

Ugu Lwethu - Our Coast. A profile of coastal KwaZulu-Natal

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3.3 Estuaries

Although estuaries are distinct habitats with an individual ecology, they form part of a transition gradient where freshwater from rivers meets saltwater from the sea. In the broadest sense, this is the longest standing and generic global definition of an estuary.^{1;2}

Estuaries include a wide variety of systems from small to large, and those that are either periodically or permanently open depending on factors such as the estuarine type, shape and function. Indeed the interaction of these functions provides a unique, highly productive environment that supports a great diversity of wildlife and resources, contributing great value to the economies of countries.³

In terms of the *ICM Act*, “estuary” means a body of surface water that:

- is part of a water course that is permanently or periodically open to the sea;
- in which a rise and fall of the water level as a result of the tides is measurable at spring tides when the water course is open to the sea or;
- the salinity is measurably higher as a result of the influence of the sea.

Estuaries, where freshwater from rivers meets saltwater from the sea.



Photo: ORI



KZN estuaries

The profile of the coast, our subtropical climate and the size of coastal rivers all contribute to the types of different estuaries represented in coastal catchments of KZN. We know that estuaries are productive, complex and support a large number of different plants and animals. But how do we simplify this diversity and intricate ecology? One way is to organise estuaries into groups. Estuaries can be classified according to the way they were formed and how they function. Once the type is known, it is easier to understand how the estuary behaves. Estuaries are all different in terms of size, depth, tide patterns, catchments, fresh water flows, salinity and types of sediment, which in turn influences the varieties of animals and plants that live there. Thus when it comes to managing estuaries it is seldom possible to adapt information from one estuary type to another.

KZN has a fairly small share of South Africa's 3 200 km coastline, but the 580 km KZN coast (see *Section 1.2*) supports 77 of the 300 estuaries in the country.⁴ KZN has representative examples of all five South African estuarine types, which are 1) estuarine bays 2) permanently open systems 3) river mouths 4) estuarine lakes and the smaller but more numerous 5) temporarily open estuaries.⁵ Although they are the only representatives of this type, the St Lucia and Kosi Estuarine Lake systems account for 90% (365 km²) of the total provincial estuarine area of 400 km², which in turn is 66% of the national area, highlighting the importance of these two systems.

The classification or "typing" of estuaries is important for their management as different estuaries respond in diverse ways to change generated by human use or natural events. Identifying these responses gives us some direction as to how they should be further studied and managed.

Importance and value of estuaries

The *ICM Act* has further defined estuaries and how they should be holistically managed by an overarching *Estuarine Management Protocol* (*Section 10.2*). It highlights that the definition of an estuary pertains to more than just the surface waters and includes the adjacent terrestrial unit, the estuarine functional zone. This zone is most frequently delineated by the 5 m (above mean sea level) topographical contour and includes areas of floodplain and estuarine vegetation that contribute towards protection of animals and habitats,

provides refuge and plant food for estuarine organisms and other uses that people can directly benefit from.⁴

Estuaries are important as they offer an assortment of habitat types and are often termed "nurseries of the sea" where many commercially important fish and shellfish are protected, feed and complete some part of their life cycle. They also offer intrinsic functions, which include filtration of nutrients such as fertilisers from surrounding farmlands. If riparian vegetation and forest are intact, they are natural buffers absorbing the full force of flooding, storm surges and bank erosion.

Aside from natural and fundamental life support services to the environment, KZN estuaries also provide a wide range of benefits that support us through cultural, recreational and subsistence needs and experiences. To us, the direct value of healthy, functional estuaries creates income generating opportunities and influences the economy of coastal areas.^{6; 7; 8}

Threats to estuaries

Generally there is a strong relationship between the size of a catchment's human population and the degree of modification of an estuary.³ Threats can be attributed to direct and indirect pressures on these systems.

Flow alteration

We live in a naturally semi-arid country with a pressing freshwater demand to meet domestic, industrial and agricultural needs for a population of 50.6 million,⁹ as highlighted in *Section 6.1*. The amount and natural timing of river water reaching estuarine and marine environments has been altered through the construction of dams and direct extraction along the river course. These changes affect the way an estuarine ecosystem functions and therefore the services it provides.

Declining water quality

Pollution causes harmful concentrations of chemicals, nutrients, herbicides, pesticides and litter in our estuaries (*Section 9.3*). A consequence of human settlement is that waste water often flows into estuaries, which causes oxygen depletion often leading to fish kills, algal blooms and a host of human health problems.¹⁰ In part, estuaries are productive ecosystems because they receive nutrients from the surrounding catchment. When the quantity of pollutant exceeds the filtration capacity they can be some of the most polluted ecosystems.¹¹

Estuary mouth breaching

Mouth manipulation is often required when inappropriate development has taken place inside the estuarine functional zone.⁴ Artificial breaching of an estuary results in a sudden and catastrophic lowering of water levels for aquatic plants and non-motile animals, which will disrupt natural functioning in the system. Non-managed breaching at an unsuitable time of year can be one of the most destructive effects on a system that may require some time for ecological balance to be restored.

Harvesting of resources

Illegal or irresponsible harvesting of resources can lead to loss of critical habitat and species, sometimes indirectly influencing the wellbeing and health of non-target species.

Poor agricultural practices

Removal of natural vegetation in favour of crops, grazing or housing often leads to soil erosion and mud deposition into rivers and estuaries. With less water flowing into estuaries, normal flushing of accumulated sediments is reduced and habitats are lost as estuaries shallow.

Habitat destruction

Irresponsible planning, design and placement of buildings, concreted embankments, jetties and bridges change water flow, cause erosion, loss of habitat and pollution in estuaries. Indirect effects of urbanisation such as the removal of sand for building can also have permanent and negative consequences on the ecology of the system as outlined in Section 9.6. The provision of sand through estuaries to the coast and offshore marine environment is critical to the services provided by these ecosystems.

Invasive species

Alien species are a threat to our estuaries; they disrupt the natural ecology and pose risks to the economy through damage to infrastructure or displacement of natural species.⁴ Invasive alien species in South African estuaries are found amongst the plants, fishes and invertebrates (Section 4.2). Our KZN example involves an invasion by the quilted melania (*Tarebia granifera*). *Tarebia* is a small snail whose natural

- Estuarine types: 1. Estuarine bay: uMhlathuze Estuary;
2. Permanently open estuary: uMlalazi Estuary; 3. River mouth:
Thukela Estuary; 4. Estuarine lake: Kosi Lake System;
5. Intermittently open estuary: Nhlabane Estuary.

Photos: Fiona MacKay and Bronwyn Goble



Estuarine health conditions for estuaries in KZN districts.					
KZN District Municipality	% of SA estuarine area	2011 Estuarine Health Condition ⁴			
		% of estuarine habitat total for district			
		Excellent	Good	Fair	Poor
Ugu (42)	1	0	26	72	2
eThekweni (16)	2	0	6	22	72
iLembe (10)	0	0	45	55	0
Uthungulu (5)	4	0	6	94	0
Umkhanyakude (4)	61	0	8	7	85
% of total SA estuarine habitat	68				

populations occur primarily in freshwaters of Southeast Asia, being transported via the aquarium trade.¹² First found in Zululand in 1999, this species is now in at least a third of KZN's estuaries.¹³ This spread is an indication of their success in being able to colonise coastal water under a range of salinity and temperature conditions.¹⁴

State of KZN estuaries

Some 30 years ago, all the estuaries of KZN were surveyed and respective health status reported on.^{15; 16; 17} Even then, it was found that many of the smaller intermittently open systems had lost habitat, and natural function was compromised due to unsuitable land use and land use practices. Since then KZN estuaries again have been evaluated on the basis of their geomorphology, water quality, aesthetics and fish populations.¹⁸ Most recently, eThekweni's 16 estuaries have had the most intensive health assessment using a combination of living and non-living parameters to evaluate pressures and estuarine responses.¹⁹ None of the 16 systems retain an "excellent" status; five are "highly degraded" and the remainder ranged "good" to "fair".

According to the latest health valuation of South Africa's estuaries in the National Biodiversity Assessment,¹ all of KZN estuaries are in "fair" to "poor" health.⁴ At least 20 (27%) of the provincial estuaries are degraded. Declaring a conservation protection status is one way in which we can reduce estuarine degradation and preserve what is still left of estuarine functional areas. To this end, nine of our 77 estuaries are partially protected but with no specific measures to protect or manage their catchments. Sixty one percent of the country's estuarine habitat is found within the Umkhanyakude District

on the KZN north coast, which equates to only four estuaries. Unfortunately, these are in a poor state.

Future challenges

A new recognised pressure identified by the National Biodiversity Assessment¹¹ deals with climate change challenges. The majority of pressures faced by KZN estuaries are known and understood to a certain extent. Yet those that are anticipated with a different climate regime (e.g. warmer temperatures, sea level rise and intensification of the hydrologic cycle) are going to increase existing pressures on estuaries as well as give rise to new problems. A US programme on Climate Ready Estuaries (CRE)²⁰ warns that existing management strategies and practices will require strengthening as climates change. It may not be sufficient to restore or even sustain present conditions. Sustainability might require innovative thinking such as creating and maintaining new estuarine environments.

KZN has some of South Africa's finest estuaries, which provide a suite of goods and services to the province's communities. However, estuaries are the most vulnerable of ecosystems and this is evident from the degraded state of so many KZN smaller estuaries.

It is clear from this section that the threats to estuaries are well understood but that political will and coordinated action are now urgently required. Most of all, the development of Estuarine Management Plans (EMPs) are an essential tool for the management of KZN's estuaries. ■