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Broad Phyletic Adaptation/Exaptation to Thermal Stressin Corals, and Implications for Extinction

Corals respond to thermal stress by "bleaching", caused by increasing seawater temperatures associated with global warming. Thisis due to the loss of obligate endosymbioticzooxanthellae. For 35 yrs, it has been a major global source of coral mortality. We have demonstrated that zooxanthellae are more sensitive to thermal stress than their host scleractiniancorals, exhibiting high levels of apoptosis and necrosis (programmed cell death). Most zooxanthellae are not only dying when released, but are most likely actively expelled by their hosts. We hypothesized that the coral hosts are adapted/exapted to increasing seawater temperatures. We examined the relationship between temperature and bleaching in three species of alcyonacean soft corals derived from three families. We found parallel respective responses in the soft corals and their zooxanthellae; i.e., the endosymbionts were again more sensitive to thermal stress than the host corals, although there was species-specific variance. We propose that the upper temperature limits set by the zooxanthellaeare operating within these two distantly related cnidarian orders and may also be extended to other obligate zooxanthellate cnidarians. In addition, we hypothesize that this relationship may be operating in other marine invertebrates possessing endosymbioticzooxanthellae (e.g. bivalves, forams, nudibranchs, etc.). We hypothesize that extinction of certain species may be expected under current climate change/global warming conditions because the breadth of the oceanic tropical climatic zone may be expected to expand latitudinally. This will cause the oceanic sub-tropical, sub-temperate, temperate, and sub-Arctic/Antarctic zones to be pushed to higher latitudes, all at the expense of the arctic/subarctic zones. We hypothesize that a new oceanic climatic zone – the hyper-tropical zone - will be formed in the middle of the tropical zone, and that major extinctions of certain zooxanthellate taxa will occur there.

Biography

Paul W Sammarco is a Professor, Louisiana Universities Marine Consortium (LUMCON), Chauvin, Louisiana, USA. He has conducted research on coral reef ecology for >40 years in the Caribbean and Great Barrier Reef, Australia. He has >285 publications and has served as an Assistant Professor, Clarkson University (NY); Senior Research Scientist, Australian Institute of Marine Science; and Executive Director, LUMCON; Director, Environmental Research, Resource Assessment Commission, Dept. Prime Minister and Cabinet (Australia; Prime Minister's personal commission on natural resource and environmental issues); Executive Director, Assn. Marine Laboratories Caribbean; Chairman, State Commission, South Louisiana Wetlands Discovery Center, and Chairperson, Council, First United Methodist Church, Houma; and Assoc. Editor, Marine Biology, Marine Ecology Progress Series, Aquatic Biology. He has demonstrated genetic connectivity between coral populations on the platforms and the Flower Garden Banks. He has identified alternate uses for post-production platforms and conducted deep-water reconnaissance on platforms used as artificial reefs. His current research topics include climate change/global warming, coral bleaching, sclerochronology, coral immune systems, prediction of coral extinction, analytical modeling, oil spill impacts and remediation (BP spill), and invasive coral species, and geographic extent of the BP oil spill.

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