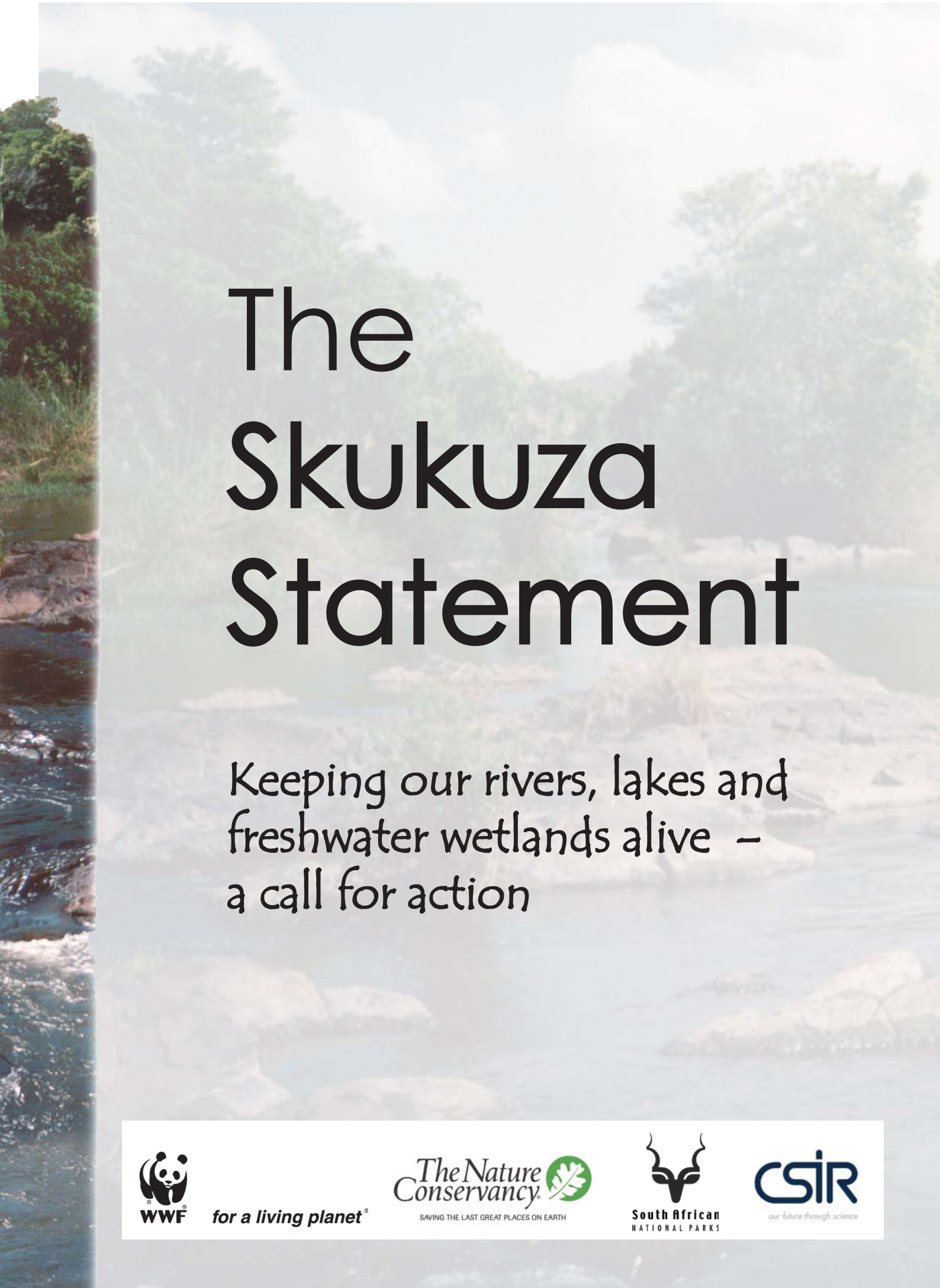


The Skukuza Statement

Keeping our rivers, lakes and freshwater wetlands alive – a call for action

WWF for a living planet®

The Nature Conservancy
SAVING THE LAST GREAT PLACES ON EARTH

South African National Parks

CSIR
our future through science

Who We Are

In October 2006, a symposium was held at Skukuza, Kruger National Park, South Africa, bringing together freshwater ecologists and conservation specialists from different parts of the world, to share their diverse experiences regarding the application and strengthening of protected areas to the conservation of freshwater ecosystems [1]. Thirty-three delegates, primarily from Australia, South Africa and the United States, discussed the current state of freshwater ecosystems, the impact of ecosystem degradation on human well-being, and the status and potential improvements to protected area design and management for securing the biodiversity and services of aquatic ecosystems. The participants decided to establish a permanent identity, the Skukuza Freshwater Group, so that the ideas presented during the week's proceedings could be followed up.

The Skukuza Freshwater Group has the mission to advance the agenda set out during the symposium [2]. This Statement presents an expression of the collective concern of the group about the general decline in the integrity, functionality and biological diversity of freshwater ecosystems and the roles and opportunities for protected areas in maintaining and improving the status of freshwater ecosystems.

If the decline in freshwater biodiversity is to be slowed or reversed, it will require our concern to be understood and shared by those without specialist knowledge or training in conservation sciences. The Statement therefore presents the arguments in non-specialist language, accessible to decision-makers, journalists, educators and the general public. It is intended to be a clarion call for urgent and responsible action.

The Skukuza Freshwater Group

[1] Throughout this document, "freshwater" is used as shorthand to describe the ecosystems of all inland waters. These include many water bodies that are in fact salty.

[2] Details of the Skukuza Symposium, including presentations and proposed follow-up actions, can be found at http://www.waternet.co.za/rivercons/.

The case in brief:

- Many of the world's rivers, lakes and freshwater wetlands are in poor or declining condition. Freshwater species are disappearing more rapidly than those in terrestrial or marine environments. Major threats to freshwater ecosystems include: alteration of natural water flow, nutrient and sediment patterns, introduction of alien species, the removal of riparian vegetation, direct habitat destruction, over-harvesting, disruption of connectivity among freshwater habitats, and destruction of wetlands.

- Reversing the decline in freshwater biodiversity should be a priority in itself: the vibrant web of aquatic life is as much part of our natural heritage as the more visible species on land. Healthy inland waters also provide essential goods and services to people, and are integral to the ecology of terrestrial, coastal and marine habitats. The practical consequences of their continued decline are wide-ranging and severe.

- Without urgent action to improve protection of freshwater ecosystems, their condition will deteriorate further, as the use and degradation of water resources become more intense. In some areas, climate change will create additional challenges which need to be addressed.

- Freshwater ecosystems are often overlooked in the design and management of parks and other areas dedicated to the protection of habitats and their wildlife. Both the borders of protected areas and the priorities of their conservation and management are generally focused on the needs of terrestrial species.

- New forms of protection are needed that account for the connectivity of freshwater ecosystems. The strong links between ecological processes and organisms in different parts of a river basin call for innovative solutions. A simple "fencing off" approach will rarely be adequate.

- Further decline in the condition of rivers, lakes and wetlands is not inevitable. Ensuring adequate flows to sustain freshwater life, protection activities targeting river stretches and wetlands of special importance to aquatic species, reducing land-based pressures such as deforestation and nutrient pollution, and protecting the world's remaining free-flowing rivers can all help safeguard freshwater biodiversity and the services it provides to people.

- Without sustainable use of water resources throughout society, from agricultural, mining and industrial interests to individual households, no conservation strategy for inland waters will be meaningful.

- Restoring freshwater ecosystems is compatible with the objectives of sustainable human development. It is often the poorest and most vulnerable people who suffer the greatest hardship when freshwater ecosystems degrade. Minimising the negative impact of human activities on the freshwater environment serves to improve social well-being.

1. Introduction

People throughout the world, since the earliest times, have lived around rivers and lakes. Many cultures revere rivers as givers of life and as the focus of spirituality. It is impossible to separate our dependence on freshwater ecosystems from the development of human societies.

In recent decades, rivers and their dependent ecosystems have been changed beyond recognition – whether through dams to generate electricity and provide water to irrigate cropland, the conversion of wetlands to other uses, or through dredging for navigation.

These changes have brought short-term prosperity to millions, but have come at a cost. The Millennium Ecosystem Assessment (MA) in 2005 found that of all types of habitat, freshwater ecosystems had the highest proportion of species under threat of extinction. According to the Living Planet Index developed by the Worldwide Fund for Nature (WWF), the populations of freshwater species fell on average by 50 per cent between 1970 and 2000, a sharper decline than that measured for terrestrial or marine habitats.

As the MA also showed, biodiversity underpins many services provided to us by ecosystems, so the rapid change in the biological functioning of rivers, lakes and wetlands raises serious concerns about their future ability to meet our needs. Clean water supplies, fish for food, flood control, recreation and wetland agriculture are threatened when freshwater environments become degraded.

Despite their strategic importance, the setting aside of national parks and other protected areas as havens for biodiversity has substantially failed many freshwater ecosystems. Protected areas generally encompass critical terrestrial habitats, but rarely protect an entire catchment. The health of a river and its wetlands are affected by many human activities in the upstream and downstream watershed, so parks often provide only limited protection for freshwater ecosystems within their borders.

Even accepting these limitations, protected area managers could do much more to conserve freshwater biodiversity. Conservation resources and management of parks usually concentrate on charismatic land animals and plants, rather than on less visible aquatic features that constitute an essential part of the larger landscape mosaic.

Addressing the massive challenge of biodiversity loss freshwater ecosystems requires a new way of thinking. We must better incorporate aquatic biodiversity in the design and management of protected areas, protect river flows and engage wider society in helping to reduce pressure on rivers and other inland waters, in the interests of social equity as well as conservation of our natural heritage.

The authors of this document have one overriding concern: that we should not collectively become passive bystanders as the freshwater ecosystems of the planet deteriorate. There is much that can and must be urgently done. The Skukuza Statement is intended to be a catalyst for positive changes that are within our reach.

2. Freshwater ecosystems – the case for special treatment

Basins are connected systems

There can be no more extreme example of the predicament of freshwater ecosystems than the disaster that severely degraded the Aral Sea. Once the fourth-largest lake on Earth, it was reduced to a poisonous remnant of its original extent, through the decision by the former Soviet Union to irrigate the Uzbek desert for cotton production and other crops. The health and livelihoods of hundreds of thousands of people living near the Aral Sea were compromised by activities hundreds of kilometres upstream, as the flows of the two rivers feeding it, the Amu Darya and Syr Darya, were drastically reduced by diversion projects. As nutrients and pesticides were added to the irrigated lands to boost production, pollution in the progressively-exposed seabed skyrocketed to lethal levels.

The near-collapse of the Aral ecosystem – sometimes described as the world's worst ecological catastrophe – illustrates the fundamental point about freshwater ecosystems. Rivers and their dependent water bodies connect ecological processes over long distances, so changes in one part of a catchment can influence all connected ecosystems and the people who depend on them.

There is also hope from the Aral story, with the northern part of the Sea slowly recovering some of its biological life with increased flows. Restoration efforts can succeed, but major human and financial costs can be avoided if such degradation is prevented from happening in the first place.

Long-distance connections within freshwater basins do not occur only in the direction of a river's flow. Many species of fish migrate between salt and fresh water – eels, for instance, require freshwater, estuarine and marine habitats to complete their life cycles. Migrating fish perform a vital function in transporting nutrients to ecosystems deep in the interior of continents. The overfishing of salmon in estuaries and at sea, the placement of dams that impede their upstream migration, or the destruction of freshwater spawning grounds can remove an important part of the diet of bears and other terrestrial animals.

Any successful strategy to reverse the decline in freshwater biodiversity must therefore recognise the importance of these connections in maintaining the biological functions of rivers, lakes and wetlands.

Satellite images of the Aral Sea from 1989 (top) and 2003 (bottom).
Source: NASA/USGS

Making protected areas work for freshwater ecosystems

Freshwater ecosystems present a special challenge in meeting globally-agreed targets for protection of biological diversity. For example the IUCN (World Conservation Union) World Parks Congress in 1992 recommended that at least ten per cent of each biome (type of habitat) should be included in a legally-protected area. This percentage is expressed as the land surface under protection, and does not account for the connectivity, flows or protection of essential catchments that each affects freshwater biodiversity.

The limitations of "fencing off"an area to protect biodiversity are not confined to freshwater ecosystems. Park borders often cover only a portion of the range of migrating land mammals and birds, and human pressures beyond the protected areas can jeopardize the conservation of wildlife populations within them.

Similarly, marine protected areas or ocean parks, a rapidly-expanding form of protection, target coastal or oceanic areas of special importance such as key spawning grounds or systems such as coral reefs. Such areas only partially protect marine biodiversity impacted by fishing practices or pollution in other regions linked by currents or migration of species – or indeed activities on land, in rivers and in estuaries.

In the case of freshwater ecosystems, effective protection demands a holistic approach to the management of entire river basins. The variety of species within rivers, lakes and wetlands will depend on factors as diverse as the quantity of sediment and nutrients, water temperature, the timing of annual floods and the variety of habitats used by organisms at different times of the year, such as the main river, floodplain wetlands, lakes and headwater streams. Changes to any of these features can have severe consequences for freshwater life, yet they are usually brought about by activities beyond the boundaries of protected areas.

Recognising these limitations, protected areas offer important opportunities for safeguarding freshwater biodiversity at a local scale. Within their areas of management, they can prevent over-harvesting of freshwater species, direct habitat destruction, riparian vegetation removal and negative impacts from a variety of land uses.

Even when protection is specifically focused on freshwater wildlife, conservation efforts can be wasted if they fail to protect the water source. For example, the Macquarie Marshes of Australia [see Box 1] in the Murray-Darling Basin have long been recognised as a vital haven for waterfowl and many other organisms, and have received strict legal protection as a Nature Reserve and through the Convention on Wetlands (also known as the Ramsar Convention). Yet because of the large-scale diversion of water for irrigation upstream, the marshes have been severely degraded, with catastrophic impacts on the diversity of wildlife. Human livelihoods have also been compromised with the reduction of suitable grazing land for cattle, which depend on the natural flooding of the marshes.

A prime example of the mismatch of freshwater needs and protected area design can be seen in Kruger National Park, South Africa, whose experience has played an important part in the genesis of this document (see Box 2 on pages 6 & 7). The creation of this vast wildlife reserve, roughly the size of Israel, showed remarkable vision on the part of its founders in the early 20th century. However, the north-south oriented park cuts across five separate river basins running from west to east.

The upstream portions of the Kruger Park's rivers flow through some of the most densely-populated areas of South Africa, serving the needs of more than 10 million people, and include areas dominated by mining, industry, irrigated agriculture and plantation forestry. The resultant quality and quantity of water reaching the park is largely beyond the direct control of its managers.

The active response of park authorities in Kruger to the deteriorating state of its rivers has shown that protected area managers can develop new strategies that better recognise the importance of freshwater biodiversity, as an integral part of the wider ecosystem. Conservation managers look "beyond the fence" and engage in wider society's decisions over upstream water-use that profoundly impact on the park.

Box 1.

The Macquarie Marshes of Australia

The Macquarie Marshes lie within the Murray-Darling Basin in south-eastern Australia and cover about 200,000 ha. They are one of the more complex and important wetland systems on the continent. They incorporate a nature reserve and two Ramsar sites (protected under the Convention on Wetlands), and a floodplain grazing industry. This internationally-recognised wetland is the most important site in Australia for breeding colonies of waterbirds (ibis, egrets, herons) in terms of frequency of breeding events, numbers of nests and variety of species. More than 70 different waterbird species have been recorded within the Marshes, including forty breeding species. The Marshes have extensive areas of floodplain eucalypts, reed beds and other aquatic plants that also support many species of amphibians, reptiles, native fish and invertebrates. Water resource development, the building of dams and abstraction of water for irrigation have reduced the area of the Marshes by at least 40-50%, affecting floodplain vegetation, waterbirds and their breeding, and other plants and animals. The abstraction of water has also reduced the frequency of flooding, estimated to have reduced the number of nests of colonial birds by about 100,000 every eleven years. Large areas of the floodplain eucalypt, river red gum, are now dying because of lack of water. The predicted effects of climate change, already reducing rainfall in southeastern Australia, will exacerbate the degradation.

Contrasting images of the Macquarie Marshes: the top photo shows part of the wetland in a healthy condition after floods in 2000; the bottom photo from November 2006 shows dying red gum trees, probably hundreds of years old, the result of diversions to irrigated agriculture upstream and prolonged drought.
Photographs: Richard Kingsford

Box 2.

Kruger National Park – attempts to address freshwater issues in a protected area

One of the largest and most famous protected areas in Africa, Kruger National Park sits in an area known as the Lowveld, between the steep escarpment descending from the great Southern Africa plateau and the international border with Mozambique to the East.

Established in 1926, the location of the park was determined primarily by a perception that the land was unsuitable for settlement or large-scale farming, due to its susceptibility to drought and a number of endemic human and livestock diseases.

The arbitrary selection of its borders has left Kruger with an enormous challenge in managing freshwater resources, as the map in this box illustrates. The upstream headwaters of all five of its major rivers lie well outside the park – in the case of the Olifants, for example, just 100km of its 840km length and 8% of its catchment area are contained within Kruger. An added complication is that in several places the rivers themselves form the park boundary, including the Crocodile River in the south and the Limpopo River in the north.

The quality and quantity of water entering the park are influenced by a wide range of upstream activities, notably commercial irrigation agriculture, plantation forestry, sewage treatment plants and mining. At least two million people now live within 50km of the western border of Kruger, largely as the result of the "homeland" policy of the apartheid government, in which large numbers were forcibly relocated.

The downstream uses of the rivers in Mozambique also have a significant impact – for example, raising the height of the Massingir dam on the Olifants River will flood a gorge that provides a critical breeding habitat for Nile crocodiles (see photo).

Crocodiles in the Olifants River gorge which will be flooded with the raising of a dam wall downstream in Mozambique. Photographs: SANParks.

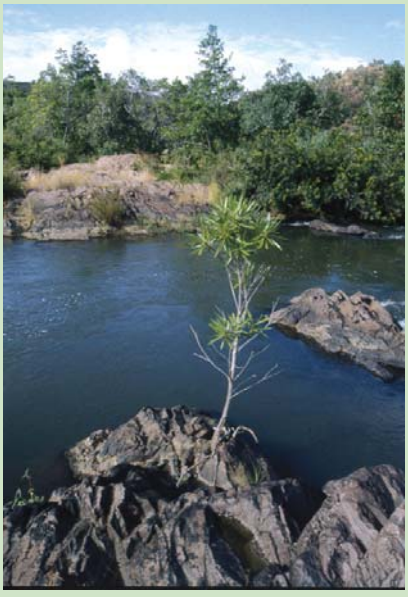
From the 1960s, the rivers of Kruger began to show signs of significant deterioration. Three of the five rivers changed from being perennial (flowing all year round) to becoming seasonal, dry for part of the year. The Crocodile and Olifants have suffered pollution from silt, heavy metals and other substances, and invasion from alien plant species such as water hyacinth. One sensitive fish species, *Opsaridium peringueyi* disappeared from the Olifants due to the worsening condition of the river system. It reappeared briefly after the 2000 floods.

During the 1970s, the main concern of the Kruger authorities was that reduced water flows would compromise the big game animals that provided the raison d'être of the park. In a programme called Water for Game, some 400 boreholes, dams, weirs and sluices were built within the park, aimed at supporting herbivore species during drought..This strategy assisted herbivores, but had other side-effects in the eco-system, and many of these waterholes have now been closed.

From 1988, a River Research Programme was initiated that would change the whole approach of Kruger's management. In the first place, the Lowveld began to be viewed not as a static, unchanging landscape but rather a dynamic system that depends on natural variation of elements such as surface water and fires to maintain its rich diversity and resilience.

This led to the introduction of a system known as strategic adaptive management – behind the rather opaque jargon lies a simple concept: work out what state you would like your rivers to be in (desired future state); identify warning signs that things are moving dangerously in the wrong direction (thresholds of potential concern); and when those signs appear, take corrective action to prevent the ecosystem going "over the cliff" into another state from which it may be difficult or impossible to recover.

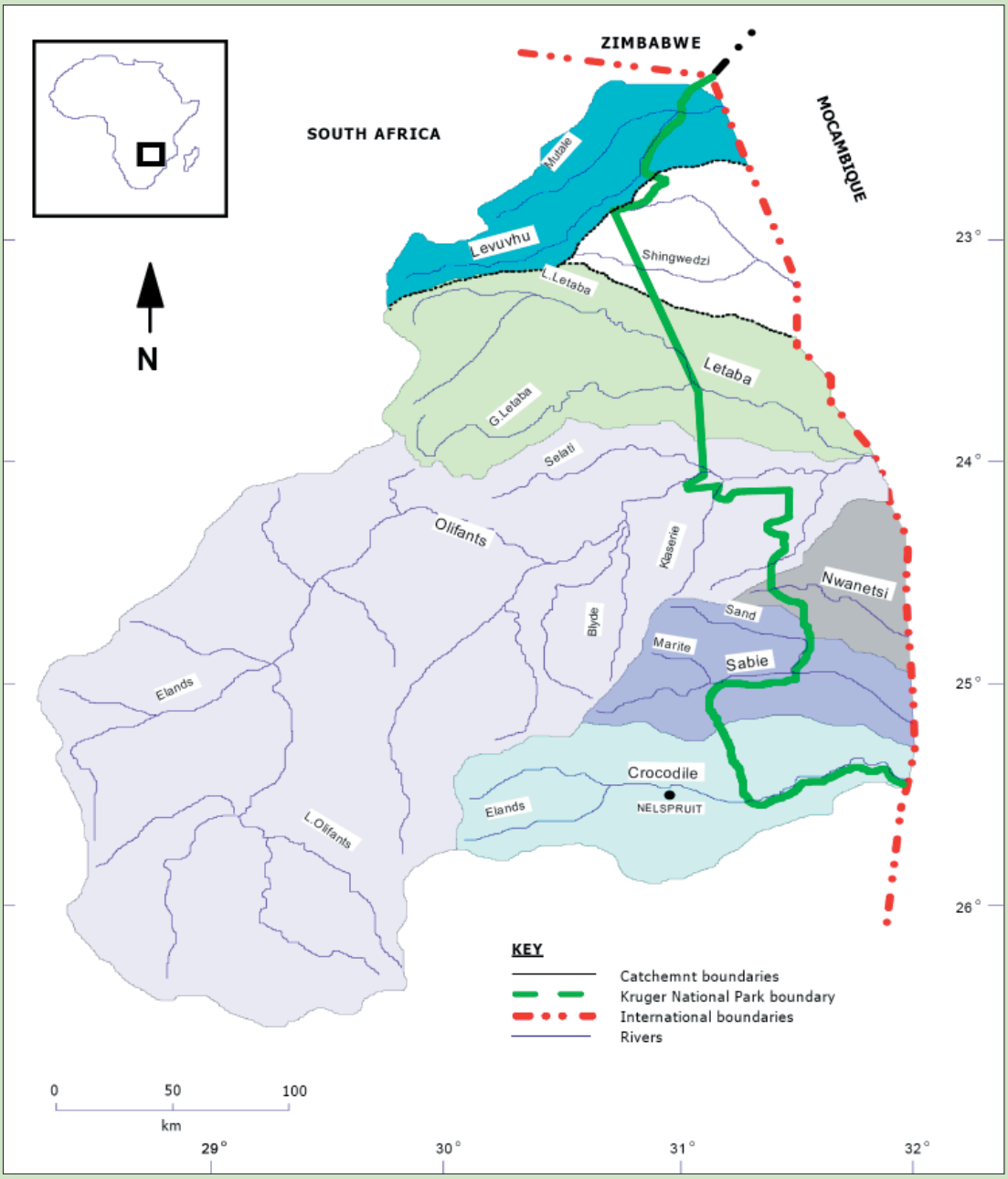
In Kruger, an example of these warning signs is the matumi tree, Breonadia salicina, which only grows on bare rock along the banks of the Sabie (see photo). It will not become established when the rocks become smothered in sand. Since over-sedimentation is a major threat to the diversity of fish and other aquatic life, the abundance of matumi trees acts as a proxy indicator of the overall health of the river. Conversely, their absence triggers concern that the river is on a path towards rapid decline in biodiversity.



The Matumi tree, a sensitive indicator of sediment levels in the Sabie River. Photographs: SANParks.

Coupled with this new approach has been an increasing involvement of Kruger staff with the management of the wider river catchments in which the park is situated. With the political changes following the end of apartheid, and the passing of the National Water Act in 1998 (see box 3 on page 8), it has become far more possible for park experts to influence upstream activities that have such a fundamental impact on the Kruger rivers. Among the concrete achievements of this engagement have been the release of additional water from dams to maintain flows during severe droughts, and the development of management plans to prevent highly-damaging surges of sediment associated with the flushing out of upstream reservoirs. The complete drying out of rivers has become a rarer occurrence, but one that has not been eliminated.

Kruger remains far from removing the threats to its freshwater biodiversity. However, it may provide a model for the many protected areas that occupy small sections of heavily- used river basins. Recognising the importance of rivers and wetlands to the wider ecosystem, detecting and reacting flexibly to adverse change, and engaging with the wider community in management of river basins are all crucial steps towards making the protected area system work for freshwater life.



Major river systems and associated catchments of the eastern escarpment, Lowveld and Kruger National Park, South Africa
Source: Pollard,S. and du Toit, D., Recognizing heterogeneity and variability as key characteristics of savannah systems: The use of Strategic Adaptive Management as an approach to river management within the Kruger National Park, South Africa, IUCN/SANparks 2005

Measuring protection of freshwater systems

It is difficult to know what percentage of rivers and wetlands are currently protected, and therefore what a target for freshwater protected areas might look like. Calculating the areas of rivers, lakes or wetlands under legal protection is possible, but it is much more difficult to quantify equally important factors such as how much of their flow is protected (both timing and magnitude), the threats surrounding a river and the impact of barriers within it.

Even a simplified approach of measuring just river length within protected areas is challenging. A recent study by the Australian National University found that less than seven per cent of the 2.8 million km of the country's streams and rivers lay within areas protected for wildlife (see map in Figure 1). At least half of the river length nominally under protection was threatened by some form of barrier such as a dam, or activities in unprotected headwater sections. When the rivers were divided into landscape, geology and vegetation categories, the study found that many were represented poorly or not at all in the protected area network. While existing parks provide important opportunities to conserve freshwater biodiversity in Australia, these data suggest the level of protection could be very much more comprehensive.

On a smaller scale, the level of protection of Jamaica's freshwater habitats was recently assessed by The Nature Conservancy (TNC). Of 17 ecosystem-types examined, only six reached IUCN's recommended threshold of 10% under legal protection – five had no protection at all. Even this understates the problem, as protected status does not guarantee that rivers remain free from the effects of barriers on the ecological connectivity essential to freshwater ecosystems, or from alien invasive species that do not respect park boundaries.

There are enormous gaps in the knowledge available to decision-makers on the adequacy of existing protection of freshwater wildlife, and how that protection can be improved. We must be committed to developing new tools that can improve that knowledge, but we cannot afford to wait before addressing the needs of our rivers, lakes and wetlands. There is much that can and must be done now.

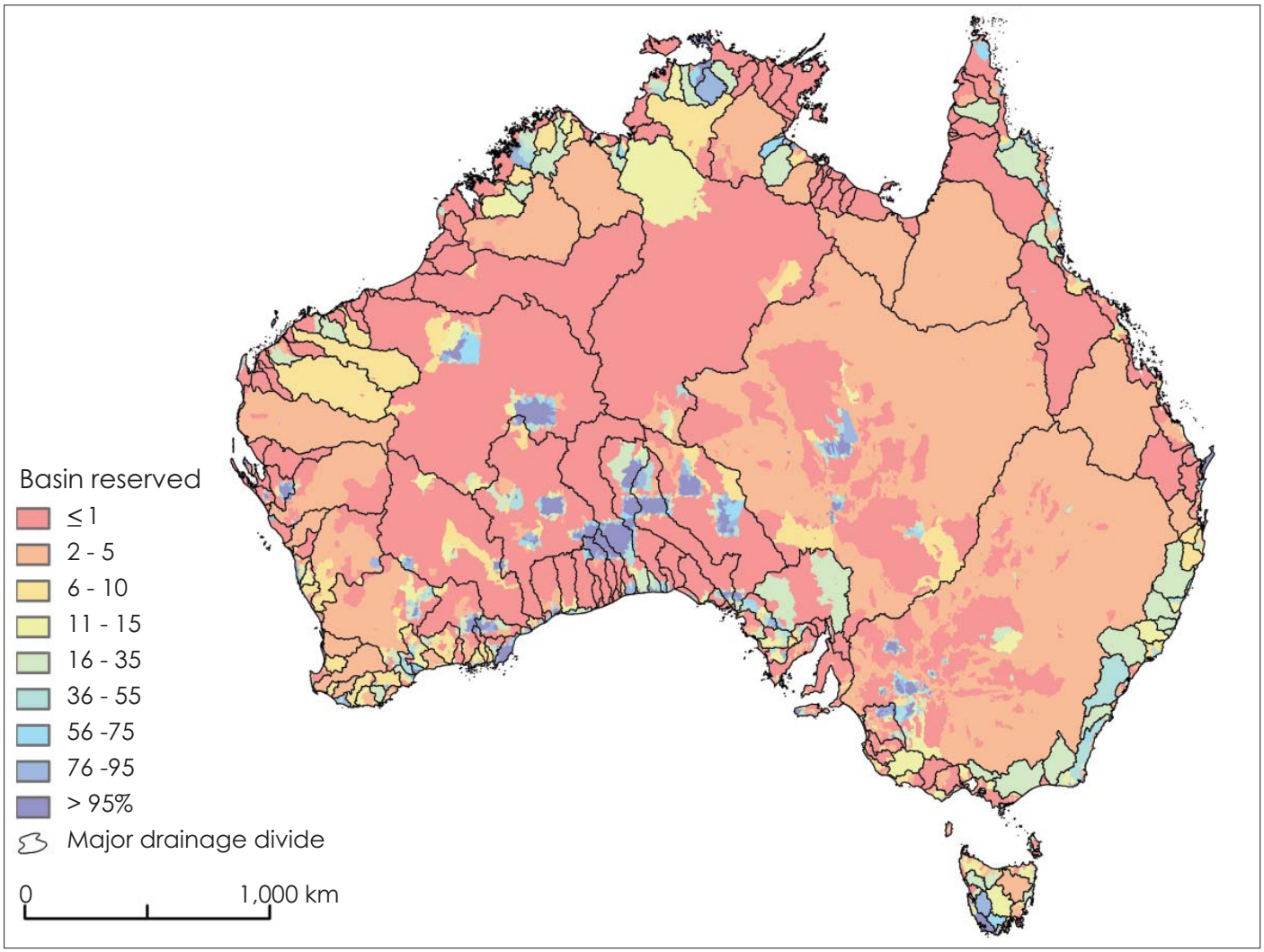


Figure 1. Proportion of Australian drainage basins included in protected areas (IUCN classes I - IV).
Source: Janet Stein, Australian National University, presentation to the Skukuza Symposium.

3. The key role of water flows

Natural flows are the key to the sustainability of freshwater ecosystems. Ecological degradation occurs when these are disrupted by water abstraction, the construction of barriers, artificial channels and transfers between basins.

The MA estimated that between 1960 and 2000, the amount of water abstracted from rivers and lakes doubled to supply agriculture, industry and households. The quantity of water held behind dams quadrupled in the same period, and there is now much more fresh water impounded in artificial reservoirs than there is in natural rivers.

In extreme cases, the amount of water left in rivers after all these demands has been so small that they cease to flow to the ocean – this has happened to the Nile, Indus and Colorado. These are the ultimate consequences of a dominant attitude on the part of many decision-makers, civil engineers, and irrigation specialists around the world, that water reaching the sea is water wasted.

An alternative view is fortunately gaining currency: that in the division of the finite flow of fresh water within a particular basin, the ecological needs of rivers, lakes and wetlands must be accounted for, alongside the demands of other "users". The concept of "environmental flows" has emerged, to define the quantity of water and other elements of the natural flow system required for the integrity of the freshwater environment.

This is not a competition between the needs of nature and people. Millions of people around the world depend directly on the biological functioning of rivers, lakes and wetlands for their livelihoods and security – indirectly, so do we all. Protecting river flows is a question of social equity, ensuring that some sections of society are not over-using the limited resource of fresh water at the expense of others – especially as it is the most vulnerable communities that are often most severely affected when freshwater life goes into decline.

The economic power of big water and energy users such as commercial agriculture, mining and industry make strong demands on governments. The demands grow ever greater as consumption of food, energy and consumer goods increases, and in many areas the long-term supply of water is threatened by climate change – especially in areas such as Sub-Saharan Africa where drier conditions are anticipated, and in regions dependent on meltwater from glaciers. In this squeeze, it is easy for the freshwater environment to be the loser.

Some governments recognise the needs of freshwater ecosystems in law in the allocation of water resources. In South Africa, the post-apartheid government passed its National Water Act in 1998, creating an "ecological reserve" for each river basin, calculated as the flow to maintain sustainably the natural functions for a river at a desired state [see Box 3 on this page]. This is in addition to a "human reserve" of water to meet basic human needs.

Box 3.

The National Water Act of South Africa

In 1998, the Republic of South Africa enacted legislation widely acknowledged to be one of the most sophisticated instruments in the world relating to freshwater resources. The National Water Act is based on the principles of sustainability and equity in the "protection, use, development, conservation, management and control of water resources." A key provision of the Act is the setting up of a reserve for each river catchment area in the country, that takes precedence over allocation of water to other uses. It is composed of a basic human needs reserve aimed at providing "the essential needs of individuals served by the water resource in question and includes water for drinking, for food preparation and for personal hygiene"; and an ecological reserve, defined as the flow and quality of water required to meet a set of ecological functions that corresponds to the desired state of the river. That desired state is determined by a range of stakeholders within each basin area, and can vary from maintaining a virtually pristine state to accepting a high level of use and modification, but in all cases must be judged to be sustainable. The responsibility for maintining the desired state is given to decentralized management bodies overseeing local water issues in each catchment. One impact of the Act is to enable representatives of protected areas to take part in these stakeholder discussions, in effect giving a voice to the freshwater environment alongside the various interest groups traditionally involved in water allocation decisions. The process of calculating the reserve for each river stretch in the whole country is still under way, and great challenges are foreseen in the implementation of the Act.

Passing such laws is much easier than putting them into practice, and it is already proving difficult to implement the environmental flows stipulated by the South African Act, in the face of intense and growing water competition.

This example of explicit legal recognition of the ecological requirements of river basins is still the exception, with most systems of water management still favouring dominant economic interests over the wider needs of nature and society. Despite the implementation challenges, such laws serve as a model for other countries.

Maintaining natural flow rhythms are necessary but clearly not sufficient for healthy functioning of freshwater ecosystems. Often, rivers and wetlands are degraded by pollution from sewage, industrial waste and the run-off of nutrients such as nitrogen and phosphorous from farmland, where they are used to fertilise crops. Soil erosion from deforestation, overgrazing, land-use change and poor agricultural practices can also choke river life, and alien fish, shellfish, and plant species have often had a devastating impact on native wildlife.

Improving the state of our freshwater ecosystems requires concerted efforts to safeguard the quantity and quality of the water flowing through them, applying integrated management to river basins that frequently cross administrative and national boundaries. While there are rarely easy or painless answers in the choices on how to manage freshwater resources, continuing to make compartmentalized decisions based on the demands of individual sectors or interests will ensure that in the long run, everyone loses.

4. Recognizing the wider values of freshwater ecosystems

Reversing the current alarming decline in freshwater biodiversity will require the engagement of wider society. This involves greater recognition of the common interest between the protection of freshwater species and the overall needs of human communities. The link comes in the ecosystem services provided by rivers, lakes and wetlands, and the contribution they make to human well-being.

A striking example was the disastrous impact of Hurricanes Katrina and Rita on the Mississippi Delta region in the United States in 2005. Many low-lying human communities were exposed to the full force of the winds and storm surges because the cypress swamps that had served as a natural barrier to extreme weather from the Gulf of Mexico were destroyed. These wetlands relied on the seasonal deposition of sediments from the Mississippi River, disrupted over many decades by the hard levees that failed to contain the violent force of the hurricanes.

Fish market at Zhangdu Lake, Hubei Province, China. Provision of food is a vital service of freshwater ecosystems, especially for the poor.
Photographs: WWF-Canon / Yifei ZHANG

A critical ecosystem service provided by the wetlands and their biodiversity was protection from natural disasters. Arguments before the 2005 hurricanes for wetland restoration as a cost-effective investment were ignored by the public authorities, a decision that now seems a very expensive miscalculation.

The MA identified nine separate ecosystem services provided by inland waters, each of which can be compromised if rivers and wetlands become degraded or disconnected:

- Provision of fresh water, relies in the long term on protection of the natural functions of rivers and wetlands. Over-abstraction now places future supplies under threat.
- Provision of food in the form of fish and other aquatic life as a principal source of nourishment is a hugely important function of freshwater ecosystems, especially for the rural poor . Wetlands can also provide vital land for subsistence agriculture in dry areas.
- Pollution control is provided by wetlands that can filter contaminants and avoid the need for expensive water treatment facilities.
- Nutrient cycling is an important function of wetlands, where elements such as nitrogen and phosphorous are recycled from waste products back into forms that provide nourishment for plants and crops.

- Flood regulation is enhanced when wetlands are left to act as natural overflow areas for river basins. Some of the worst flooding is caused when floodplains have been built on or drained for agriculture, and rivers confined to narrow artificial channels that cannot contain the volume of water following intense rains.
- Sediment retention and transport is an essential service of rivers and wetlands that can be disrupted by destruction of riverside forests, degradation of wetlands and construction of barriers such as dams. The consequences can be blocked rivers, fish kills and damage to coastal environments.
- Disease regulation is a service of freshwater ecosystems that is generally noticed only when they are damaged: excess nutrients, for example, can cause toxic algae to form, and the creation of artificial water bodies behind some big dams has increased diseases such as schistosomiasis.
- Recreation and ecotourism provide important sources of income, as well as health and other less tangible benefits, to riverside and lakeside communities. These services are especially vulnerable to degradation of the ecosystem.
- Aesthetic values arise from the general appeal of rivers and lakes as desirable places to live and visit. Reduced flows, stinking sewage pollution or a channel choked by invasive weeds all detract from this value.

These services are often taken for granted, but they require investment in the natural infrastructure of freshwater ecosystems. The cost of replacement is much greater than that of protection– an important element of which involves conserving freshwater biodiversity.

To achieve the political and economic backing for conservation efforts, the many benefits of healthy freshwater bodies must be clearly identified and promoted – only then will they be valued by society alongside the immediate gains from using their resources for maximum short-term profit.

5. Addressing the challenge – a suggested action plan

There is no silver bullet that will remove the threat to the biodiversity of our freshwater ecosystems. The threat itself is an insidious one, with each successive change often going barely noticed, until one returns to a favourite bathing pool or wetland meadow from childhood, and the long-term degradation becomes suddenly obvious. Solutions will require patience and persistence.

As professional freshwater conservation biologists, we believe key steps can help provide effective protection of the variety of life in rivers, lakes and wetlands. They all hinge on better awareness of a crisis going on beneath the surface, sometimes invisible but often all-too-evident, and the development of better tools to address the peculiar needs of freshwater ecosystems.

a. Broadening conservation priorities.

While existing national parks and protected areas have limitations in dealing with freshwater biodiversity, much can be done to improve the state of rivers, lakes and wetlands within their boundaries. Park managers need to focus on the processes, often at the basin level, that determine the ecosystem health of their rivers and wetlands. The Skukuza Freshwater Group is developing a set of guidelines and management tools to help protected area staff strategically manage the freshwater habitats within their areas, and develop a hierarchy of objectives for future action. An essential element of these plans will be the continuous assessment and monitoring of objectives that may require further management intervention. This is vital, because ecosystems are complex and are constantly changing, both through natural variations and through human impacts such as climate change. Managers will often need to engage in wider decisions on river basin use outside their parks, in order to meet the objectives they have set for freshwater biodiversity within their borders.

b. Redefining freshwater protected areas.

To help address some of the gaps in current protection of freshwater habitats, a new, flexible approach should be developed that recognizes the specific challenges of protecting rivers and wetlands, while accepting the reality of the widespread presence of human settlements in most catchments. This will require identification of key features of the ecosystem whose protection can help conserve its overall diversity and the services it provides. A mosaic of different uses can then be developed, including: comprehensive protection of the most important areas such as breeding grounds for key species; restrictions on the use of land in the most important headwaters of the river catchment; the designation of areas of limited human use such as fishery reserves that allow the needs of local livelihoods to be met without imposing undue pressures on the ecosystem; and rules that can reasonably be applied to entire basins without unduly limiting economic activity, such as the protection of riparian forests. A schematic map showing the way in which this might work is shown in Figure 2.

c. Celebrating and protecting free-flowing rivers.

WWF has estimated that of the world's 177 large rivers, only a third remained free from significant barriers to their flow such as dams. Only 21 rivers longer than 1000km flow uninterrupted from source to mouth. Because of the importance of connectivity in the ecological processes of river basins, these remaining free-flowing rivers represent vital assets in the protection of global freshwater biodiversity and ecosystem services. The Skukuza Freshwater Group is drawing up criteria for governments to register and celebrate their free-flowing rivers, bringing together a global network that recognizes their collective importance to maintaining the variety of life on Earth. This should not detract from measures to improve the condition of river basins that have already undergone significant changes.

d. Improving long-term accountability for water decisions.

When proposals are made for changes to freshwater ecosystems – such as dams, diversions or inter-basin transfers – it is essential to have a full assessment of the social and ecological costs. This must include the cost of rehabilitation of damaged ecosystems, which can be very high indeed. Decision-makers responsible for approving such projects must be fully accountable for their long-term impacts.

1. National Park / Wildlife Reserve
2. Wild / Heritage River
3. Private Protected Area / Conservancy
4. Ramsar Wetland
5. Wetland protection zoning
6. Fisheries / Aquatic Reserve
7. Urban Land Use Zoning
8. Community Conserved Area
9. Water Supply Catchment
10. Aquifer Recharge Area
11. Marine Park / Reserve
12. Certified Forest Area
13. Environmental flow
14. Floodplain / Riparian Reserve

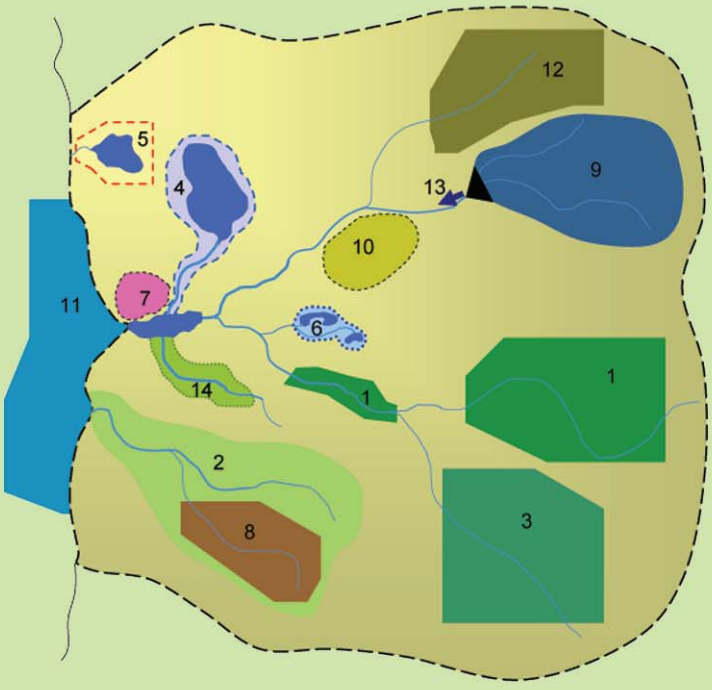


Figure 2. A suggested schematic model for different forms of protection within a typical river basin.
Source: Skukuza Freshwater Group, work in progress.

Conclusion

Beyond these specific steps, protecting the wealth of freshwater life involves new thinking at every level of society, from the biggest corporations to individual citizens. Ultimately we have to decide what it is we collectively value about rivers, lakes and wetlands, and what has always drawn us to them for sustenance, enjoyment and spiritual inspiration. If we want to continue getting those benefits, we must learn to use the resources of these ecosystems – and especially water itself – much more prudently. We have taken for granted the enormous benefits freshwater life has given us. If we are not careful, we will only recognise its true value once it has been lost.

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