

## The local coastal and marine environment



Artificial reefs are increasingly being deployed to enhance marine life by compensating for the loss of other habitats, although their success in achieving such aims is still under review - the author is seen diving on one such reef site off Cesme in Turkey.

Our island status is an advantage to study the coastal and marine environment. In fact, with a coastline stretching for over 250 km and a less than 100-metre-deep marine area which is ten times the terrestrial area, the Maltese Islands must be considered as a top billing when it comes to the study of coastal and marine biology.

This blessing is further bolstered by the fact that the islands are in the Mediterranean, a sea rich in marine biodiversity. Although the monk seal (bumerin - *Monachus monachus*) has long deserted our coastlines and no turtle-nesting beaches are found locally, our waters can still be considered as a treasure trove of life - in concert with the Johannesburg declaration (2002) of 2005-2014 as the Decade for Education on Sustainable Development, a greater recognition by the public of our coastal and marine resources is being promoted by an innovative marine course offered by the Foundation for International Studies (FIS) in Valletta.

Although making up just 0.7 per cent (2.5 million sq km) of the world's seas, the Mediterranean is home to an estimated 12,000-15,000 marine species, of which about 5,000 are estimated to be in our waters, and has a 47,000-km-long coastline, of which more than half (25,000 km) is already under concrete. There are over 630 fish species in the Mediterranean; there are about 1,300 species of molluscs, 400 species of crustaceans while there are only five kinds of phanerogams (i.e. seed-bearing plants).

A fifth of the marine species recorded in the Mediterranean are considered endemic to this sea, including *Posidonia oceanica* - the percentage of endemism within every taxon (hierarchical group of related species) is highest for vertebrates and sponges (51 per cent).

The Mediterranean is considered an oligotrophic sea, in view of the paucity of nutrients in the water column (arising mainly from the relatively few large rivers which empty into this sea) - where upwelling takes place (e.g. the Gulf of Lyons and off the western coast of Greece), nutrient concentrations are bolstered and can sustain more plankton, which, in turn, can sustain large fish and megafauna populations. Although the majority of Mediterranean marine species have an eastern Atlantic affinity, the proportion of tropical Indo-Pacific species is increasing recently due to a warming of surface sea temperatures leading in turn to a tropicalisation of the Mediterranean. The Suez Canal is the main avenue for introduction of such tropical 'alien' species. The distribution of biota within the marine environment is determined through an interplay of various factors, namely light penetration and intensity, salinity, nutrients, substratum, temperature

Protected (at a regional and local level) marine species include the endemic topshell species *Gibbula nivosa* (Maltese topshell - *Gibbula ta' Malta* - used in the past for necklaces), the fan mussel (*Pinna nobilis* - *Nakkra tal-harira*), the fascinating mollusc Triton's Trumpet (*Charonia variegata* - *Bronja tal-Mithna*), the coral species *Astroides calycularis* (star coral - *qroll tad-dell*) and *Corallium rubrum* (red coral - *qroll ahmar* - still used for jewellery) and the echinoderm species *Ophidiaster ophidianus* (violet starfish - *stilla hamra kbira*) and *Centrostephanus longispinus* (long-spined sea urchin - *rizza tax-xewk twil*) and the keystone species *Posidonia*

oceanica (Neptune grass - alka, which is quite a misnomer since the species is a flowering plant).

The restricted area of our islands, coupled with a burgeoning population and tourist density, ensure that local coastal and marine natural resources face many threats and pressures. In fact, about 45 per cent of the Maltese coastline is accessible (mainly on the eastern side of the islands) and, of this, 96 per cent is dominated by tourist and industrial development. This sets the stage for a number of land-use conflicts, whose resolution is addressed through tenets of ICZM which embodies principles such as stakeholder involvement, etc.

Just 2.4 per cent of our coastline consists of sandy beaches, an anomaly considering that beaches constitute an estimated 50-66 per cent of the global coastline. In addition, local beaches are considered to be pocket beaches, since they are flanked by headlands which restrict the long-shore transport of sediment between beaches.

Local sand is also mainly calcium carbonate in composition, indicating the importance of the terrestrial sediment input to our beaches. Sandy beaches can be understood in terms of the interaction between wave exposure, tide ranges and sediment characteristics, known as beach morphodynamics.

Since the coast is a transition zone (much like estuaries between freshwater rivers and the sea), it is characterised by a very harsh environment, survival within which necessitates the possession of the appropriate morphological, behavioural and physiological adaptations by resilient coastal species.

These include halophytic (i.e. salt-tolerant) and xerophytic (drought-tolerant) adaptations, such as the extrusion of excess salt (e.g. by *Tamarisk africana*), the possession of thick, waxy cuticles, the reduction of the leaf surface area, adequate osmolytes to maintain a constant internal osmotic potential, a firm holdfast to attach the substratum in case of strong wave action and the possession of succulent tissue.

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