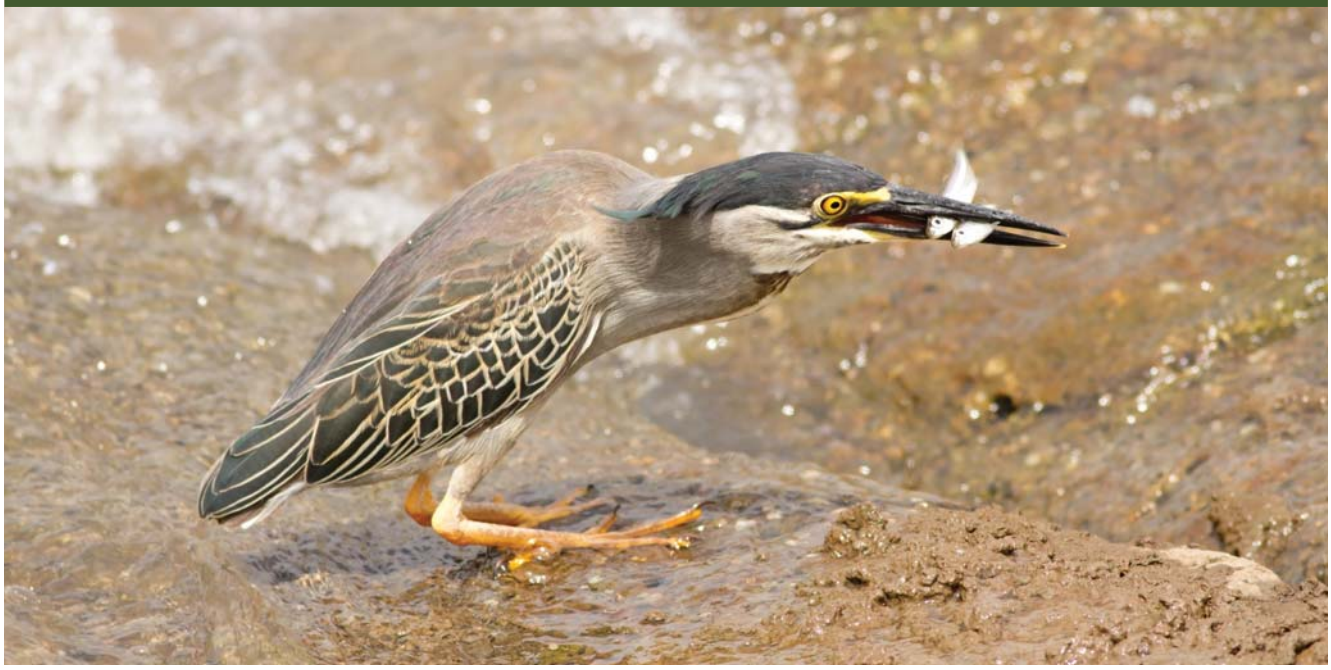
# Capacity development

## Have our provincial aquatic scientists become critically endangered?

*Conservation agencies play a vital role in the conservation management of natural terrestrial and aquatic resources at a provincial level. What is the role of aquatic scientists and technicians in this important task, and do we face a capacity crisis at present?*

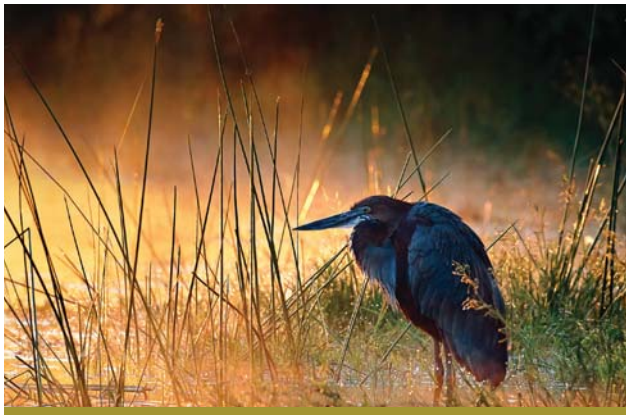
*Article by Dean Impson.*



South Africa is a country blessed with extraordinary levels of biodiversity (ranked third in the world) and is the only country to have one of the world's six floral kingdoms (Cape Floral) contained entirely within its borders. There are also a wide variety of inland aquatic ecosystems present, including seven of the world's freshwater eco-regions; namely the Cape Fold, Karoo, Western Orange, Amatolo-Winterberg highlands, Drakensberg-Maluti highlands, Southern Temperate Highveld and Zambesian Lowveld.

These ecoregions are characterised by a wide range of river ecosystem types and wetland groups. The national Atlas of freshwater ecosystem priority areas (FEPA) produced in 2011, identified 223 river ecosystem types in South Africa as well as 133 wetland groups. Housed within these ecosystems are an amazing diversity of aquatic animals and plants that are dependent on ecologically healthy inland waters for their survival. Many animal and plant species are restricted to certain aquatic eco-regions, and these reach their highest level of endemicity within the Cape Fold Eco-region. According to an excellent analysis of this area by Drs Ferdy de Moor and Jenny Day, an incredible 92% of some aquatic insect groups (e.g. Plecoptera), 86% of freshwater fishes, 86% of hydrophilic vascular plants and 69% of frogs are found nowhere else.

However, unlike many other nations that are rich in biodiversity (e.g. Brazil, Indonesia), South Africa is not blessed with abundant water resources. This is highlighted in the 2016 WWF-SA report, ***Water: Facts and Futures. Rethinking South Africa's Water Future***. For example, South's Africa's average rainfall of 490 mm/year is half the world's average and is highly seasonal and variable. The average rate of evapotranspiration is very high – almost three times the value of our average rainfall, at 1 800 mm.



*South Africa's unique wildlife associated with its aquatic ecosystems are being threatened by the lack of provincial conservation personnel to look after them.*

*Only one agency comes close to the minimum number of staff required, while two provinces have half the suggested minimum requirement and other provinces have few or no aquatic staff.*

Many rivers are over-abstracted for agriculture, and several naturally perennial rivers are now seasonal. In fact, approximately 98% of our surface runoff is already allocated to users. The little water that is left in rivers is frequently in a poor state due to the effects of poor land-use practices and malfunctioning wastewater treatment plants.

Over half of South African rivers are classed as threatened, with 26% regarded as critically endangered, i.e. largely unable to perform essential ecological services. The condition of wetlands is even worse. Wetland ecosystems comprise only 2.4% of our land-surface area, and yet they perform vital ecological services to society. Here, a shocking 48% of wetlands are regarded as critically endangered.

Many of these wetlands have lost most of their capacity to generate and purify waters and assist with flood attenuation services. The effects of habitat degradation are compounded by the impacts of invasive alien species in catchment areas, in riparian zones, in rivers, and in or adjacent to wetlands. Alien plants are water thirsty and cause wetland and river bank degradation. The loss of water through alien plants is severe (estimated at 1.44 billion $m^3$/year) and is a major threat to South Africa's water security.

This is fortunately being addressed countrywide by the massive alien plant clearing efforts of the Working for Water section of the Department of Environmental Affairs' (DEA's) Natural Resource Management Programmes. Invasive alien fishes also have severe impacts on inland waters, including water quality impairment (e.g. carp) and loss of biodiversity through predation and competition (e.g. bass and trout). The impacts of alien fishes are most severely felt in the Cape Fold Ecoregion and are the prime reason why the majority of endemic fishes there are threatened.

Given this backdrop, it would make sense for South Africa to make the management of aquatic ecosystems a national priority, with a strong regional aquatic capacity in conservation agencies. But is this the case?

**Role of aquatic scientists and technicians in provincial conservation agencies**

Rivers and wetlands that provide high-quality ecological services (provision of abundant uncontaminated water, flood attenuation, fisheries, biodiversity, eco-tourism) are generally those that are in a good to excellent ecological condition. Every province in South Africa is very dependent on such ecosystems for water security, but all are also water stressed (especially at present with the ongoing droughts).

Hence this vital ecological infrastructure needs to be effectively managed at provincial level by appropriate agencies and appropriate staff experienced in the management of rivers and wetlands.

The ecological management of rivers and wetlands is primarily the responsibility of the DEA and its provincial departments and agencies. It is true that the Department of Water and Sanitation (DWS) also plays an important role here through its Resource Protection section, but their mandate differs from that of the DEA.

So what then is the role of an aquatic section in a provincial conservation agency? The functions of this group include the following:

- Monitoring aquatic biodiversity, focusing on threatened species. Most aquatic sections have a particular focus on FEPA's, including Critical Biodiversity Areas for fish that have been identified in the national Atlas.
- Monitoring the ecological condition of rivers and wetlands using nationally approved indices (e.g. those development for the River Eco-status Monitoring Programme). This should be done in conjunction with the Resource Protection section of DWS. The choice of monitoring sites on rivers and wetlands should include rehabilitated areas where Working for Water and Working for Wetlands have been active.
- Land-use advice for proposed developments near rivers and wetlands (e.g. proposed dams, fish farming, housing developments) that trigger Listed Activities.
- Provide scientific input to the conservation management section of the agency. This section manages the Protected Area network, which in many provinces is a vital source area for water provision (consider the Hottentots Holland Nature Reserve, managed by CapeNature that provides arguably most of the run-off to Theewaterskloof Dam and the Ukhathlamba-Drakensberg Park, managed by Ezemvelo Wildlife that provides southern KwaZulu-Natal with most of its water). It has been estimated that 8% of our land-surface (generally declared mountain catchments) provide 50% of South Africa's water.
- Recommendations regarding regulatory requirements e.g. permits to stock fish, permits to start fish farms, permits to use Alien Invasive Species.

- Identify research needs for inland waters and their biodiversity
- Guidance regarding conservation planning, as this has to include aquatic priorities for planning.
- Provide scientific information, based on monitoring work and expertise, to assist in the compilation of National Biodiversity Assessment reports, Alien Species Management reports, and State of River reports, amongst others.
- Advice to the public regarding aquatic issues. Many queries are about angling and associated issues as angling is a very popular outdoor activity in South Africa. Furthermore, inland fisheries play a vital role in recreation as well for subsistence purposes. The Department of Agriculture, Forestry and Fisheries (DAFF) is the logical department to drive the fisheries mandate, but currently has not yet developed inland fisheries capacity.
- Network with other stakeholders involved in inland water management in terms of scientific information exchange (scientific agencies e.g. CSIR; funders e.g. Water Research Commission (WRC), WWF-SA, EWT; government agencies e.g. DWS, DAFF, South African National Parks; water user associations e.g. catchment management agencies and public groups such as the angling sectors).
- Ensure that aquatic science is integrated into conservation work by using readily available scientific products (WRC reports, scientific literature), platforms (annual South Africa Society of Aquatic Scientists conference) and networks (e.g. with South African Institute for Aquatic Biodiversity).
- Synthesise information from the ever-growing body of scientific evidence in support of evidence-based decision making
- Scan the 'knowledge horizon' to alert their agencies of emerging threats and opportunities
- Solicit, steer and conduct relevant research to provide the necessary evidence base for evolving social-ecological issues

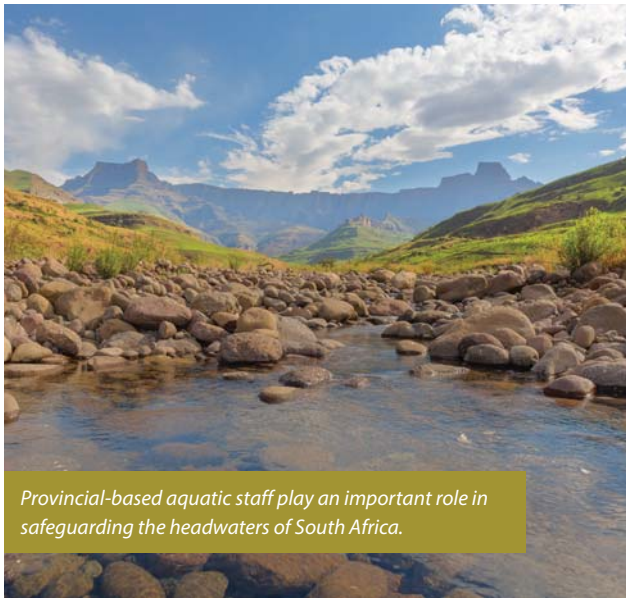
From the above, it seems obvious that provincial conservation agencies needs a competent aquatic section. So then what should a minimum capacity be at such an agency?

**Proposed capacity for an aquatic component at a provincial conservation agency**

In determining such a capacity one needs to give consideration to the work that is needed, to what is currently working at a regional level and the availability of funding. There needs to be a distinction between coastal and inland provinces as the former's waters include estuaries as inland waters and these require an additional skill set for appropriate management.

The capacity suggested in the table below is based on presentations on this subject given by the author to the Freshwater Ecosystem Network (FEN) which the South African National Biodiversity Institute has established. This is a grouping of aquatic scientists in South Africa that work on inland waters and meet annually as the FEN. They comprise consultants, research scientists as well as aquatic scientists at provincial conservation agencies and DWS. The capacity in the table below is regarded as a minimum requirement, not an optimum requirement.

| Provincial group | Section leader | Scientists (MSc, PhD) | Technical support | Total |
|---|---|---|---|---|
| Coastal province | Assistant Director (Aquatic) | Fish scientist<br>Wetland scientist<br>River scientist<br>Estuarine scientist | 3 staff with BSc or diplomas | 8 |
| Inland province | Assistant Director (Aquatic) | Fish scientist<br>Wetland scientist<br>River scientist | 2 staff | 6 |



*Provincial-based aquatic staff play an important role in safeguarding the headwaters of South Africa.*

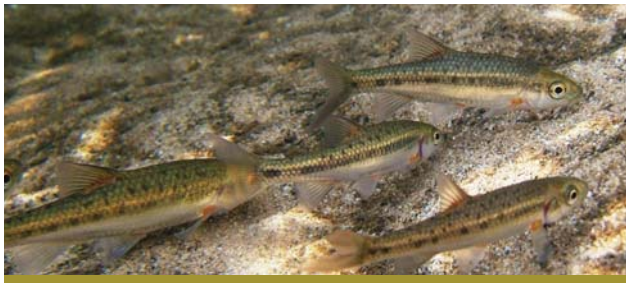
If the capacity suggestion in the table is correct, the minimum capacity is 8 per coastal province and 6 per inland province in terms of dedicated staff. Obviously aquatic teams would benefit from the ready availability of field ranger staff when conducting field work.

**Current capacity in the provinces in the conservation / environmental agencies**

Provincial conservation agencies (aquatic staff) were consulted about current capacity and the table below is understood to be correct at the time of writing this article. The table suggests that we may have a crisis in terms of aquatic capacity in the provincial conservation agencies as only one agency (Mpumalanga Parks Board) comes close to meeting to what is suggested as a minimum requirement for aquatic capacity.

Two other provinces have half the suggested minimum requirement (CapeNature, Ezemvelo KZN Wildife) while other provinces have very few aquatic staff or no dedicated staff.

| Province and provincial body | Section leader (Aquatic) | Scientists (MSc, PhD) | Technical support | Total and suggested minimum in brackets |
|---|---|---|---|---|
| Mpumalanga<br>Mpumalanga Parks Board | 0 | 4 | 1 | 5 (6) |
| KZN<br>Ezemvelo KZN Wildlife | 0 | 3 | 1 | 4 (8) |
| W. Cape<br>CapeNature | 1 | 2 | 1 | 4 (8) |
| Gauteng<br>Dept. Agricultural and Rural Development | 0 | 1 | 1 | 2 (6) |
| Limpopo<br>Dept. Economic Development, Environment and Tourism | 0 | 1 | 1 | 2 (6) |
| Free State<br>Dept. Economic Development, Tourism and Environ. Affairs | 0 | 2 | 0 | 2 (6) |
| N Cape<br>Dept. Environmental Affairs and Nature Conservation | 0 | 1 | 0 | 1 (8) |
| North West<br>Dept. Econ. Devel., Environ., Conservation and Tourism | 0 | 1 | 0 | 1 (6) |
| E. Cape<br>Dept. Economic Development and Environmental Affairs | 0 | 0 | 0 | 0 (8) |



Dean Impson

*Aquatic staff play a key role in conservation status assessments of threatened fishes such as the Clanwilliam redfin, a Vulnerable species.*

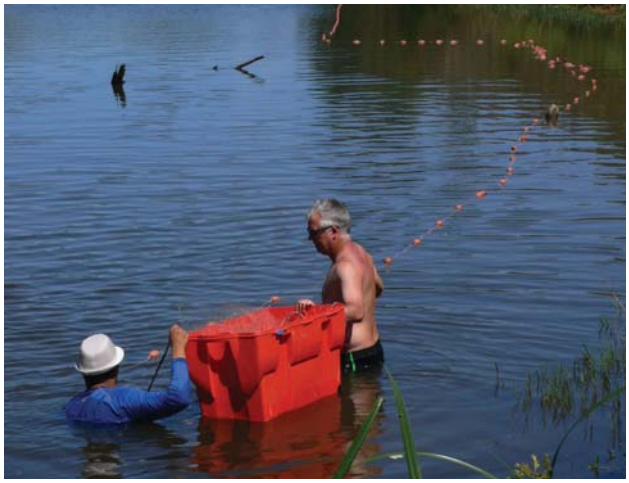
**A dire situation that requires attention**

Given the current capacity constraints, two main questions arise for the way forward. How will the minimum aquatic capacity be funded and where will the funding for increased capacity come from? The latter is an over-riding question in government these days as the Treasury Department strives to substantially reduce government expenditure to meet its budget goals.

Given the value of ecological infrastructure that generates and provides water in our water stressed country, a strong argument can be made for dedicated funding in the form of a water levy to sustain organisations that manage major water source areas. Although costs vary between regions and user groups, South Africans pay for water that is used in a variety of ways. Therefore, it seems sensible that a small proportion of this charge per water management area could be in the form of a catchment management levy that is ring-fenced and allocated to management of ecological water infrastructure.

This levy could then be used to ensure that inland water ecological infrastructure is maintained in an excellent health by keeping catchments clear of alien plants, ensuring that wetlands and riparian zones are not degraded, ensuring the implementation of environmental flow releases from dams and effectively monitoring and reporting on the health of key rivers and wetlands.

In closing, this article should not be seen as a criticism of government or any government department. The aim is to make readers aware of the need for aquatic capacity in conservation agencies at provincial level and what form the capacity could take to meet operational requirements. The author has worked as an aquatic scientist at a conservation agency for nearly 25 years and welcomes comment on the article and alternative suggestions to addressing what is viewed by the national Freshwater Ecosystem Network as a growing problem that requires national attention.



Dean Impson

*Aquatic staff are needed to guide and undertake fish survey work.*