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4.2 Invertebrates

Around 98% of all animal species described are classified as invertebrates. Simply, invertebrates are animals that lack a backbone but are multicellular. With no backbone, these animals rely on other strategies for physical support such as hydrostatic pressure (e.g. sea anemones with a fluid filled internal cavity), exoskeletons (e.g. crabs with a hard carapace) and shells (e.g. clams and mussels).

Some invertebrate groups have only one species, while others like the Arthropoda (includes all Crustacea and Insecta) with over a million species constitute more than 80% of all described animals.

Invertebrates come in many different forms across a range of ecosystems; from estuaries at the coast (*Section 3.3*) to far offshore in the deep, open ocean and from within the soft sediments on the ocean floor (*Section 3.9*) floating on the sea surface. In the coastal and marine realm there are more groups of invertebrates than in terrestrial ecosystems.

Invertebrate organisation

Classification

Living organisms are organised according to various criteria. The earliest method of classification developed by Linnaeus in the 1800s, was based on a species' appearance or morphology. With modern technology animals can now be classified at the molecular level using genetic and chemical analysis techniques. The highest level of invertebrate organisation is the Phylum which is differentiated according to embryonic development and how the body is organised as an adult. There are 16 such invertebrate Phyla found in coastal KZN.

Sand prawns emerging from a marine sediment sample.

Photo: Fiona MacKay

Invertebrate Phyla found in coastal KZN	
Phylum	Typical KZN coastal examples
Porifera	sponges
Cnidaria	jellyfish, bluebottles, sea anemones, corals
Platyhelminthes	flatworms
Mollusca	clams, mussels, nudibranchs, octopii, squid
Arthropoda	crustaceans e.g. copepods, amphipods, barnacles, shrimps, crabs, lobsters.
Annelida	insects e.g. shore flies; segmented worms e.g. bristle and mussel worms
Echinodermata	sea stars, urchins, brittle stars, feather stars, sea cucumbers
Urochordata (not a true invertebrate)	red bait, sea squirts

Lifestyle category

With such a range and diversity of marine invertebrates, scientific classification may not always be helpful to understand these animals. Where different organisms exist in the same habitat and have similar survival strategies, it is useful to classify these according to their lifestyle. Hence Plankton are the passive drifters in ocean currents and include animals or zooplankton such as copepods which are permanent residents in plankton or larval phases of other species which adopt other lifestyle categories at later stages. Nekton are active swimmers and are mostly fishes but do include some invertebrates such as squid. All other invertebrates are associated with the seafloor and are the Benthos (collection of organisms living on or in the sea bottom). Benthos are either sessile (attached to reefs) or active moving invertebrates. The Epifauna are animals such as crabs that live on the seafloor and the Infauna are partially or completely buried including clams and tubeworms.

Ecological role

Invertebrates are also organised according to their role and function in an ecosystem. An important role of invertebrates no matter what habitat they occupy is that they are the "consumers". The most basic ecosystem plan has four parts: 1) a non-living or abiotic component (e.g. geology, water column chemistry, sediment type), 2) the producers (e.g. phytoplankton – small plants in the pelagic layer), 3) the consumers (e.g. shrimps, worms, corals), and 4) the decomposers (e.g. bacteria). Most species fit into the ecosystem as something that consumes or is consumed. The higher the diversity in an ecosystem, the more stable and resilient it is. Thus, when organisms eat a variety of foods, the loss of one type of prey is not as devastating to the overall ecosystem.

Why diversity counts

South Africa is recognised for its spectacular diversity. Eighty percent of animal species described thus far are invertebrates, with 75% being from five Phyla.[1] By far the most species-rich are the Mollusca (3 154 species) and the Arthropoda (2 451 species).[2]

Studies conducted in South African waters have concentrated mainly on the West Coast but given that marine fauna become progressively more species rich towards the sub-tropical East Coast,[3] true diversity of the KZN coast is estimated to exceed the West Coast. Knowledge of the biology and distribution of invertebrates is constrained by the fact that many species still remain to be formally described. The imperative to preserve biological diversity is based on the notion that a loss of biodiversity leads to a loss of ecosystem functioning, and a reduction in natural and economic goods and services that people rely on.

Invertebrate goods and services

Food and economic resources

Invertebrates form the basis of numerous valuable fisheries, providing employment and food security to many. Examples of such fisheries in KZN include coastal mussels, oysters and crayfish harvesting as well as industrial prawn and lobster fisheries offshore (see *Section 8.2*). Invertebrates also fulfil an important functional role in ecosystems by providing a food source for higher trophic level consumers such as linefish.[2]

Indicator species of environmental change

Because many invertebrates are sessile and can't readily escape unfavourable environmental conditions, many make good indicators of environmental change. Trends in their abundance or reproductive rate are examples of how invertebrates can be used to monitor pollution and habitat modification.[4; 5; 6]

Habitat modifiers and creators

Some invertebrates are excellent habitat modifiers or create habitats themselves. For example, stabilising sediments by

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marine tube worms or the burrowing and pumping at the sediment-water interface by sandprawns, creates a habitable environment that allows settlement of other types of fauna.[7;8] Examples of habitat creators are the reef building invertebrate species such as corals. Our own KZN coral communities are marginal in that they are higher latitude, thus slow growing and not of the true reef building nature (*Section 3.8*). However, species such as brain and staghorn corals do create important localised new habitat for settlement of other reef-associated invertebrates.[9]

Invertebrate habitats and habitat connectivity

Invertebrates occur in all coastal and marine ecosystems of KZN. Typical examples include coastal lakes where relic estuarine micro-crustaceans are found, estuaries that are home to sandprawn, mudprawn and bristle worms and mangrove forests offer shelter to fiddler crabs and snails. Sandy beaches provide refuge to mole crabs, beach lice, ghost crabs and plough shells and rocky shores are home to urchins, starfish, barnacles, mussels, crabs, whelks, and limpets. Brittle stars, crustaceans, snails, clams, bristle worms and seapens can be found in the seabed; while subtidal reefs offer refuge to hard and soft corals, seafans, sponges, shrimps, reef worms and sea anemones to the continental shelf edge and beyond. The expanse of water above is the pelagic environment where zooplankton such as opossum shrimps, jellyfish, arrow worms and micro-crustaceans can be found.[10] Research has revealed that many of these ecosystems are linked not only as a result of movement of water carrying food and nutrients but also of eggs and larvae of invertebrates being freely transported between different ecosystems.[11] Understanding this coastal-marine habitat connectivity is a prerequisite for ecosystem based management including that of larger species such as line fishes, sharks and birds. The over-exploitation, damage and removal of one habitat may have detrimental impacts upon others.

In KZN, an example of coastal-marine connectivity was demonstrated by a study using molecular (isotope) signatures that showed that suspended riverine organic matter flowing out of estuaries from the coast and out to sea plays an important role in sustaining coastal filter-feeding organisms dominated by red bait, black mussel, and Cape and Natal rock oysters.[12]

Invasive species – a growing threat

While connectivity between ecosystems is a natural and desirable phenomenon, there is growing concern about the artificial introduction of species through human activities. Such species can become invasive and pose a threat to local biodiversity. Marine introduced species have been found in all marine and estuarine systems surveyed to date in South Africa, inclusive of the open coast.[13] Here, invertebrate species predominate the marine invasives with: Crustacea (33 species), Mollusca (22 species) and Cnidaria (16 species), as well as 18 species of sea squirts.

Invertebrates dominate the animal kingdom and underpin the diversity of life on Earth. From the minuscule to the giant squids, they play an important ecological, economic and social role – ignore them at your peril. ■

Photo: Fiona MacKay

Tiger prawns are large marine invertebrates that require access to coastal habitats to breed.