Coral reefs: Aspects of management, conservation and restoration
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Chapter 8

SUMMARY

The analysis of the *Stylophora pistillata* populations, at the two reef sites open to human activities versus the one protected through a small-scale closure policy demonstrated the importance of applying basic research and long-term monitoring in order to critically evaluate management strategies. The low colony breakage levels and the high abundance of the adult size-classes recorded in the population at the protected site were logically caused by the deployment of the ‘no-use’ zone policy. The high levels of colony partial mortality recorded in the closure site, and the temporal fluctuations in colony size-frequency distributions and living area coverage observed at all three studied sites, however, indicate that ‘no-use’, or protected area management, does not suffice to protect coral populations from the impact of environmental effects such as pollution. The magnitude of physical damage and coral loss of *S. pistillata* colonies at the Eilat reserve recreational sites, and their altered population structure, unequivocally point to major deficiencies in the conservation agenda that demand a sufficient solution.

The results of the coral mariculture study demonstrated the potential of coral farming as a tool to assist in ecological restoration of degraded coral populations. Through the combination of *in-situ* and *ex-situ* gardening techniques, and the integration of formerly neglected aspects such as colony pattern formation into the concept of restoration, coral nurseries can produce new colonies ready for transplantation as rapidly as two years from initiation. From a management perspective, the mariculture approach—the establishment of cultivated, protected coral stocks can serve as a work frame, or a platform for the design of well-considered, active restoration programs (such as transplantation). Strategically, maintaining large, self-sustained coral production pools will considerably improve current transplantation techniques, primarily by dismissing the need to inflict additional damage to donor reef sites prior to each transplantation operation. From a biological point of view, coral nurseries are of considerable importance. They assist in improving local levels of recruitment and in maintaining local genetic diversity that otherwise would be lost under conditions of increasing anthropogenic disturbance. This is because maricultured propagules (colony fragments, laboratory settle larvae) are
transplanted back into the reef while their original colonies might have succumbed to perturbations.

The complete absence of the adult size classes in the *S. pistillata* populations at the recreationally abused reef sites of the Eilat reserve indicates a lower reproductive output and reduced persistence. These populations probably receive considerable larval input from the up-stream situated protected site, which prevents further decimation. The protected site, however, also suffers high levels of partial colony mortality (most probably due to exposure to pollution). This raises the suspicion that a decrease in the reproductive output of the protected site population will further affect the already deteriorating populations at the open sites. The management agenda of the Eilat Coral Reef Reserve should provide some assurance against these odds. The problem is that the implementation of additional restrictions on tourism or the creation of buffer zones are not possible due to the limited size of this reserve. The practiced management agenda in the Eilat reef clearly does not meet the conservation goals of nature reserves. It is therefore essential to compensate for this reserve-ineffectiveness by actively sustaining recruitment and abundance of its coral populations. Coral *ex-situ* and *in-situ* mariculture techniques have the potential to answer these needs by successfully farming coral fragments, small colonies removed from disturbed sites, nubbins, and larvae into matured colonies in a size suitable for transplantation. Under conditions of continuous breakage damage and coral loss caused by recreational activities, replenishing degrading reef sites with grown maricultured colonies will underpin the persistence ability of abused coral populations. This will also assist in the conservation of other reef taxa depending on coral proliferation.

Development and conservation dilemmas are intensified on small sized and heavily used reef sites, and cannot be solved solely through the implementation of conventional protection measures. Adapting and developing techniques for active restoration of coral communities should now complement conservation agendas. The ‘Reef Gardening’ strategy, adapted from forest silviculture programs is an initial and important step in that direction. Realizing the importance of base-line research and the application of long-term monitoring to evaluate the effectiveness of implemented strategies in marine reserves is essential for the successful development of adaptive-management approaches.