The Status and Distribution of Freshwater Biodiversity in Southern Africa

Trapa natans L. © William Darwall

Southern Africa's wetlands are amongst the most diverse both physically and biologically of any in the world.

Of the 1,285 species assessed at the regional scale, just over 7% are regionally threatened. When compared with the global level of threat to those taxonomic groups which have been comprehensively assessed (e.g. birds, 12% threatened; amphibians 32% threatened; mammals, 23% threatened), this figure appears relatively low. This relatively low level of threat is most likely a reflection of the current low level of development throughout the region. The exception is South Africa where development has been more extensive and this is reflected in the higher numbers of threatened species in the country With extensive plans for the development of southern Africa’s water resources over the next few decades, however, the situation could change dramatically unless impacts to freshwater species are considered during the development planning phases for these projects.

Key findings:

- The inland waters of southern Africa support a high diversity of aquatic species with high levels of endemism. Many of these species provide direct (e.g. fisheries) and indirect (e.g. water purification) benefits to people. The conservation of these species is most important to the livelihoods and economies of the regions' people.

- Current levels of threat across the region are relatively low with 7% of species threatened. However, predicted future levels of threat, in particular due to development of water resources, are very high. The level of threat to species in South Africa is higher than in other countries. Steps will need to be taken to minimize or mitigate for predicted impacts to the regions' freshwater species.

- Data on the distributions, conservation status, and ecology of all 762 known species of fishes, molluscs, odonates, crabs, and 517 selected species of aquatic plants are now freely available through this project and the IUCN Red List website to inform conservation and development planners.

- The current network of protected areas is not designed for protection of freshwater species with many falling outside of any protected area. Future protected areas must be designed for the effective conservation of freshwater species.

- The data made available through this assessment must be integrated within the decision-making processes in planning for the conservation and development of inland water resources. Lack of available information should no longer be given as a reason for inadequate consideration for development impacts to freshwater species.

- Species information remains very limited for many parts of the region with Angola and Mozambique, in particular, identified as priorities for future field survey. Information on the status and distribution of aquatic plants needs to be greatly improved throughout the region.

Major threats to freshwater species in southern Africa.

Loss and degradation of habitat is the leading threat followed by water pollution and alien invasive species.

The Olifants and Berg river systems, both in the Western Cape area, support the highest numbers of regionally threatened species.

The Olifants river system: The main threat to fishes is the introduction of invasive alien fishes. The introduction of Smallmouth Bass (*Micropterus dolomieu*) in the 1930s for angling purposes is regarded as a major threat, with predatory impacts also from Bluegill Sunfishes

(*Lepomis macrochirus*) and Rainbow Trout (*Oncorhynchus mykiss*). Tilapia sparrmanii has also been introduced and is reported to compete with native species for food. In another case, *Sandelia capensis*, a species widespread throughout the Western Cape, was introduced to the Olifants River System, where it is not native, via a local farmer in a misguided attempt to use an "indigenous" fish for mosquito control. It is now common and widespread in the Suurvlei River where it competes with *Barbus erubescens*, a native species, for food and it possibly also predates on juveniles. In another case where a native species has been introduced to an area outside its normal range, *Labeobarbus capensis* has been introduced above three waterfall barriers into the upper and middle Twee River by the Cape Department of Nature Conservation in an attempt to create a sanctuary for an indigenous fish. It is thought that this has had a negative impact on populations of *B. erubescens* above the falls. As a final example, *Pseudobarbus phlegethon* has gone extinct in the Jan Dissels River, a major tributary of the Olifants River, and is no longer found in mainstream areas where it probably occurred before the introduction of alien fishes.

Habitat degradation is another substantial threat to fishes as the Olifants catchment and some tributaries are the focus for intensive citrus, deciduous fruit and vineyard development. The major problem is over-abstraction of water during the dry summer months and the planting of orchards within the 1:1 yr floodline of the river. The absence of a natural riparian zone, and hence buffer area between the river and intensive agriculture, allows fertilisers and copper-based pesticides easy access to the aquatic environment. Two large instream dams (Clanwilliam and Bulshoek) act as barriers to fish migration, and rivers are over-abstracted to fill hundreds of smaller farm dams. Instream dams prevent adults of migrating Labeo seeberi from reaching spawning grounds. The lower reaches of many tributaries have been bulldozed and canalised for flood protection purposes. The excess use of fertilisers and pesticides (many copper based) also poses a substantial threat to indigenous fishes.

The main threats to plants include the drying up of wetland areas, such as small ponds, marshlands and temporary pools, in association with urbanisation. For example, four of the twelve recorded locations of *Aponogeton angustifrons* have been lost due to urbanisation of Cape Town and Stellenbosch over the past 120 years. These wetland areas are also suffering from increased ploughing for conversion to agriculture, in particular for wheat. This is a major past and future threat to *Romulea aquatica* which lives in vernal pools completely surrounded by wheat fields. The farmers are largely unaware of the biodiversity within the pools that are being degraded by conversion, by infilling, and through trampling by large numbers of stock. In the case of Moraea stagnalis the main threat is from land conversion for production of Rooibos tea. *Oxalis uliginosa* is a restricted range plant species threatened by loss of habitat through dam construction where the habitat is completely lost when areas are inundated. As in the case of fish, there is a significant threat to many restricted range species from invasive alien species.

Dragonflies are also suffering due to over-extraction of water leading to loss of habitat. The streams in the Ceres area (where *Metacnemis angustata* was recorded in 1920) have been radically transformed and some no longer flow at all due to over-extraction of water for the

fruit industry. Other threats come from shading of the habitat by alien invasive trees, such as *Acacia* spp., and loss of habitat through damming of streams. Alien fishes, especially rainbow trout, may also be a threat due to their predation of dragonfly larvae.

The Berg river system: The main threats to the two threatened fish species, *Barbus andrewi* and *Pseudobarbus burgi* are once again invasive alien fishes and habitat degradation, with experts agreeing that the predatory impacts of smallmouth bass (*Micropterus dolomieu*) are the most significant factor driving *B. andrewi* to local extripation from the Berg. Bass (*Micropterus* spp.) dominate preferred *Barbus andrewi* habitat and have effectively halted their recruitment. Over-abstraction of water and pollution have largely reduced the river catchment to a haven for other alien fish species such as *Cyprinus carpio* and *Oreochromis mossambicus* both of which are competitors to *Barbus andrewi*. The main threat to *Pseudobarbus burgi*, endemic to the Berg River system, is *Micropterus dolomieu* which has reduced the species to isolated populations in upper reaches of tributary streams. The Rainbow trout (*Oncorhynchus mykiss*) has a further impact higher up in some of the tributary streams where they are able to survive due to colder temperatures. The relatively recent introductions of another alien species, *Clarias gariepinus*, will need to be monitored for their potential impact.

As in the Olifants, the main threats to the two threatened odonates, *Ecchlorolestes peringueyi* and *Ceratogomphus triceraticus* include alien invasive trees (pines and *Acacia longifolia*) which shade the habitat and alien invasive rainbow trout which are thought to predate on the larvae. The former threat of habitat removal (mostly for plantation forestry) has largely subsided although *C. triceraticus* is still threatened by loss of habitat to the wine industry and, to a lesser extent, cattle farming and plantation forestry. Over-extraction of water from streams and possibly pollution from the wine industry are increasing threats.

As in the Olifants system the main threats to plants include the drying up of wetland areas, such as small ponds, marshlands and temporary pools, in association with urbanisation and increased ploughing for conversion to agriculture, in particular for wheat. This is again a major past and future threat to *Romulea aquatica* which lives in vernal pools completely surrounded by wheat fields. Livestock grazing and trampling, especially by cattle and horses, has likely led to the loss of *Cadiscus aquaticus* from many of its historic localities. Infilling of wetlands, mechanical damage by heavy machinery, and invasion by alien grasses caused by dumping of cattle feed in dry pools during summer are also significant threats. Eutrophication resulting from run-off of fertilizers used on surrounding ploughed lands is also a problem. One population of *Cotula vulgaris* is known to be under threat due to groundwater pumping.

Conclusions and Recommendations

Southern Africa has been shown here to support a high diversity of freshwater species of which a significant proportion is threatened. The level of threat to the associated habitats is further demonstrated through an assessment of South Africa's rivers which found 82% threatened with 44% assessed as critically endangered. Without management intervention it

is therefore expected that the overall status of southern Africa's freshwater biodiversity will worsen as development pressures on natural resources increase. Indications from other more developed parts of the world are that the impact on freshwater ecosystems and their associated biodiversity will increase as development proceeds. In the Mediterranean basin, for example, the level of threat to freshwater species is extremely high (e.g. 59% of endemic freshwater fishes are assessed as globally threatened or extinct), mainly due to pressures induced by activities such as high levels of water extraction, pollution and alien species – all of which are associated with more developed countries.

As the southern Africa region moves forward and develops its water resources to improve access to potable drinking water and sanitation, and to provide greater production of food and power (hydropower), careful planning on the basis of reliable biodiversity information sets such as those provided here is essential if the impacts on freshwater biodiversity are to be minimised. Adequate account must be taken of the ecological requirements of freshwater species if we are to prevent their loss and the loss or degradation of the many benefits provided by wetland ecosystems. A major tool available for the protection of freshwater biodiversity is the Protected Area. However, it is clear that the current network of Protected Areas in southern Africa is in the large part not designed to target freshwater species such that any protection provided is largely incidental. The design of Protected Areas must move forward to take account of the high degree of connectivity within freshwater ecosystems. In particular, upper catchment areas should be protected to minimise downstream impacts of activities such as deforestation or excessive water withdrawal. The flow of water in wetland systems must be maintained at sufficient levels and cycles to maintain ecosystems functions in wetlands.