

# The Marine Biodiversity of Raffles Marina

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Singapore's natural shores have to a large extent been replaced by various types of coastal development. It is commonly accepted that such development is detrimental to marine life as habitats get obliterated. However, unlike a plain seawall with few features to attract species, marinas offer a diverse mix of structures like pilings and floating pontoons that create a variety of environmental conditions, which could favour different species.

A two-year project, conducted by marine biologists from the National University of Singapore and funded by the National Parks Board, ended in October 2014. It aimed to assess the biodiversity within marinas and determine whether they can serve as sanctuaries for marine life. Raffles Marina is one of the three marinas (the other two are Marina at Keppel Bay and One°15 Marina Club) that willingly partnered this initiative and the researchers are grateful for such support that contributed to the entirety of the study.

The project surveyed marine life in the seabed, on the berthing pontoons, and in the waters within, and surrounding each marina. The biodiversity assessment for Raffles Marina is reported in this article. One interesting aspect was the mass fish kill in February 2014 caused by a heavy plankton bloom and it provided the opportunity to assess the recovery of marine life and the role of the marina in that recovery.

The survey showed surprisingly diverse communities of marine life in Raffles Marina. Fifty-two species of small animals such as polychaetes (segmented worms, 82.4 percent), arthropods (e.g. crabs, shrimp; 9.0 percent), echinoderms (e.g. sea cucumbers, brittle stars; 4.2 percent), molluscs (e.g. bivalves, snails; 4.0 percent), and other animals (e.g. small fish; 0.5 percent) were documented from the marina's seabed. In addition, 90 species including algae (27.0 percent), sponges (10.8 percent), bivalves (9.4 percent), soft corals (7.0 percent) and sea squirts (4.0 percent) grew on the sides of the berthing pontoons. While these organisms appear inconspicuous, they have important roles in providing food and shelter for other animals (e.g. larger fish, shorebirds and monitor lizards) and are vital to maintaining biological processes such as nutrient cycling.

From November 2013 to February 2014, traps were deployed at various locations within and beyond the marina for a catch-and-release assessment of fish species. The trapped fishes were photographed, weighed, identified and released immediately. Species such as the fan-bellied filefish, streaked rabbitfish, painted sweetlip, and striped eel catfish were common (Fig. 1). Fish abundance within Raffles Marina were twice that beyond and species diversity was more in the marina (29) than beyond (26). Apart from fishes, other organisms including horseshoe crabs, prawns and cuttlefishes were caught in the traps and recorded.



Figure 1. Fishes common within Raffles Marina. Fan-bellied filefish (top left), striped eel catfish (top right), streaked rabbitfish (middle left), painted sweetlip (middle right); next page: orbicular cardinalfish (left), green chromide (right).





An unfortunate Harmful Algal Bloom (HAB) event occurred suddenly in February 2014 and severely affected marine life within Raffles Marina and the vicinity. Hundreds of dead fish floated on the water, which had an unusual dark brown colour and offensive odour. Common species such as the green chromide, and even rarely encountered ones such as the bluering angelfish (Fig. 2), were in various stages of decomposition.

This unexpected decimation of marine life interrupted the fish survey programme but presented the research team the rare opportunity to study the responses of the fish communities after an impact of such magnitude, as the ecological consequences of HAB events are not well documented within the region.

The fish catch-and-release programme resumed and was extended to follow up on the recovery. The survey indicated that fish abundance and species diversity within the marina reduced by 50 percent two months after the HAB event but gradually increased in the following months to full recovery by the seventh month (September 2014).

Beyond the marina, fish communities were less affected and there was no significant decrease in number of individuals and fish species trapped. The extended survey increased the total number of species found inside the marina to 42. Interestingly, more fishes were caught within the marina than beyond despite the severe impact of the HAB. These observations indicated that the marina played an important role of supporting the nearshore fish communities in the Johor Straits.

The findings from this two-year study showed that rather than displacing marine life, marinas can host appreciable levels of biodiversity and offer some resilience to environmental disturbances. The modified marine environment of marinas can serve as a refugia for marine life and underscores their invaluable contribution to conserving biodiversity in this highly urbanised city. ⚓



Figure 2: Common species such as the green chromide (left) and rare species such as the bluering angelfish (right) could be seen floating on the water surface on 11 Feb 2014.