 2001). Government responses have generally been marked by obfuscation and procrastination.

Although the development and support of community groups by governments, and the incorporation of community representation on government committees, has many benefits in principle (both to the community and the government), in practice there are also many difficulties. They are rarely addressed. They include:

- For government committees, how to select truly representative members of the community (not just the willing, articulate and those with vested interests), and how to ‘balance’ committee membership.
- How not to overwhelm government committee members with irrelevant information, so diverting attention from major issues.
- How to ensure that the on-ground work of community groups is effective.
- How to select between community groups seeking competitive government funding for projects, and how best to monitor funding.
- How to measure the extent to which advice and information from community groups to governments and water resource managers is accepted and acted upon.

No firm answers to these and similar questions can be given, though all are important. One step in their resolution, at least, is to be aware of their importance.

CASE STUDIES

Lake Washington

Lake Washington is a large freshwater lake in north-eastern Washington State, USA. It is at present 65 m deep and 65 km long. The city of Seattle developed on its shores in the nineteenth century and by 1922 there were 30 sewage outfalls into the lake. A major scheme to divert sewage was completed in 1936 but the continued expansion of Seattle and lakeshore communities meant that this scheme quickly became

overwhelmed. As a result, the condition of the lake deteriorated, with many of its uses and values threatened. By the 1950s, it was clear that unless something was done serious environmental problems would follow. In the event, a scheme to divert sewage to the sea (via Puget Sound) was proposed and after much debate, often acrimonious, was implemented. Diversion began in the 1960s and by 1967 all effluent formerly discharged into Lake Washington had been diverted. Conditions in the lake quickly improved. The important point of this case study is that it was public action and an informed public vote which ensured the success of the scheme. Scientists, particularly the late W.T. Edmondson, played an important supporting role (see, for example, Edmondson 1991).

Mono Lake

Mono Lake is a large, permanent salt lake located east of the Sierra mountains of California, USA. Before 1940, its area was more than 200 km² and its maximum depth 57 m. Its salinity was then about 50 g L⁻¹. It is important as a feeding and breeding site for migratory waterfowl, has an endemic brine shrimp, is of cultural value to the local Indian community, and is regarded by many as a lake of outstanding aesthetic appeal. In 1941, however, diversions of its freshwater inflows began and the level of the lake fell, its salinity rose, and many of its values were threatened or began to degrade. By 1980, the level of the lake had fallen 14 m and its salinity had risen to about 90 g L⁻¹. In response to these events, a small community group, the Mono Lake Committee, was formed and began to lobby the government to reverse the decision to divert inflows from the lake. After much effort and protracted debate the group was successful and a legal decision rescinded the right for inflows to be diverted. The important point of this account is that an active and committed community group, without government support, and indeed at times in the face of active government opposition, was able to bring about the conservation of the lake.

Aral Sea

The Aral Sea is a large salt lake in central Asia bounded by Uzbekistan and Kazakhstan. A closed lake, its inflows are the Syr and Amu Darya. Significant diversions of these rivers began in the 1960s and as a result the area and volume of the lake had decreased to about a third of pre-1960 values by 2000. Salinity during the same period rose from about 10 to more than 50 g L⁻¹. These changes led to the loss or significant degradation of the lake's uses and values, including the collapse of the commercial fishery and the disappearance of its conservation values. Furthermore, the lake could no longer serve as a local transport route and its cultural identity was lost. Because of the oppressive political climate which prevailed at the time, little community debate was tolerated and that which did take place was unwelcome and ineffective. In the event, the lake was lost as a natural entity, and the governments of Uzbekistan and Kazakhstan now agree that it is no longer economically feasible to restore it despite the many negative environmental features which have subsequently developed (including salinization, an increase in the frequency of dust storms, a more severe climate, and degradation in human health in the area). An important point to note here is that one of the conclusions of the Brundtland Report (World Commission on Environment and Development, 1987) was that sustainable development requires 'a political system that secures effective citizen participation in decision making'.

Lake Pedder

Lake Pedder was a small (about 9 km²), shallow freshwater lake in south-western Tasmania, Australia. It was regarded as a lake of outstanding aesthetic appeal, with its most scenic attraction being an eastern beach of pink-tinted fine-grained sand. Despite its beauty and location within a National Park, it was inundated (drowned) in the 1970s by the Tasmanian Hydro Electricity Commission (HEC) as part of plans to provide a huge water storage area (the Serpentine-Huon impoundment). The flooding sparked a large

community reaction within both Tasmania and continental Australia as a result of which the national government formed a Committee of Enquiry. Amongst the findings of this committee were that the government of Tasmania and its Hydro Electricity Commission (a government body) had withheld information from the public and had been unwilling to consider public viewpoints. Unfortunate as the loss of Lake Pedder was, it offered important lessons to the public and the Government of Tasmania and further plans to flood natural areas in the same region were abandoned in the face of huge community opposition. The relevant court case now forms an important legal precedent in environmental law in Australia.

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