

Ruth D. Gates (1962–2018)

Coral biologist and tireless reef advocate.

Dr Ruth Gates achieved widespread recognition with her research on coral biology and human-assisted coral evolution. Her untimely death has not only deprived the field of a talented scholar and indefatigable mentor, but has also caused the loss of a tireless and charismatic advocate for coral reefs. This is exemplified by her appearance in the Emmy-award-winning documentary *Chasing Coral* (<https://www.chasingcoral.com>). Ruth brought an irrepressibly positive attitude to her career, and her personality and scientific acumen propelled her research, and the scientists she mentored, to international prominence. Funding from the philanthropist Paul Allen provided high-profile recognition of the importance of her research, and allowed Ruth to advance her agenda to harness the basic biology of corals to conserve coral reefs, in part through the development of ‘super corals’ with enhanced resistance and resilience to climate change.

Ruth began her career as a PhD student with Professor Barbara Brown at Newcastle University, United Kingdom, from 1985 to 1990. Her research involved fieldwork at the Discovery Bay Marine Laboratory in Jamaica; she arrived there in 1985, shortly before the first devastating wave of bleaching impacted Caribbean reefs. Her earliest research identified coral bleaching as a homeostatic process that was accentuated by warming seawater that drove regional scale bleaching phenomena. Ruth then continued her research for more than a decade at the University of California, Los Angeles (UCLA), where she spent several years working with Professor Len Muscatine. During her time there, she identified key mechanistic components in the processes of coral–algal symbioses and coral bleaching, including the role of host cell detachment in the loss of algal cells during thermal stress, and the role of amino acids as ‘host factors’ in promoting carbon loss from algal symbionts. While at UCLA, she also developed interests in the capacity of corals to acclimatize to changing environmental conditions, and cultured diverse skills in molecular genetics, which together laid the groundwork for her engagement in the concept of assisted evolution.

In 2003, Ruth was appointed as a research faculty member at the Hawai‘i Institute of Marine Biology (HIMB). By 2006, it



Ruth Gates at HIMB in 2016. Credit: Elyse Butler

had become clear that coral symbionts were a group of diverse clades capable of changes in relative abundance within a host. Ruth was instrumental in identifying limitations of contemporary genetic markers in understanding this diversity, and her application of higher-resolution molecular techniques revealed the diversity of possible functional relationships between coral hosts and their symbiotic algal complement. This description of the symbiotic landscape cleared the way for a new generation of researchers to address the implication of a shifting functional identity of the coral–*Symbiodinium* association, first proposed to much controversy in 1993.

Ruth continued to challenge our understanding of the diversity of taxa capable of living in association with reef corals, as revealed by the coral field’s acceptance of the terms ‘holobiont’ to describe symbiotic corals, and ‘symbiome’ for the complexity of microbes and macrobes with which they associate. She conducted research at the forefront of efforts to recognize the roles of bacteria, viruses and other microbes in modulating the functional response of the coral holobiont to changing conditions. While Ruth’s work helped to redefine what ‘makes’ a coral, and how it responds to environmental

conditions, her prominence in the field provided a powerful voice advocating for the roles of fundamental research, organismic biology and ecological investigations in addressing the coral-reef crisis.

Ruth became director of HIMB in 2015, energizing a wave of renovations and updates to the facility. This was also the time at which she crystallized a collaboration with Dr Madeleine van Oppen of the Australian Institute of Marine Science and University of Melbourne to use assisted evolution to grow coral stocks with enhanced resistance to anticipated future environmental challenges. At the time of her death, Ruth was midway through a five-year project supported by Paul Allen’s Vulcan Foundation to generate such stocks, with the vision that they might be explanted to reefs within the distributional range of conspecifics to enhance resilience of coral communities. The research represents a radical departure from the prevailing constructs for enhancing the survival of corals and coral reefs, and the concept attracted critics. But Ruth remained committed to its feasibility, and contended that her purpose was being misconstrued. With this project, she did not intend to ‘reseed’ global reefs, or to suggest that no other options were available, rather that the severity of the coral-reef crisis made it

important to explore all possible solutions while there was time.

Indeed, Ruth came to play a leadership role in facilitating a range of solutions to help corals survive. These included the Allen Coral Atlas (<http://allencoralatlas.org/#1/0/0>), a high-resolution mapping tool that documents the global distribution of coral reefs on a metre scale (launched just days after her death), and creating giant ex situ reefs as laboratories for radical experimentation (for example Biosphere 2 Ocean, <http://biosphere2.org/research/model-system/reef-solutions-biosphere-2-ocean>). Ruth's gift for public speaking and championing the cause of coral reef conservation took full flight in the last five years of her life. She was widely viewed as the most effective communicator for coral reefs in a generation, conducting countless interviews with the media, appearing in multiple documentaries and interacting tirelessly with the public in myriad outreach activities.

Throughout her career, Ruth claimed to favour research over teaching and eschewed traditional academic engagement through coursework and student mentoring. Nevertheless, she was the primary mentor for 6 MSc and 13 PhD students, 13 postdoctoral researchers and countless undergraduates in her lab. As the first female president of the International Society for Reef Studies, she revitalized the society's image, membership and mission, and was an exceptional role model for women in science. The outpouring of support following her death suggests that 'teaching' may in fact turn out to be her greatest legacy: a generation of early career scientists whose research paths have been shaped by her influence; a large circle of colleagues and peers who will now carry forward her scientific vision and infectious enthusiasm for all things coral; and a public multimedia audience whose attitudes to science, scientists and coral reefs have been altered

by her charisma and passion for coral-reef conservation. 

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