Reducing diving impacts on coral reefs

The National Park System is home to many of North America's coral reefs, which are environmentally sensitive, ecologically diverse, and extremely popular. In Florida, reef destinations include Biscayne and Dry Tortugas national parks. The Virgin Islands host several units with coral reefs: Buck Island Reef National Monument, Virgin Islands National Park, Virgin Islands Coral Reef National Monument, and Salt River Bay National Historical Park and Ecological Preserve. War-In-The-Pacific National Historical Park is in Guam, and National Park of American Samoa is in American Samoa. Parks in Hawaii with coral reefs are Kalaupapa and Kaloko-Honokohau national historical parks.

Web sites tout snorkeling as "the best way to become familiar with the park's underwater world and all its resources" (e.g., http://www.nps.gov/viis/snorkeling.htm), and all National Park System units with coral reefs allow either scuba diving or snorkeling, or both. Many parks provide concessions for such activities.

As the ocean's equivalent of rainforests, coral reefs are home to 25% of all marine species, so their popularity is no surprise. However, according to the USGS Coastal and Marine Geology Program, many of these fascinating undersea worlds will be destroyed or significantly damaged in the next 20 years (http://coralreefs.wr.usgs.gov/). Reefs are in decline globally because of human-caused stresses, in particular pollution from sediment, chemicals, and sewage. Barker and Roberts (2004) documents another stressor, once thought to be benign—scuba divers. As the authors point out, "Minor damage and resuspension of sediment by most divers may seem trivial, but by compounding other reef stresses, they could undermine the resilience of reef ecosystems." In addition, studies have shown that pathogens or other invading organisms are more likely to infect damaged corals, which have a higher risk of mortality than undamaged colonies (Hall 2001). Though damage varies depending on the types of corals present, signs of damage from scuba divers include broken coral fragments, and dead, reattached, and abraded corals.

In an attempt to quantify damage and seek ways to reduce it, Barker and Roberts (2004) documents observations of 353 divers over 26 weeks during two periods—high and low tourist season. As incognito divers, investigators recorded information about 12 independent variables; multiple regression analysis using these variables confirmed that dive type, photography, and intervention status contributed most strongly to explaining contact rate (Barker and Roberts 2004). Dive leaders were aware of the study but were asked to not publicize the information. If a visitor inquired about an observer's note taking during a dive, they were told that researchers were collecting data about fish and corals for the Soufrière Marine Management Area, Saint Lucia, in the Caribbean, where the study took place.

Before the dive, investigators randomly selected divers to be observed; targeted divers included photographers and non-photographers, men and women, first-day divers and second-day (or more) divers, and both cruiseship and hotel visitors. During the dive, investigators recorded each contact and the number of minutes into the dive at which the contact occurred, what part of the diver was involved in the contact, whether the contact was intentional or not, what part of the reef was affected, and the consequence of the contact (i.e., minor damage [touch or scrape], major damage [breakage], and suspension of sediment).

Results showed that the majority of divers (73.9%) did make contact with the reef, with the greatest number of contacts occurring during the first 10 minutes of the dive. Most of the contacts were unintentional (81.2%) and caused minor damage (79.8%), though a small proportion (4.1%) caused major damage. Nearly half of the contacts (49.0%) resulted in suspension of sediment. By far the most common type of contact was fin kicks (81.4%), followed by touching and holding with hands (10.1%). Night dives had more than double the contact rate compared to day dives, which is a conservative estimate because reduced visibility limited the ability of the researchers to make observations. Moreover, more contacts were made during dives that originated from shore (97.9%) than dives where entry was from boats (65.0%). Investigators surmised that this was largely because divers swam across a sandy, shallow area at the beginning and end of the shore dives. The authors suggest that to avoid this particular contact, managers could place buoys to mark where divers should begin descending and ascending.

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Another significant outcome of the study was the realization that photographers contacted the reef much more frequently that non-camera users, with "specialist" and "non-specialist" photographers (determined by the type of equipment used) being equally damaging. On average during a 10-minute period, photographers caused 3.8 contacts and 0.4 breaks as compared to divers without cameras causing 1.1 contacts and 0.04 breaks. Contact by camera users typically occurred as photographers steadied themselves by holding onto and kneeling on the reef to take pictures.

As observed during this study, the primary means for reducing damage was intervention by dive leaders at the time of contact. This reduced average rates from 11.6 to 2.4 contacts per 40-minute dive. As part of the study, dive leaders included a statement in pre-dive briefings about not contacting the reef; this had no effect on contact rate. Other studies have shown that intensive briefings—45-minute sessions that cover reef biology, damage caused by divers, the difference between reef cover and non-living substrate to illustrate areas that could be touched safely, and the concept of protected areas—followed by in-water demonstrations decreased damage during dives (Medio et al. 1997); nevertheless, this type of education program is rare. Barker and Roberts (2004) found that pre-dive briefings typically last only a few minutes and often do

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not include how to avoid damaging reefs. Hence, the study concludes that ensuring that dive leaders intervene underwater, as well as lead by example in keeping fins and equipment clear of the reef will reduce diver damage. Additionally, extra vigilance at the beginning of dives, on night dives, and toward camera users will result in substantial reductions in damage to coral reefs.

Reference Cited

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