Citizens indispensable in modern biodiversity protection

Members of the Bot River Estuary Coordinated Waterbird Counts team conduct a waterbird count.

Tygerberg Bird Club

While Water Research Commission (WRC)-funded research projects are typically undertaken by highly qualified experts, the contribution of ordinary citizens to scientific endeavours should not be overlooked. Sue Matthews looks at this increasing trend.

The University of Cape Town's Animal Demography Unit – simply known as the ADU – has been at the forefront of initiatives to involve members of the public in scientific research for more than two decades. Recently, the ADU celebrated the role of its volunteers by declaring the week of 8 – 16 March 'Citizen Science Week'.

"Each data point the ADU's citizen scientists collect is a piece of the jigsaw puzzle of biodiversity," explains ADU Director, Prof Les Underhill, on the unit's website www.adu.org.za. "The ADU's mission is to fit together all the puzzle pieces, so that we can map South Africa's biodiversity through time. We turn the myriad bits of raw data into the kind of information that conservation decisions can be based on."

Here we profile a few of the ways in which citizen scientists are involved in data collection for water-related programmes.

WATERBIRD COUNTS

When the ADU was established in 1991 the acronym stood for Avian Demography Unit, because it developed from the South African Bird Ringing Unit (SAFRING) and the first South African Bird Atlas Project, which ended that year (SABAP2 began in 2007 and passed the 100 000 checklist mark this February). The following year the ADU launched CWAC – the Coordinated Waterbird Counts – to meet South Africa's monitoring obligations in terms of Wetland International's African Waterfowl Census Programme, the Convention on Migratory Species and the Ramsar Convention.

One of the first wetlands to be 'counted' was the Bot River Estuary, outside Hermanus in the south-western Cape. The 20th anniversary of the Bot CWAC was celebrated last July, an achievement that is all the more remarkable given that most of the counters live in the northern suburbs of Cape Town, and have to leave before daylight to get to the site on time. Although a few local birders living in the vicinity of the estuary

take part, the Bot CWAC has always been conducted by the Tygerbird Bird Club and coordinated by one of its members, Mariana Delport, whose family owned property on the estuary's shores.

Nowadays the counts are done twice per year, in mid-summer and mid-winter, in line with the ADU's recommended minimum standard. Impressively, they were done monthly for a four-year period from the beginning of 2003 to the end of 2006, and then quarterly until the end of 2009, in order to monitor the birds' response to breaching of the estuary mouth, which typically occurs at intervals of two to three years.

Doug Harebottle, appointed as the ADU's first full-time CWAC Coordinator in 1999, used the data for a chapter in his PhD thesis on the conservation value of waterbirds and wetlands in South Africa's winter rainfall region. He analysed Bot CWAC data for the period 2002 to 2010 and showed that the freshwater 'lake' conditions experienced after the estuary mouth had been closed for a few years supported more waterfowl, especially red-knobbed coot and yellow-billed duck, while the saline estuarine phase and brackish lagoonal phase supported more waders and shorebirds.

The thesis also includes detailed analyses for four other wetlands, and the acknowledgements section contains high praise for the CWAC teams. "This thesis would not have been possible if it were not for the many CWAC volunteers who gave up (and still give up) their 'Saturday mornings' to spend a few hours counting waterbirds. To do this month after month, year after year takes enormous effort and dedication. I will be forever grateful for their man-hours, turning their observations into useful science and conservation outcomes," wrote Doug.

Apart from providing useful information on waterbird composition, abundance and seasonality, as well as the wetland's conservation importance, his findings were incorporated into the desktop ecological water requirements study for the Bot River Estuary, which will inform management of the catchment and estuary.

The CWAC website lists a number of other potential uses for such data, including:

- Monitoring waterbird population fluctuations and wetland health
- Improving understanding of seasonal movements of waterbirds between wetlands
- Raising awareness of the importance of wetlands as biodiversity hotspots
- Serving as an early warning system for wetland degradation or waterbird population decline.

FROGGING

Another of the ADU's citizen science projects focuses on frog monitoring. In mid-2010 the ADU launched FrogMAP, following on from its seven-year South African Frog Atlas Project (SAFAP) that ended in 2003 and resulted in the publication, *Atlas and Red Data Book of the frogs of South Africa, Lesotho and Swaziland*, the following year. SAFAP data, collected by volunteers as well as professional herpetologists, was primarily in the form of audio recordings of calling frogs, which can be reliably used for identification.

FrogMAP, on the other hand, is one of the ADU's 'virtual museums', in which the specimens are digital photographs in an online database, rather than preserved animals in a display case. Photographs submitted by citizen scientists must be accompanied by information on where and when the animal was observed – there's a built-in Google Map to pinpoint the location for those who don't have access to GPS coordinates – and all species identifications are confirmed by a panel of experts.

Currently the virtual museum contains some 44 000 records, but the majority are from the SAFAP dataset, with only about 5% having been submitted since the launch of FrogMAP. That contribution will hopefully accelerate with the recent initiation of a frog monitoring project in the Hermanus to Gansbaai area of the south-western Cape.

"We're interested in community education and so we've been investigating different educative instruments, citizen science projects being one of them," says Sheraine van Wyk, eco-learning manager at Whale Coast Conservation, the local non-governmental organisation that is driving the project. "We know we have special endemic frogs in this area and that our wetlands are under threat. And at a basic level we all understand that environmental health is vital to our survival and coexistence with

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Sue Matthews

The unique patterns on a western leopard toad can be used to identify individuals.

Whale Coast Conservation

Sheraine van Wyk with potential citizen scientists at the launch of the Whale Coast Conservation frog monitoring project.

nature. This citizen science project is a way to get members involved and more scientifically oriented, but the end point is greater awareness and knowledge, and the capacity to participate in governance of the ecosystems that surround us.

"At the same time, it's vitally important that scientific rigour is maintained and that the frog monitoring results are dependable and useable, even if limited to a rather simple scientific level."

FrogMAP only gives an indication of the distribution range of a species, but Van Wyk is hoping to collect data on frog numbers, sex ratios and size frequency distribution that could also be useful in assessing population health. "In areas where we have special species, there might be a particular project that is focused more on that frog's conservation. For example, the one in Stanford will be geared towards western leopard toads, and we're very fortunate that a local farmer, Naas Terblanche, has built up considerable knowledge about the species over the years and has been writing articles for the local magazine, so he's created an interest within the community. We'll give people an opportunity to take their interest further, learn more about frogs and get involved in monitoring."

"This sort of project couldn't be done without citizen scientists though – you need people on the ground, because it's just too intensive for a bunch of scientists."

The western leopard toad, *Amietophrynus pantherinus,* is classified as endangered in the latest IUCN Red List assessment because it only occurs in small, isolated patches totalling 440 km ^{2} between the Cape Peninsula and Cape Agulhas. Its habitat has declined as a result of agricultural and urban expansion and associated wetland degradation, and the tadpoles are heavily preyed upon by invasive fish, but the most obvious threat on the Cape Peninsula is car traffic over a few weeks in winter when the toads migrate to and from the breeding ponds at night. The carnage is there for all to see in the morning, commemorated in the Cape Pont Vineyards' Splattered Toad range of wines.

Volunteer groups such as the Toad NUTS (Noordhoek Unpaid Toad Savers) and KirMiTS (Kirstenhof/Muizenberg Toads Savers) in the southern suburbs of Cape Town initially focused on patrolling known road-crossings and 'rescuing' at-risk toads. More recently, under the guidance of the Western Leopard Toad Conservation Committee (WLTCC), which includes representatives from SANBI, Cape Nature, SANParks and City of Cape Town as well as NGOs and volunteer groups, they have also collected data.

Photographs of the toads against a ruler or on graph paper, together with the 'where and when' information, are submitted to the Upload Your Toad node on the iSpot website hosted by SANBI. Each toad's patterns are unique, so computer recognition software can be used to search for matches once the database is sufficiently large, in the long-term yielding information for population demographic estimates.

"Even in the short term, the moment we have data it starts giving us information," says SANBI's Dr Tony Rebelo, who chairs the WLT-CC. "So in the meantime the monitoring will give us data on how long the toads live and how far they move, and as we get more data it will become statistically more powerful. But it takes many years before we can start picking up trends and patterns.

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MINISASS

Citizen scientists in the water field are not limited to monitoring our feathered friends or potential Prince Charmings though. They can

also get up close and personal with creepy crawlies in rivers and streams to monitor the health of these aquatic systems, and raise red flags about pollution problems.

MiniSASS (Stream Assessment Scoring System), which uses the composition of macroinvertebrates as an indication of water quality, was originally developed in the 1990s, but with funding from the WRC has been revised in recent years to make it more robust and widely applicable as a monitoring tool. It is based on the more comprehensive SASS5 (South African Scoring System version 5), which relies on over 90 macroinvertebrate classes. MiniSASS uses only 13, but provides a similar end-result in terms of river health status.

The revision was conducted by GroundTruth, an environmental consultancy in Hilton, KwaZulu-Natal, run by Mark Graham, who was one of the original developers of miniSASS, and the new version underwent testing at the WESSA Environmental Centre in nearby Howick by river health practitioners and environmental educators. Subsequently, a new website, www.minisass.org, has been developed by GroundTruth and WESSA, and this incorporates an interactive Google Earth map and database that allows miniSASS users to upload their results and view those submitted by others.

The map reveals that most results uploaded to date are from groups in the vicinity of Durban and Pietermaritzburg, which can be attributed to the proximity of GroundTruth and WESSA and their strong networking in the area. Graham is a board member of the Duzi-uMngeni Conservation Trust (DUCT), a public benefit organisation working with local conservancies and schools in the vicinity of the uMsunduzi and uMngeni rivers, while WESSA is rolling out miniSASS through its Eco-Schools programme.

Louine Boothway, an Eco-Schools node coordinator working on a DUCT-WESSA partnership project, points out that not all miniSASS results are as yet being uploaded to the website, which only went live in October.

Louine Boothway

Learners from Mpophomeni Township, outside Howick, KwaZulu-Natal, conduct a mini-SASS assessment on the uMthinzima stream.

"With the peri-urban township schools where I work, the learners need to be supported in developing the necessary skills to do miniSASS well enough to be able to post their results, knowing that they are a good reflection of what's happening in that stream," she explains. "I can see that the kids gain in confidence and get a sense of pride in their work when we don't compromise on the results."

"My involvement in this group is extra special for me, because in first world countries citizens involved in science are generally more affluent people volunteering their time. In our situation it's sometimes unemployed or illiterate people who are just really concerned about sewage pollution in their community. They want to put a stop to it and to know what's going on, and they are really excited about miniSASS."

Through its promotion via the national Eco-Schools programme, as well as the Department of Water Affairs' Adopt-a River programme, it is hoped that miniSASS implementation will soon gain momentum.

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