OLIFANTS RIVER – Pioneering catchment-wide study reaches halfway mark

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It has only reached the halfway mark, but the Olifants River study has already yielded some surprising results. Lani van Vuuren reports.

It has been a year since *the Water Wheel* first reported on the study of the Upper Olifants River catchment ('All eyes on Olifants as experts search for answers', *the Water Wheel* May/June 2010). Led by the CSIR, the study is funded by the Olifants River Forum and involves some 30 researchers from various disciplines and organisations, all focused on pinpointing the pollution sources that has earned the river its reputation as one of the most polluted in South Africa.

The purpose of the study is to identify the critical variables in the Upper Olifants River and its tributaries, and to determine their thresholds by making use of a novel set of molecular techniques that provide accurate estimates of the ecosystem health in the study area. In addition to identifying the sources of different stressors, these data is particularly useful to develop and refine appropriate water quality management responses, decision making processes or remediation measures for the rivers in the Upper Olifants River catchment.

Among others, samples taken regularly throughout the catchment have been analysed in terms of water quality, bioaccumulation of selected heavy metals in sediment, algae and invertebrates, aquatic health, microbial contamination and the presence of endocrine disrupting compounds. Ecotoxicological bioassays have also been undertaken.

'SURPRISING' RESULTS

According to project leader Dr Paul Oberholster, while it was common knowledge that the river was polluted prior to the start of the study, the levels of pollution have, in

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Left: *CSIR senior researcher Dr James Dabrowski taking sediment samples of Loskop Dam as part of the Olifants River study.*

Below: *Local people crossing the Brugspruit – one of the worst polluted streams in the Olifants River catchment. Poor communities in the catchment make use of the river to irrigate their crops and water their cattle, putting their health at risk.*

Lani van Vuuren

some cases, been surprising. Particularly unexpected has been the level of eutrophication in the river, specifically in the main stem. Here, algal mats (the result of increased algal productivity as a result of high nutrient levels) have been found to be extensive – highlighting the severity of nutrient pollution in the river.

The high nutrient loads originate mainly from wastewater treatment works in the catchment. "Phosphate loads in these works are unacceptably high. This is a result of a combination of poor management and ageing infrastructure," says Dr Oberholster. The problem is particularly persistent during periods of low flow.

"While a well designed acid mine drainage management plan would increase short-term costs for mining companies, it would create long-term benefits to the community, local government and other stakeholders, and reduce risks to the environment."

These sewage treatment works, along with informal settlements in the catchment, also contribute to microbial pollution and associated pathogens (e.g. Vibrio cholera and Shigella) in the river. High levels of endocrine disrupting compounds have also been identified. Continuous pollution from closed mines has been equally disturbing, with receiving streams characterised by low pH, extremely high dissolved metals and salt contents. One year's monitoring and sampling does not provide enough evidence on its own of deteriorating conditions, however, and the project team hopes to shed more light on the relative contribution of the anthropogenic impacts from different sources in the catchment in upcoming months.

The study has underlined the importance of effective management

and planning of mines to minimise the effects of this problem in the future though. If left unmitigated – as experienced in the Olifants River – the impacts of acid mine drainage impose costs to the wider community of water users; often these costs will need to be borne for decades or generations. On the other hand, while a well designed acid mine drainage management plan would increase short-term costs for mining companies, it would create long-term benefits to the community, local government and other stakeholders, and reduce risks to the environment. "Recognising the nature of these costs over time, relative to the desired and anticipated benefits, is critical to the development of an acceptable solution to the current water quality situation in the Upper Olifants River catchment," says the project team.

The catchment has recently been blessed with high levels of rain, which dilute the pollution to some extent, however, this effect is only temporary. Higher rainfall also means increased sediment, which brings with it its own challenges as the team explains: "Sediment on its own is a physical polluter and also transports absorbed pollutants (i.e nutrients, metals and organics). Increased sediment yields associated with high rainfall can therefore result in an accumulation of sediments and associated pollutants in sinks, such as Loskop Dam." The dam acts as a storage facility for these pollutants which may eventually be mobilised at a later stage.

Rainwater samples have also been collected at a number of sites across the Upper Olifants River catchment and tested for their acidity. Fifty-nine percent of the samples tested were found to be acidic. This revealed that the quality of rainwater could potentially have a major effect on the surface water quality on the Upper Olifants River system as a result of both direct inputs of pollutants through wet deposition and the mobilisation of pollutants (i.e. heavy metals) through acidification of soil.

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More intensive investigations of acid precipitation are planned in phase two of the study. It is hoped that this will provide insight into the extent of the impact of acid rain on contamination of the Upper Olifants River system.

HEALTH RISK

The research team has expressed its concern over the potential impact of this pollution on communities living in the catchment. In general, water quality of natural resources should not be managed to meet drinking water standards, the team points out. However, given the large numbers of people living in poverty along the Olifants River with very little to no basic services it is inevitable that people will make use of the natural water resources available to them. Members have witnessed first hand the use of

Above: *Stretches of algal mats – the result of eutrophication – found in the main stem of the Olifants River have highlighted the severity of nutrient pollution in the river.*

Below: *Pretty as a picture yet Loskop Dam contains a cocktail of pollutants, which have manifested in fish and crocodile deaths as well as toxic cyanobacterial blooms.*

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untreated water from the Olifants River and its tributary streams for washing fruit and irrigating subsistence crops, increasing the chance of accidental exposure or ingestion of this water. Given the high levels of pollutants in some these stretches of the river, health risks are high.

There is hope for the Olifants River yet. Results are shared with stakeholders continually, especially members of the Olifants River Forum, as well as national authorities such as the Department of Water Affairs (DWA). There is a general consensus that the river is under serious threat from anthropogenic activities, and the reaction is generally one of concern. "Initially, members of the public apportioned most of the blame to the mining industry, however, our first year of study has highlighted that mining is not the only problem in the catchment," notes the project team. "It is becoming increasingly clear that pollution in the Olifants River is varied in terms of its nature (i.e. heavy metals vs. nutrients) as well as its source (i.e. mining, industry, wastewater treatment works, and agriculture)."

This concern has, in turn, resulted in positive outcomes in that stakeholders have become more amenable to sharing information and allowing access to their properties for sampling etc. DWA has also set up a task team to tackle some of the issues in the catchment.

The Olifants River study team's focus has now moved towards looking at possibilities of rehabilitation and remediation. This includes the establishment of artificial wetlands and the restoration of existing wetlands in the Upper Olifants River catchment in conjunction with organisations such as Working for Wetlands.

In the end it is quite clear that saving this catchment and others like it will require a truly collaborative approach between government, water resource managers, business and communities. ❑

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Above: *Cattle drinking from the Brugspruit, a tributary of the Olifants River. The stream receives acid mine drainage from closed coal mines.*

Right: *Industrial pollution has killed all aquatic life in this stream which eventually reaches the Olifants River, effectively rendering it sterile.*

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