

**Most MPAs have a primary, if not openly stated, goal of biodiversity protection and maintenance of whole and functioning ecosystems. The terminology involved is not always easy to understand although the underlying concepts are important. This sheet explains some of the more common terms and describes how the concepts relate to management.**

The term biodiversity, coined as recently as 1986, is short for biological diversity, which means the variability among and between living organisms and the ecosystems of which they are apart. It includes plants and animals at the gene and species level, the habitats and ecosystems that they form or are part of, and the ecological processes that support them. Biodiversity includes common and alien species, as well as threatened, endemic and rare species (see sheet H1). One can talk about the 'biodiversity' of a location, a country, a continent or the world.

Global, regional and national assessments show that biodiversity is declining dramatically. The World Summit on Sustainable Development in 2000 adopted the goal of securing, by 2010, a 'significant reduction' in the rate of biodiversity loss. Protected areas are a vital mechanism for achieving this. Placing them in areas of high biodiversity, makes conservation more efficient as many species and ecosystems can be managed at one time. Many MPAs in the WIO are thus located in areas of high biodiversity.

## SPECIES

A species is the fundamental unit of biological organisation. Individuals in the same species are genetically similar, look the same, and normally reproduce viably only with each other. The ocean has fewer species than does the land, with about 250,000 known marine species compared with 1.5 million terrestrial species. However, marine diversity is much greater than terrestrial diversity at higher taxonomic levels (phyla and classes), with 36 of the 37 animal phyla found in the sea, 18 of which are entirely marine. In the WIO, 28 phyla are marine (11 exclusively so), and of the larger creatures, over 1mm in size, there are estimated to be at least 11,000 species.

Two coral reef areas of the WIO are considered globally significant (or 'hotspots') because of their species richness and endemism – the Southern Mascarenes (Mauritius, Réunion and Rodrigues), and waters and shores off eastern South Africa. Marine waters of the WIO in general have high species diversity, typical of tropical regions.

## ECOSYSTEMS

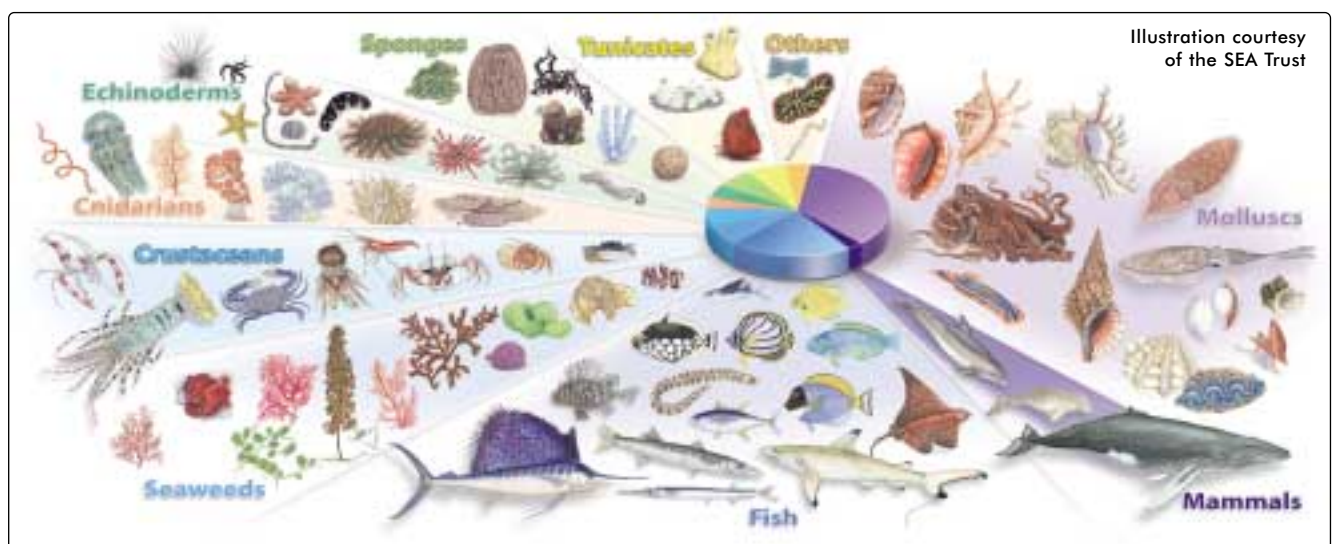
Ecosystems are communities of organisms, together with their habitats, that can be defined by certain features and characteristics, and that function as an integrated unit. Ecosystems comprise many species, including humans, all playing different roles. A habitat specifically refers to the area occupied by a particular species or group of species. The terms 'habitat' and 'ecosystem' are often used interchangeably. For example, a mangrove forest, a coral reef, and a seagrass bed are all habitats for the characteristic species found within them. Equally, they are ecosystems as they function as whole systems. At larger scales, an area comprising linked mangroves, seagrass beds and coral reefs could also be considered an 'ecosystem' as each component is integrated through ecological processes (e.g. fish movement, nutrient exchange) taking place between them.

Other important concepts are:

**Ecosystem services** - The services provided by ecosystems that are of value to humans, e.g. food, water, shore protection, cultural values, regulation of climate.

**Ecosystem functions** - Ecological processes e.g. nutrient retention, succession, productivity, decomposition.

**Ecosystem health** - An ecosystem is considered healthy if it is stable, resilient to stress and continuously provides a particular set of services.



Biodiversity pie-chart, showing approximate proportions of the larger, shallow-water, marine life in the WIO.

**Ecological or ecosystem integrity** - The ability of an ecosystem to support and maintain a viable community over the long-term, with species composition, diversity and functional organisation appropriate for its location, and the full range of native species and supporting processes.

The main coastal and marine habitats and ecosystems in the WIO are coral reefs, mangroves, seagrass beds, estuaries, lagoons and other coastal wetlands, small islands, beaches and coastal dunes, rocky shores, and the offshore pelagic and deep sea ocean. Coral reefs tend to attract most attention, but all ecosystems in an MPA must be managed, including the less appealing ones such as muddy bays!

## ECOREGIONS

An ecoregion is a biogeographic unit of land and/or water that includes a range of ecosystems, is relatively large, but can be characterised by distinct features. The WIO includes two ecoregions as defined by WWF: the East African Marine Ecoregion (EAME) along the mainland coast, and the Western Indian Ocean Marine Ecoregion (WIOMER) including the islands. A biome is an even larger ecological unit, generally defined by climatic regime; the ocean is often considered a single biome.

## MANAGING BIODIVERSITY

Protection and management of individual biological elements (e.g. threatened species, sensitive habitats, and target fishery species) has not been very successful in ensuring biodiversity conservation and maintaining productivity. Although small changes in the species that make up an ecosystem may only slightly alter how well it functions and the services it provides, some species – called keystone species – play unique roles, and their loss can have catastrophic repercussions. As more species are lost, there is greater risk of an ecosystem's functions and services being damaged or lost. Ecosystems, even more so in the oceans than on land, are linked through a complex web of direct and indirect interactions, including nutrient exchange, migration, and predator-prey interactions. Disruption of any of these processes in one ecosystem can have a negative impact on others.

The 'ecosystem approach' can help to address this. Defined as 'the integrated management of land, water and living resources to promote conservation and sustainable use of biodiversity in an equitable way', it is endorsed by many international agreements including the Convention on Biological Diversity and the FAO Code of Conduct for Responsible Fisheries. It recognises that humans are an integral part of biodiversity and that without effective management of ecosystems, sustainable development will not be possible. 'Ecosystem-based' management of fisheries recognises the interdependence of species and their habitats, the importance of healthy ecosystems for healthy fisheries, and the impact of fishing not only on target species but also on the habitats on which they depend. It thus recognises the need to halt damaging fishing methods and overfishing of predators and keystone species in order to prevent habitat damage and alterations to community structure.

## KEY POINTS FOR THE MPA

- ❑ Carry out baseline assessments of all the main species and ecosystems of an MPA and ensure that the basic principles for their management are understood.
- ❑ Choose indicators for monitoring programmes that represent the broader concepts of biodiversity and ecosystem health (see sheet G1).
- ❑ Promote the concepts of biodiversity health and ecosystem integrity using simple, clear language and minimal jargon.
- ❑ Understand the ecological linkages with other MPAs, including in adjacent countries, and encourage the management of MPAs as a 'system'.

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