iFAST: The International Forum on Advanced Environmental Sciences and Technology

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8 a.m. CDT, 9 a.m. EDT, 1 p.m. GMT, 9 p.m. China
Wednesday, May 8, 2024

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Mark E. Hay is a marine community and chemical ecologist and the Teasley Professor of Environmental Biology and a Regents' Professor in biological sciences at the Georgia Institute of Technology. Hay's research focuses mostly on the ecology and conservation of coral reefs and the role of biotic interactions and of chemical cues and signals in regulating populations and structuring communities. He has participated in dozens of ship-based expeditions but more commonly works at remote field stations to conduct longer-term experiments. He also has led four saturation diving missions (using both Hydrolab and Aquarius) – where scientists live and work at depth from an underwater lab on a coral reef for periods of 10 days. He commonly works with media outlets to assure that his basic findings are made accessible to the general public. Awards include membership in the National Academy of Sciences and the American Academy of Arts and Sciences, the Cody Award in Ocean Sciences, the Silver Metal from the International Society of Chemical Ecology, the Lowell Thomas Award from the Explorers Club, the Gilbert Morgan Smith Medal from the U.S. National Academy of Sciences, and appointment as a Fellow of the American Association for the Advancement of Sciences and the Ecological Society of America.

Disruption of positive interactions and the demise of coral reefs: long ecological fuses in the Anthropocene

Abstract: Coral reefs are in global decline with coral diseases playing a significant role. This is especially true for Acroporid corals that represent ~25% of all Pacific coral species and generate much of the topographic complexity supporting reef biodiversity. Coral diseases are commonly sediment-associated and could be exacerbated by 200 years of the overharvest of sea cucumber detritivores that historically may have cleaned reef sediments and suppressed microbial pathogens. However, this hypothesis has been difficult to test due to the paucity of sea cucumbers on modern coral reefs. In Moorea, French Polynesia and Palmyra Atoll, we found a few areas still supporting higher densities of sea cucumbers, allowing field experiments to test the effects of sea cucumber removal on coral health. In both locations, controlled field manipulations demonstrated that sea cucumbers strongly suppress disease among corals in contact with benthic sediments. Sea cucumber removal increased tissue mortality of the ecologically important coral Acropora pulchra by ~370% and whole colony mortality by ~1500%. Additionally, farmerfish that kill Acropora pulchra bases to culture their algal gardens further suppress disease by separating corals from contact with the disease-causing sediment , thus functioning as mutualists rather than parasites despite killing coral bases. Historic overharvesting of sea cucumbers increases coral loss to disease, this may be especially critical in modern oceans as we nutrify, heat and add organics to coastal oceans – all which advantage microbial growth and, for some species, upregulate pathogenicity. Disease threatens the persistence of tropical coral reefs, but enhancing sea cucumbers may strengthen reef resilience by suppressing disease.

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