

EarthTrends: Featured Topic

Title: **Coral Reefs: Assessing the Threat**

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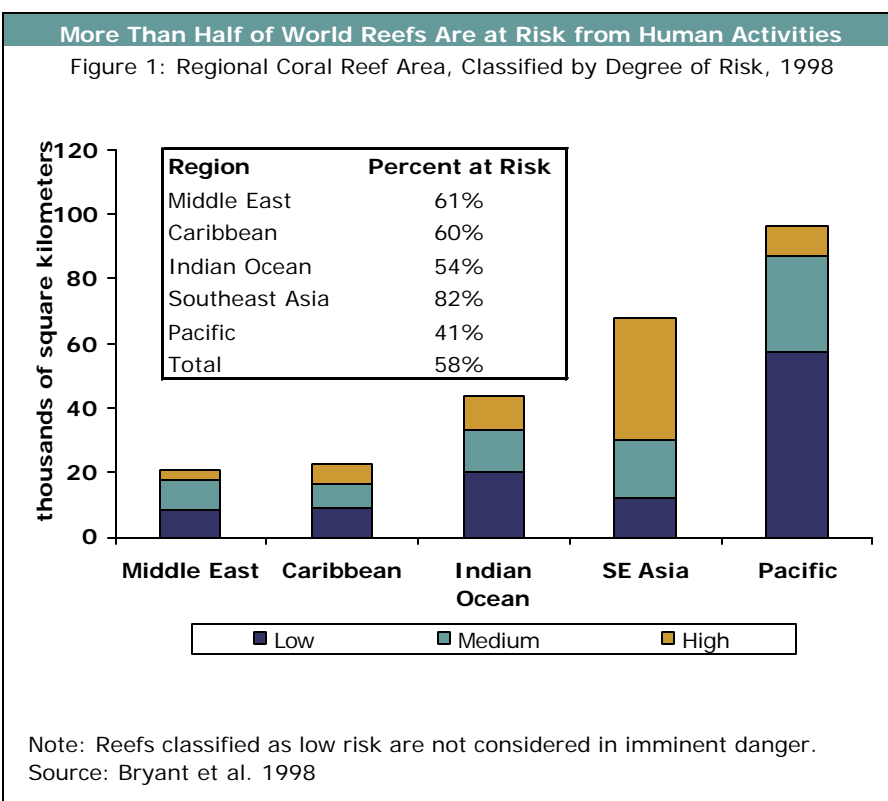
Around the world, coral reefs are under assault from a multitude of sources. Depending on their location, reefs have been damaged directly through harmful practices such as coral mining, fishing with dynamite, or overfishing; haphazard coastal development; or even careless pleasure diving by tourists. Reefs have also suffered indirectly from sediment from inland deforestation and removal of coastal mangroves; from industrial pollution; and from nutrient pollution contributed by sewage, fertilizers, and urban runoff.

Just how much reefs have suffered from these depredations on a global basis is not yet clear. Both anecdotal and scientific reports of reef damage have increased over the past 20 years, and reef specialists agree there is a serious global decline (Jameson et al. 1995:24). In 1992, Australian reef ecologist Clive Wilkinson estimated that approximately 10 percent of the world's reefs were already severely degraded; he predicted that figure would rise to 30 percent within the next two decades, with further losses continuing as populations in the coastal tropics surge (Wilkinson 1993:11-21). But these are just rough estimates,

based on expert opinion. To date, no survey of reef conditions has been conducted worldwide, so scientists do not know the actual condition of the vast majority of the world's reefs. In the Pacific, for example, 90 percent of coral reefs have yet to be assessed (Pennisi 1997:492).

Although definitive data on reef conditions are some years off, a preliminary analysis of current reef threats indicates that a high percentage of the world's coral reefs are at risk of degradation. The ongoing assessment, which is being

conducted by the World Resources Institute, the International Centre for Living Marine Aquatic Resources, and the World Conservation Monitoring Centre, looks at four broad categories of potential threat to coral reefs: coastal development, overfishing and destructive fishing practices, land-based pollution (especially sediment from deforestation and agriculture, and marine pollution from oil spills and the discharge of oily ballast water. The analysis, published in 1998, does not measure



actual reef conditions but estimates the threat to reefs based on the proximity and intensity of known risk factors, such as ports, urban centers, coastal population density, and land use patterns (Bryant et al. 1998). (See Figure 1.)

Key findings include the following:

- Globally, 58 percent of the world's reefs are at risk from human activities, with about 27 percent of reefs at high or very high risk.
- Significant regional differences exist regarding the degree of risk that coral reefs face. The reefs of Southeast Asia, which are the most species-diverse in the world, are also the most threatened, with more than 80 percent at risk, including 55

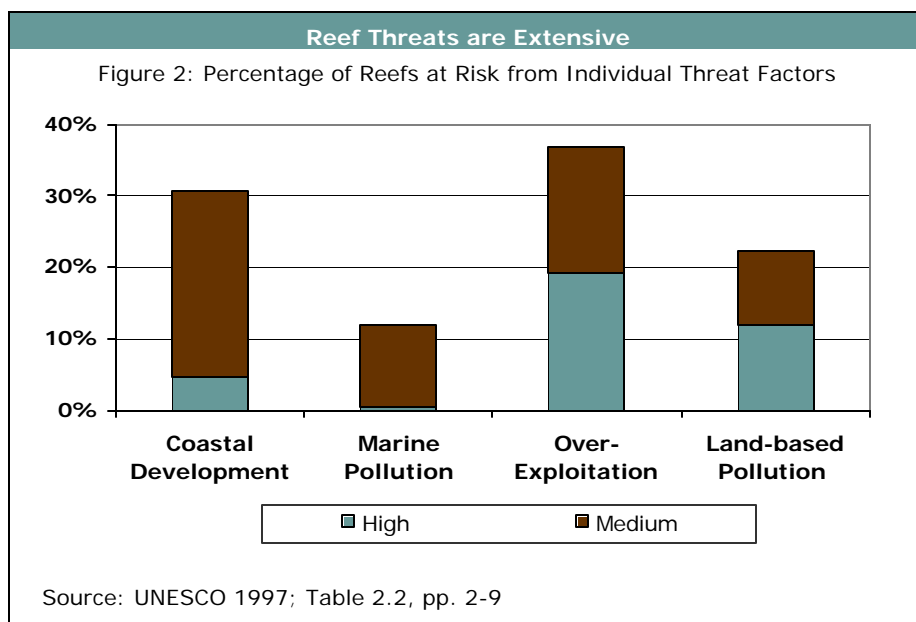
percent at high or very high risk. On the other hand, the reefs in the Pacific region, which contains more reef area than any other region, face comparatively less risk. Forty-one percent of Pacific reefs were classified as threatened, and just 10 percent face a high risk.

This ongoing assessment suggests that overexploitation (overfishing and destructive fishing practices) and coastal development pose the greatest potential threat to reefs, with each of these threats affecting about one third of all reefs (Bryant et al. 1998:6). (See Figure 2.)

Overexploitation of reef resources has several effects. Destructive fishing practices, such as dynamite or cyanide fishing and trawling in deeper waters, cause direct physical

damage to corals. The indirect effects of overfishing appear to be more widespread, although poorly understood by scientists. At a minimum, overfishing results in shifts in fish size and species composition within reef communities, which may precipitate large-scale ecosystem changes (Bryant et al. 1998:12).

In parts of the Caribbean, this process appears to have led to major changes in reef composition, particularly near Jamaica. Widespread overfishing in the region over many decades has led to very low levels of herbivorous fish, which normally play an important part in keeping algae from overgrowing reefs. In the absence of herbivorous fish, the role of keeping algae levels in check fell to a species of grazing sea urchin. When an epidemic nearly wiped out the beneficial urchins on Jamaican reefs in the early 1980s, algae quickly overgrew and killed the corals. Subsequently, hurricanes in the region reduced the now largely dead reef framework to rubble, with the result that living corals that used to cover half of the seafloor in the shallow nearshore waters off Jamaica now only cover 5 percent of the bottom (Hughes 1994:1547). Some scientists claim this is a harbinger of events to come as reefs around the world continue to be overfished. Others argue that these major ecosystem



effects may be reversible (Pennisi 1997:491-493).

Coastal development also gives rise to several harmful effects. Direct effects come from coral mining, shoreline filling for land reclamation, and harbor dredging. Indirect effects, however, are more pervasive. Algal blooms resulting from nutrient-laden sewage released nearshore can block sunlight in the water column, stunting coral growth and interfering with reproduction. Shoreline construction disturbs sediments, which smother corals. Warm water discharges from power plants and industrial effluents also take their toll (Richmond 1994:55).

Even tourism, where it is unregulated, can pose a threat. For example, recreational divers in the Gulf of Aqaba, a finger of the Red Sea, have caused considerable coral destruction through trampling and the dropping of dive-boat anchors (GEF 1996:3).

The prospect of widespread reef losses is particularly worrisome given the critical role they play in fostering the productivity of the tropical oceans. Coral reefs are often compared with tropical rainforests in terms of their importance as habitat and the biological diversity they harbor. Some 4,000 species of fish and 800 species of reef-building coral have been described to date, but the total number of species associated with reefs is probably more

than 1 million (Paualy 1997:302-304; Malakoff 1997:487).

Reefs are also an integral part of the livelihood and food supply of the human populations that live near them. It has been estimated that about one quarter of the potential fish harvests in developing countries come from coral reefs (Jameson et al. 1995:24). Properly managed, reefs can yield, on average, 15 tons of fish and other seafood per square kilometer each year (Cesar 1996:16). Reefs yield tourist dollars as well. Caribbean countries, which attract millions of visitors annually to their beaches and reefs, derive one half of their gross national product (GNP) from the tourism industry, valued at US\$8.9 billion in 1990 (Jameson et al. 1995:24). Reefs also provide essential services like coastal protection, buffering adjacent shorelines from erosive wave action and storm impacts.

Because reefs provide so many benefits, degrading them is costly. A recent study found that the costs of destroying just 1 kilometer of reef range from about US\$137,000 to almost US\$1.2 million over a 25-year period, just counting the economic value of fisheries, tourism, and shoreline protection (Barber and Pratt 1997:4).

The realization that reefs and their many benefits are increasingly in jeopardy has begun to prompt action at

many levels. The International Coral Reef Initiative (ICRI), started in 1995, stresses the need for integrated coastal management to minimize the detrimental effects of coastal development. The ICRI now boasts the participation of more than 80 nations and includes a major effort to monitor global reef conditions (the International Coral Reef Monitoring Network)—an essential component of any effort to manage reef impacts (Wilkinson 1997).

At the national and local levels, a number of governments and communities have taken steps to protect and restore coral reefs. In general, these examples of good stewardship involve a combination of planning, management, law enforcement, environmental education, and legal protection. Approaches range from building sewage and industrial waste treatment facilities, to regulating access and use of reefs (for example, by establishing community ownership over reef fisheries), to restricting development in sensitive coastal areas (Bryant et al. 1998:41-42).

Australia's Great Barrier Reef, the largest reef in the world, illustrates the potential of careful reef management. The reef remains in good condition, although sedimentation from runoff is a threat in some localized areas. Careful zoning of the reef—20 percent is protected, the rest is managed for multiple use—along with strict enforcement

and environmental education has preserved this globally important resource (Bryant et al. 1998:43-44).

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