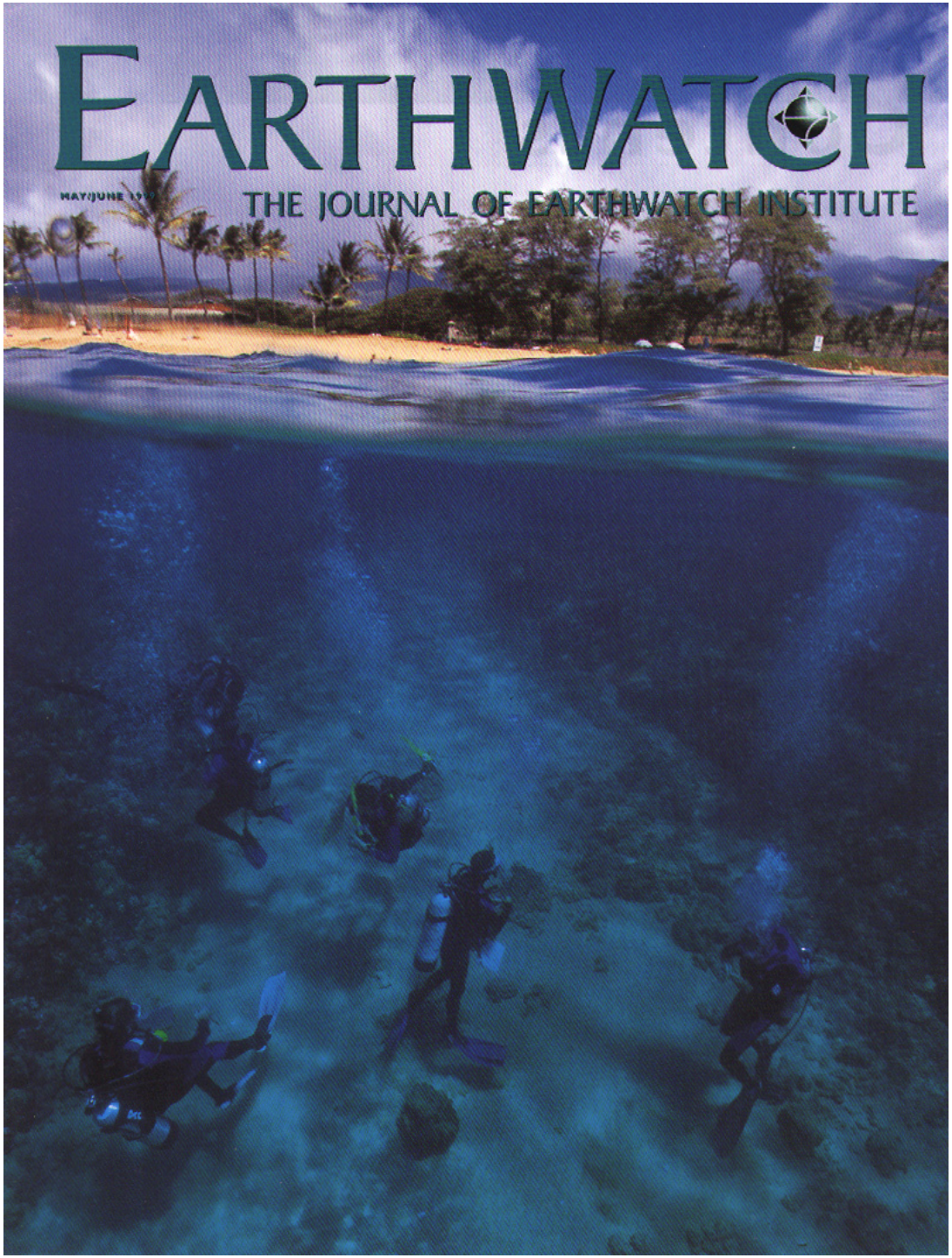

EARTHWATCH
MAY/JUNE 19
THE JOURNAL OF EARTHWATCH INSTITUTE

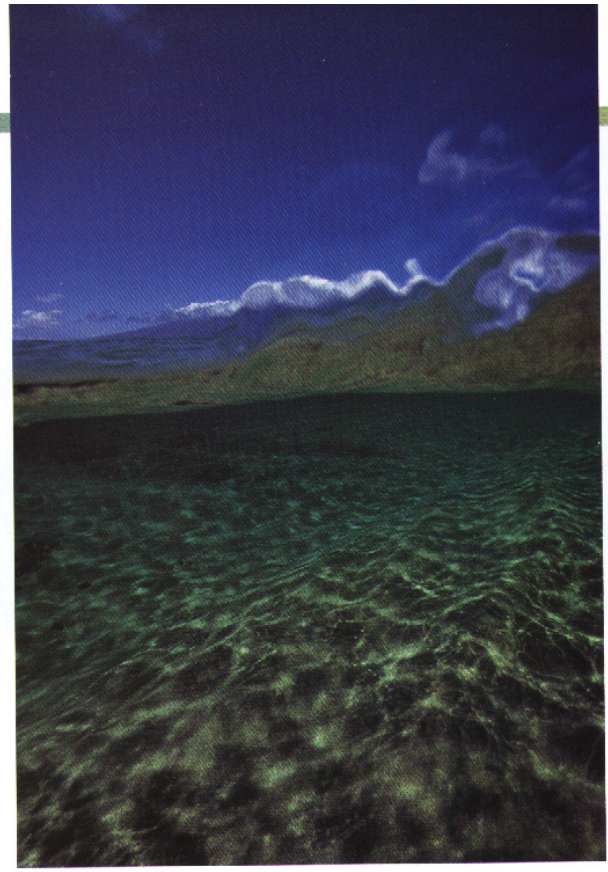
Snowflake Moray eel, *Echidna nebulosa*.

REEF ROULETTE

Coral reefs on the island of Maui take their chances amid an onslaught of environmental variables.

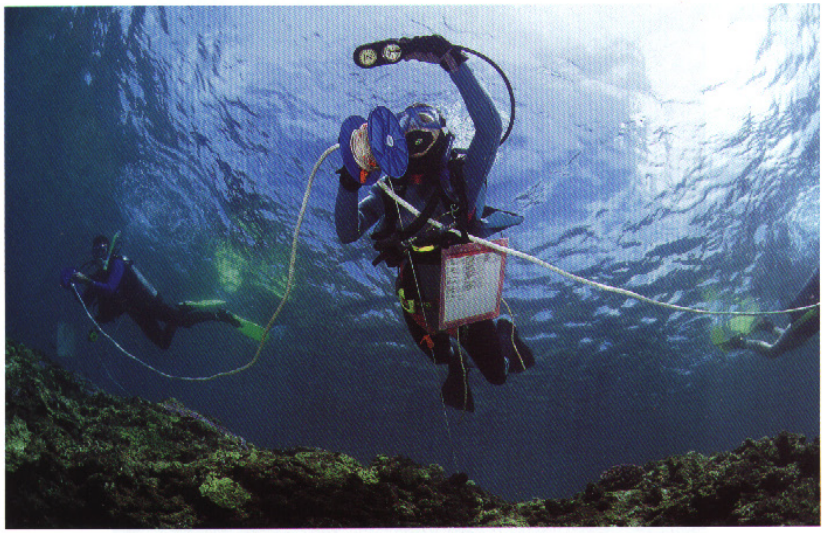
BY ERIC BROWN • PHOTOGRAPHS BY NORBERT WU

Since 1989, Eric Brown, of the Pacific Whale Foundation, has been monitoring changes in coral cover and fish populations on the spectacular coral reefs of Maui. By meticulously revisiting sample sites again and again, with the help of Earthwatch volunteers since 1993, Brown has been able to tease out the importance of diverse environmental variables, from siltation to wave action to human impacts. But far from finding overall trends that characterize Maui's reefs, Brown has discovered that each reef area is subject to its own unique circumstances and responds accordingly. In a candid conversation with Earthwatch, Brown describes the future odds of coral reefs on Maui, his positive experiences with volunteers, and the data that they have helped gather.



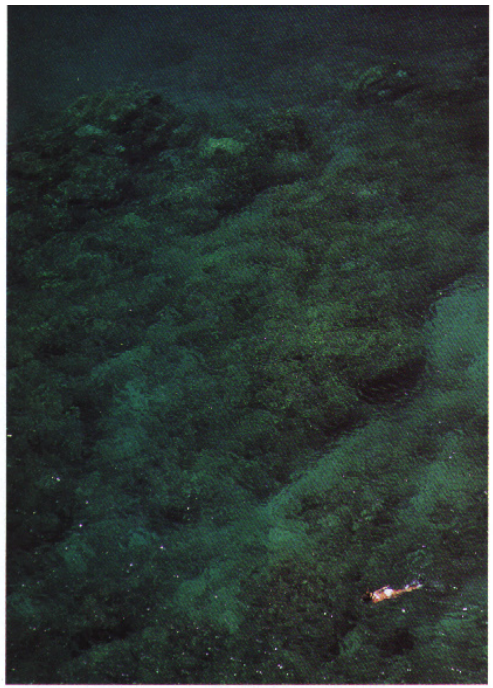
For me, the thrill is diving, getting under the water, being in the coral's realm. The beauty of the coral reef environment is the fact that you get to see all the color and the form up front. When you go into a rain forest, which has just as much diversity, you have to look a lot harder to see all the color and the patterns and the movement, because everything is so hidden. But in the coral reef, it's all there for you to see. The shapes, the colors, everything is right there. In terms of what is actually going on, it's a different story.

Hawai'i in general is doing much better than most other places. Reefs worldwide are taking a hit, and areas like Florida are experiencing unprecedented disease outbreaks. Hawai'i is pretty free of all that, at least for the moment. Things that have been implicated in coral reef disasters worldwide, like sediment, don't seem to play as big a part here because our water motion is some of the highest on the planet, especially for tropical reef areas. The sediment just doesn't stay around very long; it's flushed out to deeper water. We had a bleaching event in '96, but in '98 when the Pacific had the huge El Niño event, we had colder temperatures here. Several coral reef biologists reported bleaching from their sites, but we had little or no bleaching, because our water temperatures were colder on average. El Niño had a reverse effect on us, because it pushed the warm water over to the eastern side of the Pacific.



In order to make a valuable assessment of how things are changing, you have to keep your methods consistent. We still have the same core methods we used in 1989, but we've enhanced them. We've added sediment transport work and water motion, among other things. We've learned that variety is essential for our volunteers. This year, for instance, we added a turtle survey, and volunteers loved that. I know that in an academic setting, where you're constantly working with the same people, you can do incredible work without having to train them all. But it's nice to get that fresh blood, so to speak, from volunteers. It's not just the variety of new people coming in but the variety of backgrounds. People come in with different perspectives, things I never would have thought about. It's very important. I need to validate the type of work I do in a more general format from a public perspective. It helps me bridge the gap between scientists and managers, people responsible for caring for the environment. It's a tough bridge to cross, understanding the dynamics between what the general public perceives as important, versus what the scientists perceive as important. I'm getting a handle on it, and I think the volunteers are an integral part of that.

What we're discovering, and it's starting to bear fruit in other areas like the Great Barrier Reef and the Caribbean, is that coral-reef changes are very site specific. We've got some areas, for instance, that were wiped out by Hurricane Iniki in 1992. I went out to work at the site in 1993 and I couldn't find the reef. I'd been in Australia during the storm, and I didn't make the connection right away. Iniki leveled the reef, just wiped it out. But now it's recovered, at least at the nearshore site; it's come back threefold in about five years. It's very dramatic to see coral coming back that quickly. We've got other sites that have been going downhill steadily, chronically, since 1989. We think the decline has more to do with wave energy than any other single parameter. It's very exposed in these areas, with the greatest amount of coral damage in the winter months when not very many people are going up there. We'll go out one month and see some things and go back the next month, and all those things changed. Then we find in the wave record that this big, once-every-ten-year storm had come through. We think it's a combination of big wave events and the chronic nature of the waves just coming back. It could be that wave action has increased in the past 20 or 30 years and now the reef's just finally had enough and cannot rejuvenate. Or it could be other things that we don't have a good handle on, like the rate of recruitment, coral larvae coming back into an area to refresh or replenish the reef. That's what's happened at the other site that was wiped out: It was just replenished beautifully. I'm excited to go back again and see how things are going. And then we've got other sites where nothing's changed. It stays the same throughout all of this. So it's interesting that our methods are able to look at three different trends: increasing, decreasing, and stable.



In the past two years we have been looking at quantifying human use patterns: how many people go to the beach, how many people are in the water, the kinds of activities they are involved in. The highest number of people per site, per observation period, occurs at three sites out of the nine that we actually surveyed, and all three of them are decreasing in their coral. It's just a correlation now; whether heavy visitation is really a causative mechanism is hard to say. If it is, it would have to be a combination of people standing on the reef, actually physically coming into contact with the coral, and altering the balance of the fish community there by doing a lot of fish feeding, which divers use to attract fish. In Hawai'i, fish feeding is not currently banned, except in two marine conservation areas. And none of the areas that we worked in had restrictions; people could go in and feed the fish to their heart's content. In experiments we've done out there, we've noted particular kinds of changes, and we're starting to see those manifest themselves in the community dynamics. It tends to favor certain species over others, changing the dynamics of fish populations. Where tourists are feeding fish, species diversity actually decreases, while the total number of fish increases by a factor of two or three. And in these areas where the fish numbers are going up, the coral cover is going down. Normally you'd expect a positive relationship: more coral, more fish. Somehow, in sites that are heavily visited, the relationship is skewed, it's changed.

This work has several applications so far. One is in Honolua Bay, which is a marine conservation district, where we have the longest-running record of data of any of the 11 preserves in the state of Hawai'i. One of the critical concerns that the state has is, "how are the reefs doing?" Having data like this allows us to go back and ask how a given site differs from other areas where we don't currently have protection. Are there other areas that we should really be targeting to set aside? What are some of the trends at unique sites that are being overused? To determine correlations between, let's say, human use patterns and how the reef is doing, we need more than nine or ten years of data, because it's a chronic problem rather than an acute one. By then, though, it may be too late, so we're trying to home in on these, to detect them more precisely. If it changes just 1 or 2 percent, we need to be able to pick that up. That's what the managers need to know, even though they may not want to know it.

Eric Brown is the principal investigator for *Saving Maui's Reefs*. Norbert Wu has photographed underwater subjects from the poles to the tropics for many books and magazines, including *National Geographic*. His background includes doctoral studies in marine biology at the Scripps Institute of Oceanography. All photographs in this article are copyright Norbert Wu. For more information on his books and work, see www.norbertwu.com.