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. Beijing

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Douglas Capone

UNIVERSITY OF SOUTHERN CALIFORNIA

https://dornsife.usc.edu/bisc/faculty-douglas-capone/

D. G. Capone received his Ph.D. in oceanography from the Rosenstiel School of Marine and Atmospheric Sciences of the University of Miami in 1978. Capone joined the faculty of the Marine Sciences Research Center of Stony Brook University in 1979 and the Center for Environmental Science of the University of Maryland in 1987. Since 1999, he has held the Wrigley Chair of Environmental Biology at the University of Southern California. Capone is an elected Fellow of the American Academy of Microbiology, the American Association for the Advancement of Science, the American Geophysical Union, the Association for the Sciences of Limnology & Oceanography, and the California Academy of Sciences. He served on the editorial board of *Applied & Environmental Microbiology*, was an editor for *mBio* and *Aquatic Microbial Ecology*. He is a member of Faculty of 1000. He received the Dupont Industrial Biosciences Award in Applied and Environmental Microbiology at the annual meeting of the American Society of Microbiology in Boston in 2015. His research focuses on the role and importance of marine microbes in major biogeochemical cycles, particularly those of nitrogen and carbon. Capone has studied diverse ecosystems, including the tropical open ocean, coral reefs, mangroves, temperate estuaries, groundwater aquifers and Antarctic Dry Valleys and snows. He has participated in over 30 major oceanographic expeditions to the tropical Atlantic, Caribbean and Pacific Oceans, including to the Great Barrier Reef, over 10 as chief scientist. He has published over 200 peer-reviewed articles in scientific journals, including Science and Nature. Capone is a leading expert on the marine N cycle. He produced a still highly regarded edited volume on the marine nitrogen cycle (Nitrogen in the Marine Environment, 1983, Academic Press) and in 2008 published the updated second edition as lead editor and a monograph on Marine Nitrogen Fixation earlier this year. Capone has taken a leadership role in national environmental research programs.

Marine Mosaics: Emerging Patterns of Nitrogen Fixation in the Oceans

The importance of biological nitrogen (N) fixation in ocean biogeochemistry has only recently come to be fully appreciated. While results from early field studies, largely from observations at mid-latitudes and in marginal tropical and subtropical seas, indicated a relatively limited role for nitrogen fixation in the oceanic N cycle, several lines of geochemical evidence emerged in the late 1990s which suggested otherwise. This prompted a resurgence in field efforts examining this process, which in turn has provided direct evidence to support the biogeochemical significance of nitrogen fixation in the oligotrophic ocean. However, there are still major puzzles to be solved. Fully assessing the phylogenetic and physiological diversity of marine diazotrophs is an ongoing process as is the recognition of the diverse marine habitat in which they occur. Controls on marine nitrogen fixation are also being explored more thoroughly. Field observations and experimental and modeling results suggest diazotrophs, which are not limited by nitrogen availability, may be constrained by other macro- and micro-nutrient factors in different ocean basins. Indeed, a mosaic of factors which may limit nitrogen fixation in situ is emerging. Accumulating molecular evidence also suggests that the relative dominance of different diazotrophic groups varies among ocean basins. While early research focused largely on photosynthetic cyanobacteria, the presence of heterotrophic forms are widely reported, and their quantitative role is an area of active research globally. Biogeochemical conundrums include an apparent mismatch in some analysis of the balance between oceanic nitrogen fixation relative to nitrogen removal through denitrification and anammox. Methodological issues in tracer assays have been noted that may affect interpretation of some field data. Several geochemical models suggest a close coupling between inputs and removal (nitrogen homeostat), and mechanisms for that coupling have been proposed. We have recently tested the hypothesis that nitrogen fixation is enhanced in surface waters with excess phosphorus advecting offshore from major oxygen minimum zones. Upper ocean warming, ocean acidification and increases in dissolved inorganic carbon are all likely to affect the extent and distribution of oceanic nitrogen fixation in the future. Finally, atmospheric N deposition to the ocean is rapidly accelerating and will soon exceed current estimates of oceanic nitrogen fixation.

INSTITUTE FOR ENVIRONMENTAL GENOMICS
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