CORAL REEF
ALLIANCE

PRESS KIT FOR *NATURE CLIMATE CHANGE* ARTICLE

CORAL REEF ALLIANCE

FOR IMMEDIATE RELEASE

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PIONEERING STUDY SHOWS THAT MANAGEMENT AND EVOLUTION GIVE HOPE TO CORAL REEFS FACING THE EFFECTS OF CLIMATE CHANGE

Experts find that protecting diverse reef networks can enable rapid evolution and coral reef longevity

OAKLAND (July 1, 2019) – A new study released today in *Nature Climate Change* gives hope for coral reefs. The pioneering study launched by the Coral Reef Alliance is one of the first to demonstrate that management that takes evolution and adaptation into account can help rescue coral reefs from the effects of climate change. Importantly, the results show that by making smart decisions to protect reefs today, conservation managers can generate the conditions that can help corals adapt to rising temperatures.

"It is well documented that climate change is causing corals to die off at an unprecedented rate, but our study provides tools that offer promise for their survival," stated Dr. Madhavi Colton, co-author and Program Director at the Coral Reef Alliance. "Our results show that when evolution is enabled, conservation efforts can help corals adapt to rising temperatures."

Contrary to approaches that are popular today, such as focusing protection on reefs in cooler water, the study shows that protecting diverse reef habitat types across a spectrum of ocean conditions is key to helping corals adapt to climate change. "We found that a diversity of reef types provides the variety that evolution depends on," explained co-author Malin Pinsky, Associate-Professor at Rutgers University. "Hot sites are important sources of heat-tolerant corals, while cold sites and those in between can become important future habitats. Together, a diversity of reef types act as stepping stones that give corals the best chance for adapting and moving as climate changes."

Key to successful evolution is management that improves local conditions for reefs by effectively reducing local stressors, such as overfishing and water pollution. However, the authors caution that not all management strategies are created equal. "We used mathematical models to test the effects of management choices on coral reef outlooks," stated Dr. Tim Walsworth, lead author and postdoctoral researcher at the University of Washington. "We found that corals in well-managed areas act a source of baby corals in the future, essentially rescuing reefs after the climate stabilizes. Without both evolution and management, the corals in our model were unable to survive rising temperatures."

Coral reefs are one of the most diverse ecosystems on the planet and support the livelihoods of over 500 million people. Globally, they are estimated to be worth US$375 billion per year. The study shows that managing reefs to facilitate evolution today and in the future can enhance their prospects for long-term survival. This means creating managed area networks that contain a diversity of coral types and habitats and that effectively reduce local stressors. "This study shows that we know enough of

the science to act—and with the effects of climate change only increasing, we have little time to waste," says Dr. Colton.

The study titled, "*Management for network diversity speeds evolutionary adaptation to climate change*" is the result of a collaborative research program launched by Dr. Madhavi Colton and Dr. Michael Webster of the Coral Reef Alliance. Our partners include Dr. Timothy Walsworth, Professor Daniel Schindler and Professor Tim Essington at the University of Washington, and Associate Professor Malin Pinsky at Rutgers University. Advisors and co-authors include Professor Steve Palumbi, Stanford University, and Professor Pete Mumby, University of Queensland. The research was funded by the Gordon and Betty Moore Foundation.

About the Coral Reef Alliance

The Coral Reef Alliance (CORAL) is a non-profit, environmental NGO focused on saving the world's coral reefs. This year marks CORAL's 25th anniversary of combining science-based solutions with effective community-driven conservation. CORAL is actively expanding the scientific understanding of how corals adapt to climate change and using that information to develop conservation strategies to give corals around the world the best chance of surviving climate change. To discover more about CORAL's work to save the world's reefs, visit us at www.coral.org.

About the University of Washington

At the University of Washington, we believe that what you care about can change the world. We're more than one of the world's leading public research universities: We're a community of students and faculty united by a drive to serve the public good. From educating future leaders and making innovation work for all of us, to research breakthroughs and creative works that save and change lives, we're committed to helping people and communities achieve their full potential. With multiple campuses, a world-class academic medical center, PAC-12 athletics and extensive continuing education programs, the opportunities here are limitless. Learn how you can Be Boundless for Washington and the world at uw.edu.

About Rutgers University

Rutgers, The State University of New Jersey, is a leading national research university and the state of New Jersey's preeminent, comprehensive public institution of higher education. Established in 1766, the university is the eighth oldest higher education institution in the United States. More than 69,000 students and 22,500 full- and part-time faculty and staff learn, work, and serve the public at Rutgers locations across New Jersey and around the world.

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BACKGROUND INFORMATION

About the Organizers

Coral Reef Alliance

The Coral Reef Alliance (CORAL) is a non-profit, environmental NGO focused on saving the world's coral reefs. This year marks CORAL's 25th anniversary of our long history of combining science-based solutions with effective community-driven conservation. CORAL also expands the scientific understanding of how corals adapt to climate change and uses that science to develop conservation strategies to give corals around the world the best fighting chance to survive in a rapidly changing world.

CORAL realized long ago that our best chance to save coral reefs was in collaboration with the people who rely on them. We also recognize that it will take more than just local reef communities to save the reefs for generations to come. CORAL has formed partnerships with individuals, governments, local civic organizations, international NGOs, and other conservation organizations to assess the current state of a region and determine how to fill the gaps to mitigate threats and give reefs a fighting chance to adapt to a changing climate.

CORAL is also expanding the scientific understanding of how corals adapt to climate change through research focusing on those natural change forces that promote adaptation no matter what the future brings. We are using our scientific information along with that of others to develop regional-scale conservation plans to give corals the best fighting chance to adapt to climate change.

Founded in 1994, CORAL is based in Oakland, California and is working on reefs directly and indirectly around the globe.

University of Washington

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Stanford University

Stanford University is one of the world's leading research universities. It is known for its entrepreneurial character, drawn from the legacy of its founders, Jane and Leland Stanford, and its relationship to Silicon Valley. Areas of excellence range from the humanities to social sciences to engineering and the sciences. Stanford is located in California's Bay Area, one of the most intellectually dynamic and culturally diverse areas of the nation.

University of Queensland

The University of Queensland (UQ) is one of Australia's leading research and teaching institutions. We strive for excellence through the creation, preservation, transfer and application of knowledge. For more than a century, we have educated and worked with outstanding people to deliver knowledge leadership for a better world.

About the Modeling Adaptation Potential (MAP) Project

The Coral Reef Alliance (CORAL) and our research partners from Rutgers University, the University of Washington, Stanford University, and the University of Queensland formed the Modeling Adaptation Potential (MAP) Project to improve the scientific understanding of how coral reefs can adapt to rapid change, including describing the relative contributions of ecological reorganization and evolutionary rescue to adaptation potential. We are using this knowledge to identify conservation strategies that promote adaptation and account for uncertainty about future environmental conditions. The project focuses on building a powerful mathematical model to simulate different future scenarios for coral reefs. This project is funded by the Gordon and Betty Moore Foundation.

CORAL is currently implementing the findings of the MAP Project to create, facilitate and support Adaptive Reefscapes, which are networks of healthy reefs in which corals can adapt to climate change. CORAL works around the world to address environmental issues affecting coral reefs, and program sites in key priority bioregions exemplify best practices of coral reef management to climate change.

The MAP Project is comprised of the following scientists (P.I.s in bold):

CORAL: **Dr. Madhavi Colton**, Dr. Becky Twohey, **Dr. Michael Webster**
Rutgers University: Associate Professor Malin Pinsky, Mr. Dan Forrest, Dr. Lisa McManus, Dr. Ed Tekwa
Stanford University: Professor Steve Palumbi
University of Queensland: Professor Pete Mumby
University of Washington: Professor Daniel Schindler, Professor Timothy Essington, Mr. Lukas DeFilippo, Dr. Timothy Walsworth

About the Authors

Dr. Timothy Walsworth, now at Utah State University, completed this work while he was a postdoctoral research associate at the University of Washington School of Aquatic and Fishery Sciences. Tim's research uses quantitative approaches to explore how ecosystems respond to environmental and management changes.

Professor Daniel Schindler is a scientist and professor at the School of Aquatic and Fisheries Sciences at the University of Washington. His research takes an ecosystem approach to exploring how aquatic systems are organized and respond to changes in the broader environment, such as a shifting climate.

Dr. Madhavi Colton is CORAL's Program Director, and oversees a portfolio of community-driven conservation programs that address local threats to reefs in Fiji, Hawai'i, Indonesia and the Mesoamerican Region. Madhavi is also spearheading the Modeling Adaptation Potential (MAP) Project, which is pioneering scientific research on how ecosystems adapt to the effects of climate change. By addressing local threats and creating the conditions necessary for corals to adapt, Madhavi is guiding CORAL and partners in the establishment of the world's first Adaptive Reefscapes.

Dr. Michael Webster is CORAL's Executive Director and an expert in the fields of coral reef science and conservation management. Michael has led CORAL for eight years, and greatly increased the scale, scope and effectiveness of CORAL's conservation programs by leading the organization to develop Adaptive Reefscapes, CORAL's solution to save coral reefs around the world.

Professor Stephen Palumbi is a senior fellow at the Woods Institute for the Environment at Stanford University. His work on the genomics of marine organisms focuses on basic evolutionary questions but also on practical solutions to questions about how to preserve and protect the diverse life in the sea. Steve has lectured extensively on human-induced evolutionary change and is developing genomic methods to help find ocean species resistant to climate change. Steve's work on corals in American Samoa has identified populations more resilient to heat stress.

Professor Peter Mumby a Vice-Chancellor's Fellow at the School of Biological Sciences at the University of Queensland and the Chief Scientist at the Great Barrier Reef Foundation. His research has integrated empirical ecological data into models of coral reefs with a view to studying how changes in human activity can affect the health of reefs.

Professor Timothy Essington is a biologist who studies marine food webs and the effects that humans have on them. His research focus spans many areas—climate change, ocean acidification, and fisheries—to better understand how these change marine life. His recent research focus looks at fisheries policy tools, and the conservation benefits they may provide. Of particular interest is the application of ecosystem approaches to fisheries management, especially as applied to fisheries targeting small forage fish. These species

play important roles in food webs, but are also the target of growing fisheries. Essington is looking for ways to measure the trade-offs between the vital ecosystem services those fish provide and their increasing commercial value. For this work, he was awarded a Pew Fellowship in Marine Conservation. Essington is presently the director of the Quantitative Ecology and Resource Management (QERM) interdisciplinary graduate program and the Center for Quantitative Sciences (CQS) at the University of Washington.

Associate Professor Malin Pinsky is an ecologist and evolutionary biologist studying the ecological and evolutionary impacts of global change in the ocean. Malin leads the Pinsky Lab at Rutgers, which advances global understanding of marine populations and communities in a rapidly changing environment to inform stewardship and train the next generation of scientific leaders.

Facts About Corals and Coral Reefs

- Fifty (50) percent of reef-building corals have disappeared over the past 30 years
- One third of reef-building corals are at risk of extinction due to climate change and local threats
- By 2030, over 90 percent of coral reefs will be threatened. If action isn't taken soon, nearly all reefs will be threatened by 2050.
- Ninety (90) percent of global reefs are projected to experience severe bleaching annually by 2055
- Twenty-five (25) percent of all marine life is associated with coral reefs
- Five hundred (500) million people depend on coral reef ecosystem services
- Nearly 200 million people depend on coral reefs to protect them from storm surges and waves
- Three-hundred and fifty (350) million people travel to coral reef areas of the world every year
- Over $375 billion per year in goods and services are provided by coral reefs
- Coral reefs are the world's most economically valuable natural asset
- The flood-protection services provided by coral reefs are worth roughly US$4 billion a year
- One hundred and nine (109) countries have coral reefs
- Six countries contain over half of the world's coral reefs: Australia, Indonesia, Philippines, Papua New Guinea, Fiji, and the Maldives
- What do corals need to survive? (https://coral.org/coral-reefs-101/coral-reef-ecology/what-do-coral-reefs-need-to-survive/)
    - Sunlight
    - Clean, clear, saltwater
    - Warm (not hot) water temperature
- How corals are made (https://coral.org/coral-reefs-101/coral-reef-ecology/how-reefs-are-made/)
- How corals grow (https://coral.org/coral-reefs-101/coral-reef-ecology/how-coral-reefs-grow/)
- How corals reproduce (https://coral.org/coral-reefs-101/coral-reef-ecology/how-corals-reproduce/)
- Types of reef formations (https://coral.org/coral-reefs-101/coral-reef-ecology/types-of-coral-reef-formations/)
- Global reef threats (stressors) (https://coral.org/coral-reefs-101/reef-threats/global/)
- Local reef threats (stressors) (https://coral.org/coral-reefs-101/reef-threats/direct/)

Digital Artwork Resources

The digital material and additional information can be found on the Press Page of CORAL's website at https://coral.org/presscenter/