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3.4 Coastal Lakes

South Africa has two sets of coastal lakes; a group of five in the Southern Cape and a northern series on the sandy coastal plain north of the Thukela River, in KZN.[1; 2] These 13 water bodies differ from the estuaries (see *Section 3.3*) along this coast in that they lack a surface water connection with the sea under current conditions and are highly variable in their origins and contemporary characteristics.

Although they differ in size, surface flows into these systems are low and they are primarily fed by ground water. This has implications for the water chemistries and consequently for the ecological characteristics, threats that face them and the way in which they and the surrounding landuse should be managed.

Lake origins and characteristics

While they represent a diverse group of water bodies, the coastal lakes of KZN have been little studied. All but Shengeza, Nsezi and Mangeza were probably estuarine in the early stages of their evolution when rising Holocene (Epoch: 11,500 yrs ago to present) sea levels flooded the river valleys along the coast.[1] The lakes were separated from their original estuaries by segmentation (Qubhu, Mzingazi, Zilonde) or by sedimentation (Mgobezeleni, Shazibe, Eteza, Bhangazi South). In the case of Sibaya, Bhangazi North and Nhlabane, isolation of the entire former estuary from the sea took place through dune accumulation that provided a direct physical barrier between the lake and the sea. This process of enclosure was incomplete at Nhlabane, until construction

Young fishers on the shores of Lake Nhlabane.

Photo: Fiona MacKay

of a barrage in 1977 which isolated the lake from its estuary. The lakes have different shapes, sizes (ranging from 7 to over 7 000 ha), depths (from less than a metre to 40 m) and volumes. They all have the characteristics of freshwater lakes but their coastal location causes their hydrological and chemical characteristics and their flora and fauna to differ from typical freshwater bodies.

Ecological function and value

Most of the KZN coastal lakes are characterised by sandy porous soils and a high surrounding water table. Their waters are therefore clear and nutrient poor. Biological productivity is driven by vegetation, either emergent forms in surrounding reed-banks and marshes, or submerged and floating forms in their shallow sections.[3; 4] The highest numbers of animals and most diverse communities occur in the marginal areas. This is likely due to the higher productivity in these areas as well as higher habitat diversity.

All of the coastal lakes are presently isolated from the sea but many (e.g. Mzingazi, Qubhu, Nhlabane) have their estuarine origins still reflected in the composition of their fauna.[3; 4] This was first documented four decades ago when extensive study of Lake Sibaya showed that it retained and supported a productive complement of species that had origins in estuarine and marine ecosystems.[5; 6; 7] Now with studies having been done on several more coastal lakes we know that the structure of invertebrate communities (see *Section 4.2*) in particular largely reflects the degree to which marine connections have influenced salinity regimes even centuries and millennia before.[3; 8; 9] What has enabled these estuarine relic animals to continue living in what are now freshwater systems? The answer lies in their physiology, which is centred around marked osmotic and ionic regulation capabilities – adaptations that are still seen in fauna that migrate between salt and freshwaters and vice versa.

Many of the crustaceans found in lake sediments or on plants at the lake edge are South African or regional endemics.[3; 9] In terms of numbers of these and other small invertebrates, KZN coastal lakes are comparable if not more productive, than the province's periodically closed estuaries.[10]

Several of the larger invertebrates that use these lakes still rely on a direct link with estuarine and marine environments. These include most notably the paddler crabs *(Varuna litterata)*, incredible migrations of which are highlighted in *Section 5.1*.

Lakes that are still connected to the marine environment appear to be a preferred habitat for these crustaceans based on their relative abundance in these systems compared to estuaries and coastal rivers.[11] Other catadromous fauna in the lakes are freshwater *Macrobrachium* prawns. Although adults prefer an environment ranging from fresh to brackish water, early larval forms of many species of these prawns require water at least 20-25% as salty as seawater.[12]

The lakes support less diverse fish communities than estuaries[13] or adjacent marine habitats.[14] Most are characterised by a set of freshwater species, dominated by cichlids (Mozambique tilapia, banded tilapia and southern mouthbrooder). A set of species with estuarine affinities but which are capable of breeding in freshwaters is also common amongst the lakes and includes small pelagic forms such as estuarine roundherring and Knysna halfbeak as well as several goby species. In systems with marine connections fishes with stronger estuarine dependencies (glassies) and marine spawners such as mullet, pursemouths and stumpnose become abundant.[11] Subsistence fishing is conducted and recreational line fishing is popular on some systems, but overall, fish productivity in these lakes is unlikely to support fisheries of any significant size.

Influences and threats

Industry, mining, urbanisation, farming and forestry all pose present or future threats to KZN coastal lakes. These systems are places of aesthetic beauty and are increasingly used as areas for tourism development. Threats also arise from increased exploitation of living resources in these lakes (e.g. reeds, fish).

Because of the low productivity of these lakes they are sensitive to extractive use and water quality and quantity impacts.[3] The naturally nutrient poor and clear waters are likely to be easily impacted by even moderate increases in nutrient loads, either from domestic or industrial effluent or agricultural runoff, which causes a marked change in the ecological nature of these unique systems. Similarly, activities surrounding these lakes that affect ground water need to be carefully managed. Forestry and mining for example has the potential to markedly reduce groundwater inputs into these lakes. Invasion by alien plants and animals has long been recognised as a threat[15] and this has proved true in recent years particularly in systems near Richards Bay. Lakes here have also been impacted by the need for water to feed large-

Coastal lakes summary data[17] (unless indicated)				
Lake	**Surface Area (Ha)**	**Maximum Depth (m)**	**Average Depth (m)**	**Potential Sea Connection**
Zilonde	89	4	2	outflow
Shengeza	150	6	2	seepage
Sibaya	7 750	43	13	seepage
Shazibe	10			outflow
Mgobezeleni	100	5	3	outflow
Bhangazi (N)	170	8.4		seepage
Bhangazi (S)	337	5	2	outflow
Eteza	160	2.1		floodplain lake
Nhlabane	470	3.2[16]	1.8[16]	outflow
Nsezi[3]	453	3	1.5	floodplain lake
Mzingazi	1 070	14	6	outflow
Qubhu	464	4		outflow
Mangeza[3]	27	2	0.8	floodplain lake

scale industrial and urban development. Construction of barrages at their outlets, built in order to increase water yields has compromised connectivity in these systems, resulting in very marked losses in fish communities and some crustaceans.[4; 11]

In a semi-arid country such as South Africa these coastal lakes are potentially valuable sources of freshwater. They also have intrinsic value and significance to coastal biodiversity and ecology. It is therefore imperative that these systems be well managed. ■

Significance and importance

On the Zululand coastal plain there are relatively few large rivers and the coastal reaches of these are typically characterised by extremely shallow waters in winter or flowing turbid waters in summer, both unsuitable for many of the species particular to the coastal lakes. Many species appear to have a high preference for coastal lake habitats, and several of these are of conservation significance as recognised by IUCN and SA Red Data listings.[4] This suggests a potentially high conservation value of these systems and highlights the need for further research. Of all KZN lakes only Lake Sibaya has been well studied.

In addition, the low energy conditions in the lakes mean that they have a high potential as archives of past environmental change. Preliminary work on Lake Eteza and on the peats around Mgobezeleni for example, shows the high degree of preservation of sediments, pollen, diatoms and other indicators of past conditions.

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3.9 Subtidal Soft Sediments

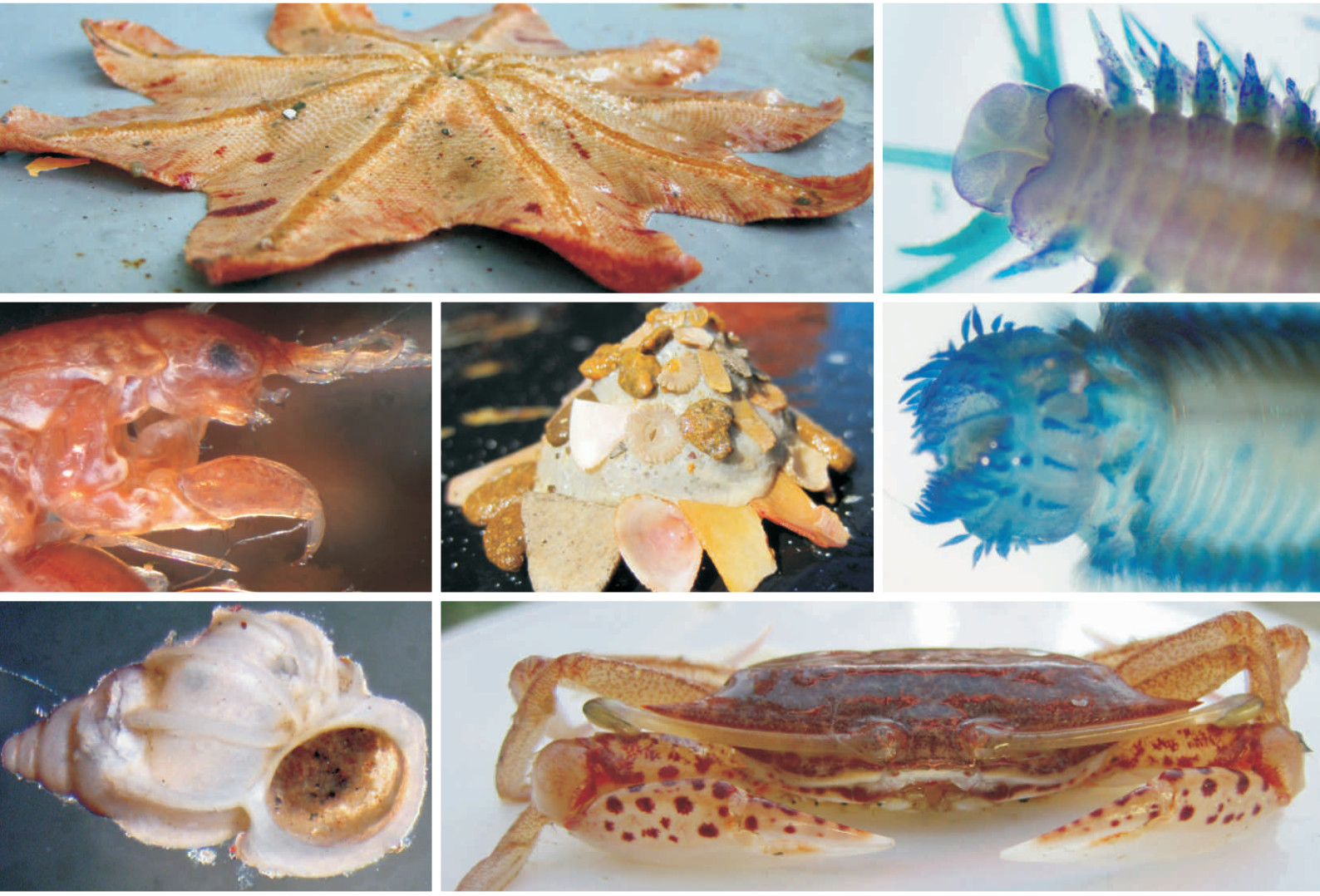
Generally what is considered "marine" relative to "coastal" is separated at the 30m depth contour.[1] Marine habitats extend from the midshelf and beyond into the abyss. Contiguous from estuaries to the coast, in- and offshore to the KZN shelf edge at 20 m is a habitat that is always covered by water (subtidal) and characterised by soft sediment at the bottom.

Coastal and marine sediments, ranging from large gravel elements to fine muds, occupy over 70% of the seafloor and constitute one of the largest habitats on earth.[2; 3] This is a three dimensional habitat, due in part to its relatively unconsolidated nature as opposed to rocky and coral reef counterparts, where biota are confined to hard, impermeable substrates.[4; 5]

Distribution and nature of soft sediments

In KZN the most significant subtidal soft sediment habitat is found on the continental shelf between Richards Bay and Durban. This uncharacteristicly wide shelf section, known as the Natal Bight, has been identified as being highly productive due

Types of animals found in or on the KZN seafloor.



Photos: Fiona MacKay