

Rock anchoring in Karimun Jawa, Indonesia: Ecological impacts and management implications

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CORAL reefs everywhere are under increasing pressure from a suite of stressors. Recently, threats associated with climate change have been brought closer into focus and now dominate discussions and debate relating to the coral reef crisis (Hughes *et al.* 2003, Hoegh-Guldberg *et al.* 2007). Indeed, mitigating local stressors on coral reefs has been given less priority and publicity than the global need to reduce greenhouse gas emissions. Interestingly though, recent

surveys demonstrate that most reef scientists agree that coral reefs are under greater threat from impacts associated with human population growth, coastal development, and overfishing than from global climate change (Kleypas and Eakin 2007). This is especially true for the reefs in SE Asia and the Pacific, which make up the bulk of the reefs in the world (Bryant *et al.* 1998). In these areas, regulations to ensure that anthropogenic activities near and on coral

reefs are conducted sustainably, such as development, sanitation, fishing and even tourism; either do not exist or are rarely enforced due to a lack of resources. Here, we present one such example from Indonesia, one of the most densely populated countries in the world, a country where over 60% of the population relies in some way on marine resources.

Karimun Jawa Marine National Park is an archipelago area that includes 27

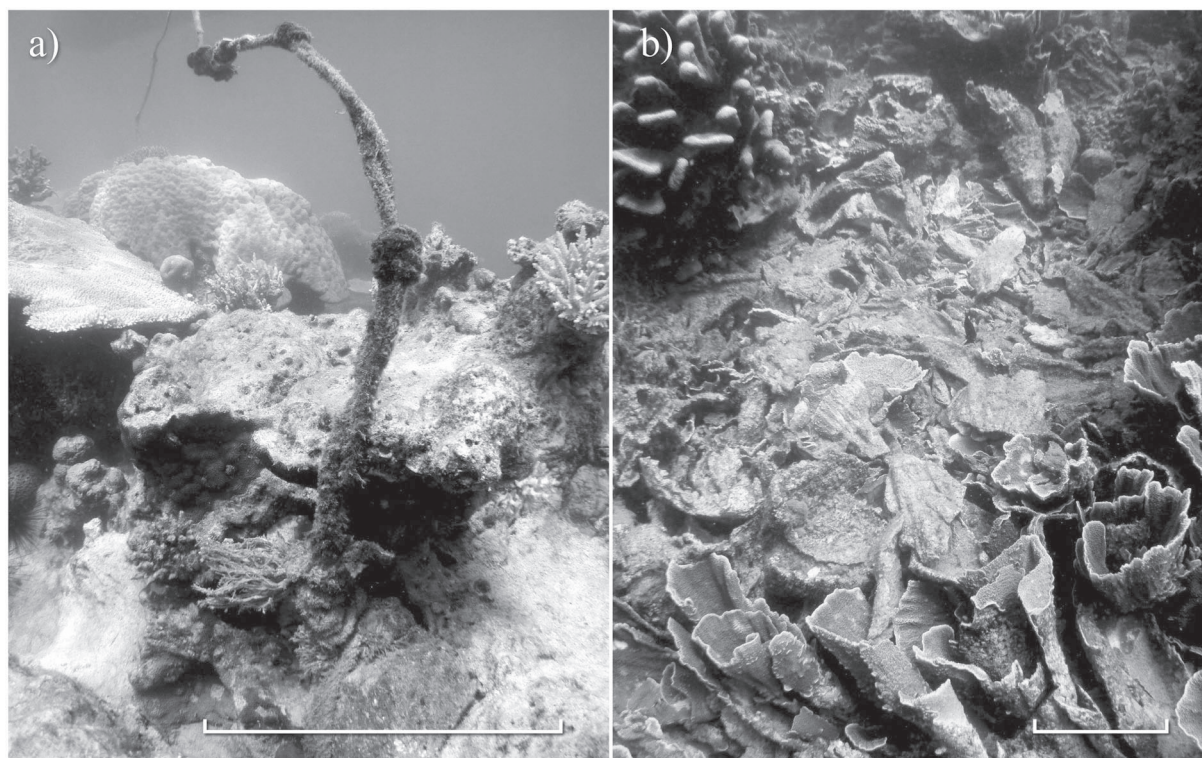


Fig. 1. Abandoned rock anchor (a) and characteristic scar (b). Scale bars equal 30cm.

coral islands located 90km northeast of Jepara in central Java, Indonesia. Within the Park, fishermen using rocks as anchors are destroying large areas of otherwise healthy reefs. Rock anchoring is far more damaging than any conventional anchor practice. Contrary to a reef-pick style anchor, a rock anchor rarely grips the bottom and, instead, produces a demolition trail across the reef as the boat above moves up and down in the swell. When a rock anchor eventually does get caught in a reef gully, the fishermen abandon the anchor, rope, and any tangled fishing gear endangering fish, turtles and boat traffic (Fig. 1a). As a result of rock anchoring, large (>2m², see Fig. 1b) swaths of reef in the area have been completely destroyed. In a survey of 15 sites across the Park, anchor damage was visible at all sites, but at 6 sites greater than 10% of the substrate was made up of these large scars — a large portion of the live coral cover at sites where coral cover ranges from 30 to 60%. Rock anchoring is used extensively in the area because granite boulders (each weighing around 10–12 kg) are readily and freely available as leftover infrastructure used to cultivate the red algae *Kappaphycus alvarezii*, a farming practice that is rife throughout the region.

Previous attempts by local managers to address the rock anchoring issue by installing reef protection markers, signage, and public moorings have all failed due to lack of compliance and theft of the buoys and ropes. Installing cheap and simple mooring

buoy systems such as plastic bottles tied with light line to popular reef sites could provide a sustainable solution. Simple mooring buoy systems, however, do not meet government regulations — the same regulations that have worked to ensure that the sturdy but valuable moorings previously installed were stolen in the weeks following installation. Such an approach would, therefore, require the regulations be changed or a special case be made just for the Park. Both are possible but would require lengthy resource-intensive processes by agencies and government departments characterized by a lack of resources.

Importantly, physical damage from rock anchoring reduces the potential value of reefs to a tourism industry in the region that has been slow to grow. Even so, and though changing government specifications for moorings is worth investigating, the practice of rock anchoring may not actually stop or be reduced until locals fully grasp the meaning and value of the concepts sustainability and conservation. Fully appreciating those concepts is likely to require that locals increasingly see economic value in live fish and reef habitat. Continuing to promote and potentially even subsidizing the tourism industry in the area could, therefore, form part of the answer. It is the aim of our working group to communicate these messages to local managers by building their capacity through: on-the ground training, the supply of information packages and education materials, and collabora-

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