



The desertification of a large area of supratidal saltmarsh on the estuary's south bank is partly due to flood attenuation levees and a causeway which obstructed water exchange.

ORANGE RIVER MOUTH

– Saving the integrity of one of SA's most important estuaries

Decades of human-made impacts have left its mark on the estuary of South Africa's largest river, the Orange. Now new plans are underfoot to prevent the further degradation of this important Ramsar site. Article by Sue Matthews.

When Robert Jacob Gordon – the Dutch explorer and military officer who named the Orange River – spent a few days at the river's mouth in August 1779, he observed a large marsh on the southern bank and noted that the land was so low that it 'must be completely covered when the sea and river are high'. The only people living in the area at that time were a group of about

20 Khoikhoi, who had constructed a few dome-shaped huts from whale bones, driftwood and grass.

Today, human settlement and development – both in the immediate vicinity of the estuary and in the distant reaches of the catchment – have taken their toll on the estuary, and that supratidal saltmarsh on the southern bank now resembles a barren desert. Most of the damage has occurred since the 1960s, but the history of decline dates back to the late 1920s, when diamond-mining began in the area.

Apart from the increased presence of people and the environmentally damaging effects of mining and other activities, the estuary mouth was artificially breached when it closed, typically every few years. In fact, the recent migration of the mouth back to the southern side of the estuary has exposed old machinery that was dumped in the mouth at some stage in an attempt to keep it open and fix its position. The aim of artificial breaching was to reduce the impact of floods and maintain the quality of water drawn from the alluvial aquifer, but the practice also prevented occasional inundation of the supratidal saltmarsh.

The more enduring impact on the estuary, however, was the commissioning of the Gariep

and Vanderkloof dams in the 1970s. Situated more than 1 400 km upstream, the dams have not only altered the flood regime of the river because of their large storage capacity, but also elevated low-flows during the dry season and drought periods due to their water release schedule. And, of course, the total volume of water reaching the estuary annually has been reduced significantly as development in the catchment has inexorably increased the water demand of the industrial, agricultural and domestic sectors. These changes in flow have had a variety of impacts on the ecological health of the estuary.

The prospect of new dams in the Orange River catchment has raised concerns that the estuary will be under even more pressure in the future. Lesotho's Metolong Dam will supply water to Maseru and neighbouring towns by the first quarter of 2015, while the Polihali Dam is expected to be completed by 2022. The Neckartal Dam is under construction on Namibia's Fish River, and South Africa's recently completed Reconciliation Strategy for the Orange River Water Supply System has recommended that a feasibility study be conducted for the long-mooted Vioolsdrift Dam on the Lower Orange River.

A baseline survey is conducted on the Lower Orange River for the environmental flow requirements study.



Rob Palmer

“The mouth hasn’t closed since the 1990s, so salinity is increasing in the saltmarshes, which is one of the main reasons the system is declining in health.”

Recognising the potential threat to the estuary – as well as the transboundary nature of the problem – the UNDP-GEF funded Strategic Action Programme of the Orange-Senqu River Commission (ORASECOM) contracted consulting firm Rivers for Africa to conduct an environmental flow requirements study for the final 150 km of the Lower Orange River, from its confluence with the Fish River to the mouth. The study also included the Fish River itself, in order to recommend release options for the Neckartal Dam, and the nearshore marine environment in the vicinity of the mouth, to assess the possible effects of changes in freshwater input. Overall project leader, Delana Louw of Rivers for Africa, headed up the team responsible for the river components of the study, while the CSIR’s Lara van Niekerk led the estuary and marine teams.

The study found that in its natural, pristine state – the reference condition – the Lower Orange River would have had a mean annual runoff (MAR) of an estimated 11 373 million m³. Today, the MAR is only 4 641 million m³, which means that the quantity of water reaching the mouth is only about 40% of the natural volume.

The various physical, chemical and biological components of the systems were assigned a health score by specialists on the study teams, and these were integrated to determine the overall present ecological state, or EcoStatus. While the river reach attained

a B/C – indicating slight to moderate modification from the reference condition – the estuary could only manage an overall health score of 51% , translating to a D.

The D represents a largely modified system, but could just as easily stand for degraded. The primary cause is the reduction in the frequency and magnitude of floods of all size classes, together with the more constant, year-round flow associated with river regulation.

“The estuary is not getting the high flows it used to, and it’s not getting the low flows either,” says Lara van Niekerk. “The mouth hasn’t closed since the 1990s, so salinity is increasing in the saltmarshes, which is one of the main reasons the system is declining in health.”

Small floods that used to regularly bathe the supratidal saltmarsh in freshwater – diluting and flushing accumulated salts from the soil – have been reduced considerably, but the same effect occurred when the mouth closed, causing the water body to start spreading over the floodplain.

“One of the critical findings from the study is that we need the estuary to close two to four times in a ten-year period,” says van Niekerk. “It doesn’t have to close for very long, but the water level must go up by at least a metre so that there’s backflooding into the supratidal saltmarsh.”

Windblown dust and wastewater from mining activities have contributed to the degradation of the Orange River estuary.



Steve Lamberth

She explains that mouth closure is achievable if river flows during the low-flow season could be sufficiently reduced and timed to coincide with high-wave sea conditions, when sand is washed into the estuary and deposited in the mouth. This is difficult to control when flows are governed by releases from the Vanderkloof Dam, which take four to six weeks to reach the estuary and must meet the needs of irrigation schemes along the way.

But the proposed Vioolsdrift Dam, only 350 km upstream, would enable flow manipulation to be fine-tuned to allow for mouth closure. Although the dam would result in a further reduction in medium-sized floods and sediment supply, the specialists believe that mouth closure is more important for improving the health of the estuary. (The dam would also be beneficial to the Noordoewer-Vioolsdrift Joint Irrigation Scheme, covered in the November-December 2014 issue of *the Water Wheel*).

Another factor that contributed to the decline of the supratidal saltmarsh was the construction during the 1960s of a causeway across it to provide road access to the beach, as well as flood attenuation berms to protect agricultural land on the floodplain the following decade. These structures prevented inundation of the saltmarsh by both freshwater flows during small floods and saline waters during exceptionally high spring tides and storm surges.

Any water that did reach the saltmarsh – as occurred in the major flood of 1988 and a mouth closure event in 1993 – was unable to escape and slowly evaporated, increasing the salinity of the soil and groundwater to the point that it inhibited seed germination and seedling establishment. By 1995 the supratidal saltmarsh had collapsed, prompting South Africa to have the estuary, which was declared a Ramsar wetland of international importance in 1991, listed on the Montreux Record – a register of Ramsar sites where ecological changes have occurred.

Sections of the causeway were removed in 1997 and 2005 in an effort to rehabilitate the now desertified saltmarsh, but this did not improve flow enough to flush out the accumulated salts. Recently it was proposed that the entire causeway as well as the levees be removed, and replaced with a berm constructed further inland to protect the town of Alexander Bay's low-lying areas and sports fields from flooding. Withers Environmental Consultants were appointed to conduct the environmental impact assessment, but just as the Final Basic Assessment Report was to be circulated for comment, the process stalled. The provincial Department of Environment and Nature

Conservation – delegated responsibility for managing the Ramsar site – requested that separate applications be submitted to the national Department of Environmental Affairs for the removal and construction components.

A further complication is that state-owned mining company Alexkor is responsible for the EIA process as it is required to rehabilitate all historic disturbances associated with its activities, but the land is now owned by the Richtersveld Sida !Hub Communal Property Association (CPA), following a land claim awarded in 2007. The CPA representatives have changed during the course of the EIA process, and support for the removal of the levees has been retracted because it would result in periodic flooding of agricultural fields.

The recommendations from the environmental flow requirements study highlighted the importance of removing the causeway at least if the estuary is to be rehabilitated to its 'best attainable state' of a C ecological category. This would also require remedial actions to reduce the nutrient input from the catchment downstream of Vioolsdrift through improved agricultural practices, to control windblown dust and wastewater disposal from mining activities, and to curtail the fishing effort on both the South African and Namibian sides of the estuary. Illegal gillnetting is known to occur in the estuary, and angling pressure in the vicinity of the mouth is relatively heavy. This can only be addressed through increased compliance and law enforcement, and ideally the alignment of fishing regulations between the two countries.

The study team recommended that the remedial measures relating to 'non-flow' impacts, as well as

The Lower Orange River flows through a desert landscape to its final destination, the Atlantic Ocean.



Krick Heli

potential flooding and water quality issues stemming from increased mouth closure, should be addressed as part of the estuary management plan. The development of the plan began in 2011, and followed a collaborative process involving government agencies, local communities and other key stakeholders in South Africa and Namibia, many of them represented on the Orange River Mouth Interim Management Committee.

The plan was structured according to Ramsar guidelines, and published in April 2013 as the 'Strategic Management Plan for the Orange River Mouth Ramsar Site'. As a result, it is now considered a wetland management plan, and will need to be tweaked to meet the requirements of the National Estuary Management Protocol, gazetted in May 2013.

The management plan identifies a range of specific actions that should be undertaken to fulfil strategic goals and management objectives under institutional, ecological and socio-economic themes. The Northern Cape's Department of Environment and Nature Conservation (DENC) has been assigned responsibility for many of these, but its ability to implement them is largely contingent on the South African side of the Ramsar site being formally proclaimed a provincial nature reserve, in which case staff and a budget to manage it would be allocated. For some years it has been working towards this, and has already completed all the required documentation as well as a protected area management plan, but the change in land ownership and CPA representation caused what was hoped was a temporary setback.

The recent eruption of a turf war with the national Department of Environmental Affairs' Oceans and Coasts directorate, which has assumed responsibility for the estuary in accordance with the National Estuarine Management Protocol, has been a further disappointment. Management authority for the

Ramsar site and responsibility for proclamation of the protected area now requires clarification. Importantly, South Africa's National Biodiversity Assessment 2011 recommends that the Orange River estuary is made a full (no-take) protected area, while the Namibian side of the estuary is bordered by the Tsau//Khaeb (Sperrgebiet) National Park.

In the short term, some of the actions identified in the strategic management plan will be undertaken by the Endangered Wildlife Trust. The NGO is the South African implementing partner for a three-year USAID-IUCN project called 'A water secure future for southern Africa: Applying the Ecosystem Approach in the Orange-Senqu basin', and in this final phase – due to end in May 2015 – has US\$ 100 000 to spend on a demonstration project on ecosystem priority activities.

"We selected the Orange River mouth as our demonstration site after a consultation process with key stakeholders," says project leader and manager of EWT's Source to Sea programme, Bridget Corrigan. "We've had a field officer based there since September, and we're looking at what activities we can implement from the management plan. As a future objective, once the grant comes to an end, we hope to expand our involvement through our existing strong partnership with Conservation South Africa, which is already operational in the Namaqualand area."

- A popular publication summarising the environmental flow requirements study, as well as the technical reports, can be accessed through <http://undp.orasecom.org/resources-2/>. 



The Orange River estuary, situated at the South Africa-Namibia border, has been seriously impacted by changes to the river's flow regime, as well as developments associated with the mining towns of Alexander Bay and Oranjemund.



Aubrey Withers