
Fig 2a


Fig 2b

What Lies Beneath Biodiversity In Raffles Marina


Fig 2c


Fig 2d

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The demand for seafront living and marine recreation in Singapore has resulted in the transformation of natural shores to human-modified ones such as marinas and coves. Such development impacts on the original marine biodiversity of the previous natural shores but the modified environment does not necessarily mean the end of marine life. The new environment could still support and sustain diverse biological communities.

This was evident when a team of marine biologists from the Reef Ecology Laboratory of the National University of Singapore began their biodiversity surveys at Raffles Marina in November 2012. This marked the start of a two-year project supported by the National Parks Board that is aimed at establishing the biodiversity existing both within and outside marinas in Singapore. The information gathered will be useful in profiling the role that marinas can potentially play in contributing to the City Biodiversity Index. Interesting results have since been obtained in the course of the team's on-going work at Raffles Marina.


Fig 1a


Fig 1b


Fig 1c


Fig 1d


Fig 1e


Fig 1f

Fig. 1. The Ekman grab (a) and sieving station (b) are used to survey the soft bottom sediment. Animals that live in the soft bottom sediment of Raffles Marina include segmented worms (c), brittle stars (d), crabs (e), and bivalves (f).

Biodiversity in the soft bottom sediment

The bottom soft sediment harbours a myriad of fauna that can only be extracted with the use of specialised equipment. Sediment is obtained from selected locations with an Ekman grab, which resembles a pair of metallic jaws that clamp shut when triggered at the seabed (Fig. 1a). The collected sediment is then put through a series of sieves of decreasing pore size to separate out the animals from the sediment grains (Fig. 1b). As many of the animals are no larger than a few centimetres, they have to be brought back to the laboratory for identification under the microscope. Segmented worms comprised the majority (66%) of organisms in the soft bottom sediment, followed

by brittle stars (13%) and marine snails (7%) (Figs. 1c-f). A higher species diversity was recorded within the marina than just outside it. Additional surveys will continue to investigate whether the soft bottom community exhibits seasonal changes.

Biodiversity on the pontoons

The pontoons are encrusted with an assortment of marine life. Surveys involve snorkelling beside the pontoons and taking photographs to quantify the biodiversity growing on them. Ninety species of flora and fauna have been identified. Thirty-five percent of the pontoons are covered by algae, followed by sponges (13.5%), bivalves (7.8%) and soft corals (7.5%) (Fig. 2). However, suspended sedimentation levels within the marina are moderately high, resulting in some sessile organisms and pontoon surfaces being smothered.

Fig. 2. Flora and fauna on the sides of pontoons at Raffles Marina: branching soft corals (a), sponges (b), sea squirts (c), juvenile fish among green bubble algae (d), filter-feeding sea cucumber (e), and sea urchin (f).

Biodiversity in the water column

The various structures in the marina create a range of microhabitats that help to host a wide assortment of pelagic animals. These include the gaps between and under the pontoons, among the cables, as well as on the concrete seawalls. The animals, mostly fish are best observed with the use of traps ('bubus') and diving surveys. Trials involved securing 'bubus' to the underside of pontoons and on the seabed. This enabled the researchers to photograph them quickly before release. More traps will be deployed in the subsequent months to obtain an indication of the biotic assemblages at various locations in the marina. In addition, scuba diving also allowed the researchers to observe animals that moved about in the water column or on the seafloor (Figs. 3e-j).

The observations thus far indicated that the marine life in a modified environment such as that of a marina can be surprisingly diverse, indicating that this type of coastal transformation can enhance rather than reduce marine biodiversity.

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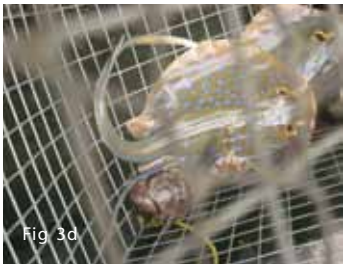

Fig. 3. Animals caught in traps and released after being photographed: eel-tail catfish (a), thunder crab (b), copper-banded butterflyfish and leatherjackets (c), blue-spotted stingrays (d); and encountered while diving in Raffles Marina: jellyfish (e), sea snake (f), flatworm (g), schooling fish (h), sea cucumber (i), red swimming crab (j).