

Curriculum Vitae: Anthony Francis Michaels

Managing Director

Proteus Environmental Technologies, LLC
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Employment

2008 – Present Managing Director, Proteus Environmental Technologies LLC
2003 – 2008 Professor, Biology, University of Southern California (on leave, 2008)
1996 - 2008 Director of the USC Wrigley Institute for Environmental Studies
1996 - 2003 Associate Professor, Biology, University of Southern California
1992 - 1996 Associate Research Scientist, Bermuda Biological Station for Research, Inc.
1989 - 1992 Assistant Research Scientist, Bermuda Biological Station for Research, Inc.
1988 - 1989 Postdoctoral Scholar, Woods Hole Oceanographic Institution.
1988 Postdoctoral Researcher with Dr. Mary Silver, Univ. of California, Santa Cruz.

Education

1983 - 1988 Ph.D. in Biology, University of California, Santa Cruz.
1982 - 1983 M.S. in Ecology and Evolutionary Biology, University of Arizona.
1980 - 1982 B.S. in Ecology and Evolutionary Biology, University of Arizona. With Highest Distinction and Honors
1976 - 1979 University of California, San Diego.

Management Experience and Professional Service

2008-Present: Co-Founder and Managing Director of Proteus Environmental Technologies LLC. Proteus takes transformational discoveries that address major environmental challenges and builds successful companies to commercialize those environmental solutions. It has a novel team of experts in academia, entrepreneurship, commercialization and fund management, coupled to a novel strategy for identifying so-called “stranded” discoveries and building them into products that address very large commercial markets and opportunities. It has five companies under development addressing large opportunities in biofuels, waste-to-energy, clean water, sustainable aquaculture and carbon sequestration.

1996-2008: Director of the USC Wrigley Institute for Environmental Studies. The USC Wrigley Institute is an Organized Research Unit within the USC College of Letters, Arts and Sciences. Primary responsibilities for defining and implementing the vision for the USC Wrigley Institute for Environmental Studies in close coordination with USC and USC College goals, USC College Deans and the faculty. This included the academic mission, the outreach goals, the financial and academic health of the marine lab on Catalina Island and broad connections to the other academic activities at USC and elsewhere.

1993-1996: Co-founder and co-leader of the Risk Prediction Initiative – a joint venture with a group of insurers and reinsurers. Co-founder, with Dr. Anthony Knap, of a special program that created a unique connection between the academic climate science community and the insurance and reinsurance industries to improve the pricing of catastrophe reinsurance as it relates to hurricanes and other natural disasters.

1989-1996: Coordinator of the U.S. Joint Global Ocean Flux Study, Bermuda Atlantic Time-series (BATS). Oversaw the operations and expansion of the BATS research activities including both my own science and the science of a large group of researchers in an interdisciplinary team.

Additional Academic and Institutional Service at the University of Southern California

Member of the Advisory Committee for the USC Energy Institute, 2008
Chair of the Planning Committee for the USC Future Fuels and Energy Initiative, 2007
Chair, Search Committee for the “Cluster Hire” in marine and environmental science, 2005-2006
Chair of the Planning Committee for the USC Future Fuels and Energy Initiative, 2006-2007
Member of the Planning Committee for the USC Future Fuels and Energy Initiative, 2006
Member of the Executive Committee of the Biology Department (2003-2008)
Member of USC University Committee on Academic Review (UCAR), 1999-2003
Chair of UCAR subcommittee to review the Neuroscience program (NIBS), 1999-2003
Chair of UCAR subcommittee to review the Political Science department, 2000-2003
Participant in the Provost Planning Committees for the Life Science Initiative
Member of USC Dive Control Board 1996-2008
Member of faculty search committees in the Biological Science Department, 1996-2004
Member of a faculty search committee in the Political Science Department, 1999
Member of a faculty/staff search committee in the Information Services Division, 1999
Lead author of a report on the Life Sciences Critical Pathway for the USC Provost, 1999
Member of the search committee for the second Wrigley Chair, 1997-2001
Member of the search committee for the first Wrigley Chair, 1996-1998

Professional Service

Member of the Board of Trustees, Ocean Leadership, 2007-2008
President, National Association of Marine Labs, 2006-2007
Member of the Board for the National Council for Science and the Environment, 2004-present
Chair, NSF Advisory Committee for Environmental Research and Education, April 2005-March 2007
Member, NSF Advisory Committee for Environmental Research and Education, Oct 2003-March 2007
Chair of the Board for the Catalina Island Conservancy, 2008-present
Vice Chair of the Board for the Catalina Island Conservancy, 2006-2008
Member of Executive Committee, Council of Environmental Deans and Directors, 2006-2008

Past President, Council of Environmental Deans and Directors, 2004 & 2005
Founding President, Council of Environmental Deans and Directors, 2002 & 2003
Member of the planning committee to create a Council of Environmental Deans and Directors through the National Council for Science and the Environment, 2000-2001
President-Elect, National Association of Marine Labs, 2005
Past-President, Western Association of Marine Labs, 2005 and 2006
President, Western Association of Marine Labs, 2003 and 2004
President-Elect, Western Association of Marine Labs, 2001 and 2002
Member of the Governing Board for the Council for Ocean Research and Education, 1999-2007
Associate Member, Scientific Committee on Oceanic Research Working Group on Sediment Trap and ²³⁴Th Methods for POC Export in the Upper Ocean (2000-2006)
Associate Editor, Biogeochemistry, October 1995 to 2001
Co-editor of two special editions of Deep-sea Research on Ocean Time-series
Invited participant – National Academy of Science meeting on ocean observatories (January 2000)
Invited participant and speaker– National Academy of Science meeting on climate dynamics and feedback processes (August 2001)
President of the Board, Southern California Marine Institute 1996-present
Member of the Board for the Long Beach Aquarium of the Pacific Marine Conservation Research Institute, 2002-present
Member of the Board for the Catalina Island Conservancy, 2001-present
President of the Board for the Los Angeles Water Science Education Center, 2000-2003.
Member of ASLO's committee on Public Policy and Science 1998-2004
Member of ASLO's ad hoc committee on Electronic Publishing 1995-1997
Member of ASLO's endowment committee 1996-1998
Member of the U.S. JGOFS Steering Committee 1996-2003
Assistant Coordinator at SCOR WG 73 Workshop on Network Modeling, 1984

Awards

McNichol Fellowship, Bermuda Biological Station for Research, 1989-1991
Woods Hole Oceanographic Institution, Postdoctoral Scholar, 1988 - 1989.
Regents Fellowship, 1983. Regents of the University of California.
The Outstanding Senior Award, 1982. The College of Liberal Arts, University of Arizona.
Phi Beta Kappa. 1982

Professional Society Memberships

American Geophysical Union
American Society of Limnology and Oceanography
The Oceanography Society
American Association for the Advancement of Science

Research Experience

- 1999 - present Complex systems in ocean biology and biogeochemistry
- 1986 - present Food-web dynamics and sinking exports from oceanic ecosystems
- 1984 - present Nitrogen fixation and carbon cycling and sequestration in the oligotrophic Pacific and Atlantic Oceans
- 1995 – 1997 Simulating the insurance industry as a complex system (Insurance World)
- 1994 - 2002 Climate, Hurricanes and Environmental Risk in the Insurance Industry
- 1993 - 2000 Remote Sensing and Ocean Biogeochemistry of the Sargasso Sea.
- 1990 - 2000 Optical characterization of the ocean at the Bermuda Atlantic Time-Series.
- 1989 - 2000 Temporal variability in the biogeochemistry of the Sargasso Sea
- 1983 - 1996 The Acantharia-algal symbiosis in upper ocean carbon and nitrogen cycles
- 1989 - 1996 Scientific oversight of the Bermuda Atlantic Time-Series Program
- 1989 - 1995 Dynamics of dimethylsulfide in the Sargasso Sea.
- 1987 - 1988 The role of Acantharia in the fluxes of strontium and associated trace elements.
- 1984 - 1988 Vertex: Phytoplankton Origins and Biological Attrition of the Detrital Rain.
Postdoctoral Researcher (1988) or Research Assistant for Dr. Mary Silver,
Univ. Cal. Santa Cruz.
- 1983 Demography and reproductive strategies of desert annual plants. Research
Assistant with Dr. Larry Venable, University of Arizona.
- 1981 - 1983 The evolution of algal-invertebrate symbiosis and seasonality of the *Prochloron-
Didemnum* Tunicate symbiosis. Masters Research with Dr. Robert Hoshaw,
University of Arizona.
- 1981 - 1983 The affects of herbicides on mesquite grassland ecology. Research Assistant with
Dr. Norman Smith, University of Arizona.
- 1983 - present Participant on 27 oceanographic cruises and chief scientist on 11 of those cruises.
- 1989 - 1996 Participant and Chief Scientist on frequent BBSR and JGOFS Time-series cruises

Funding History Summary (total of awards as PI or co-PI)

National Science Foundation (1990-2008): \$21.3 million
National Aeronautics and Space Administration (1993-1996): \$1.8 million
Private Philanthropy (1991-2008): \$31.4 million

Publication Record

Total: 99

Peer Reviewed: 66

Hirsch h-index: 29 (Dec, 2007)

Publications (peer reviewed):

2007

1. Moore, K.J., S.C. Doney, K. Lindsay, N. Mahowald, A.F. Michaels (2006). Nitrogen fixation amplifies the ocean biogeochemical response to decadal timescale variations in mineral dust deposition. *Tellus* 58B:560-572.

2006

2. Buesseler, K.O., A.N. Antia, M. Chen, S.W. Fowler, W.D. Gardner, O. Gustafsson, K. Harada, A.F. Michaels, M. Rutgers van der Loeff, M. Sarin, D.K. Steinberg, T. Trull (2007) An assessment of the use of sediment traps for estimating upper ocean particle fluxes. *Journal of Marine Research* 65:345-416

2005

3. Mahaffey, C., A.F. Michaels, D. G. Capone (2005) The Conundrum of Marine Nitrogen Fixation. *The American Journal of Science* 305:546-595
4. Pfirman, S.L., J.P. Collins, S. Lowes, A.F. Michaels (2005) Hiring, fostering and tenuring interdisciplinary scholars. *The Chronicle of Higher Education*. Volume LI (23): B15-B16.
5. Capone, D.G., J.A. Burns, C. Mahaffey, T. Gunderson, A.F. Michaels, J.P. Montoya, A. Subramanian, E.J. Carpenter (2005) Nitrogen fixation by *Trichodesmium* spp.: An important source of new nitrogen to the tropical and subtropical North Atlantic Ocean. *Global Biogeochemical Cycles* 19

2004

6. Galloway, J.N., F.J. Dentener, D.G. Capone, E.W. Boyer, R.W. Howarth, S.P. Seitzinger, G.P. Asner, C. Cleveland, P. Green, E. Holland, D.M. Karl, A. F. Michaels, J.H. Porter, A. Townsend, C. Vorosmarty (2004) Nitrogen Cycles: Past, Present, Future. *Biogeochemistry* 70:153-226

2003

7. Karl, D. M., N. R. Bates, S. Emerson, P. J. Harrison, C. Jeandal, O. Llinas, K. K. Liu, J.-C. Marty, A. F. Michaels, J. C. Miquel, S. Neuer, Y. Nojiri and C. S. Wong. (2003) Temporal studies of biogeochemical processes in the world's oceans during the JGOFS era. In: *Ocean Biogeochemistry: The role of the Ocean Carbon Cycle in Global Change* (Ed: M.J.R. Fasham), Springer-Verlag, New York. pp. 239-267

2002

8. Karl, D., A.F. Michaels, B. Bergman, D. Capone, E. Carpenter, R. Letelier, F. Lipschultz, H. Paerl, D. Sigman & L. Stal. (2002) Dinitrogen fixation in the World's Oceans. *Biogeochemistry* 57: 47-94
9. Dennett, M.R., D.A. Caron, A.F. Michaels, S.M. Gallager, C.S. Davis (2002). Video plankton recorder reveals high abundances of colonial radiolaria in surface waters of the central North Pacific. *J. Plankton Research* 24: 797-805

2001

10. Michaels, A.F., D.M. Karl and D. Capone. (2001) Element stoichiometry, new production and nitrogen fixation. *Oceanography* 14:68-77.
11. Karl, D.M, J.E. Dore, R. Lucas, A.F. Michaels, N.R. Bates and A.H. Knap. (2001) The U.S. JGOFS Time-series Observation Programs. *Oceanography* 14:6-17.
12. Siegal, D.A., D.M. Karl, DM and A.F. Michaels, AF. (2001) Interpretations of biogeochemical processes from the US JGOFS Bermuda and Hawaii time-series sites. *Deep-sea Research II* 48:1403-1404.
13. Steinberg, D.K., C.A. Carlson, N.R. Bates, R.J. Johnson, A.F. Michaels, and A.F. Knap (2001) Overview of the U.S. JGOFS Bermuda Atlantic Time-series Study (BATS): A decade-scale look at ocean biology and biogeochemistry. *Deep-sea Research II* 48:1405-1447
14. Karl, D.M. and A.F. Michaels. Nitrogen Cycle. In: J. Steele, S. Thorpe and K. Turekian (Eds), *Encyclopedia of Ocean Sciences*, pp 1876-1884.
15. Orcutt, K.M, F. Lipschultz, K. Gundersen, R. Arimoto, A. F. Michaels, A.H. Knap, J.R. Gallon. (2001) Seasonal pattern and significance of N₂ fixation by *Trichodesmium* spp. at the Bermuda Atlantic Time-series Study (BATS) site. *Deep-sea Research II* 48:1583-1608
16. Gundersen, K, K. Orcutt, D. Purdie, A.F. Michaels & A. Knap (2001) Elemental carbon mass distribution at the Bermuda Atlantic Time-series study (BATS) site. *Deep-sea Research II* 48:1697-1718

17. Nelson N., N. Bates, A.F. Michaels and D.A. Siegel. (2001) Spatial Variability of the CO₂ sink in the Sargasso Sea. *Deep-sea Research II* 48:1801-1821
18. Siegel, DA, T.K. Westberry, M.C. O'Brien, N.B. Nelson, A.F. Michaels, J.R. Morrison, A. Scott, E.A. Caporelli, J.C. Sorensen, S. Maritorea, S.A. Garver, E.A. Brody, J. Ubante, M.A. Hammer. (2001) Bio-optical modeling of primary production on regional scales: the Bermuda BioOptics project. *Deep-sea Research II* 48: 1865-1896.
19. Fasham MJR, Balino BM, Bowles MC, Anderson R, Archer D, Bathmann U, Boyd P, Buesseler K, Burkill P, Bychkov A, Carlson C, Chen CTA, Doney S, Ducklow H, Emerson S, Feely R, Feldman G, Garcon V, Hansell D, Hanson R, Harrison P, Honjo S, Jeandel C, Karl D, Le Borgne R, Liu KK, Lochte K, Louanchi F, Lowry R, Michaels A, Monfray P, Murray J, Oschlies A, Platt T, Priddle J, Quinones R, Ruiz-Pino D, Saino T, Sakshaug E, Shimmield G, Smith S, Smith W, Takahashi T, Treguer P, Wallace D, Wanninkhof R, Watson A, Willebrand J, Wong CS. (2001) A new vision of ocean biogeochemistry after a decade of the Joint Global Ocean Flux Study (JGOFS). *AMBIO Sp. Issue* 10: 4-31

2000

20. Howarth, R.W and A.F. Michaels. The measurement of primary production in aquatic ecosystems. In: *Methods in Ecosystem Science*, Sala, O.E, R.B. Jackson, H.A. Mooney and R.W Howarth (eds.) Springer, New York. Pages 72-85.
21. Michaels, A.F., D.A. Karl and A.H.Knap. (2000) Temporal studies of biogeochemical dynamics in oligotrophic oceans. In. *The Changing Ocean Carbon Cycle*, Hanson, R.B., Ducklow H.W., Field, J.G. (eds.). Cambridge University Press, Cambridge. Pages 392-413.
22. Steinberg, D.K., C.A. Carlson, N.R. Bates, S.A. Goldthwait, L.P. Madin, and A.F. Michaels. (2000) Zooplankton vertical migrations and the active transport of dissolved organic and inorganic carbon in the Sargasso Sea. *Deep-sea Research* 47:137-158
23. Murnane, R.J., C. Barton, E. Collins, J. Donnelly, J. Elsner, K. Emanuel, I. Ginis, S. Howard, C. Landsea, K. Liu, D. Malmquist, M. McKay, A. Michaels, N. Nelson, J. O'Brien, D. Scott, T. Webb III. (2000) Model estimates of hurricane wind speed probabilities. *EOS* 81:433, 438
24. Buesseler, K.O., D. K. Steinberg, A. F. Michaels, R. J. Johnson, J. E. Andrews, J. R. Valdes and J. F. Price. (2000) A Comparison of the Quantity and Composition of Material caught in a Neutrally Buoyant versus Surface-Tethered Sediment Trap. *Deep-sea Research* 47:277-294.
25. Febvre, C., J. Febvre and A. Michaels (2000) *Acantharia Haeckel, 1881*. In: *The Illustrated Guide to the Protozoology*, J.J. Lee, G.F. Leedale, P. Bradbury (eds), Society of Protozoologists, Lawrence, KA

1999

26. McGillicuddy, D.J., R. Johnson, D.A. Siegel, A. F. Michaels, N.R. Bates, A.H. Knap. (1999) Mesoscale variations of biogeochemical properties in the Sargasso Sea. *J. Geophysical Research* 104:13381-13394.

1998

27. Bates, N.R., A.H. Knap, A.F. Michaels. (1998) Contribution of hurricanes to local and global estimates of air-sea exchange of CO₂. *Nature* 395:58-61.
28. Dacey, J.W.H., F.A. Howse, A.F. Michaels, and S.G. Wakeham. (1998) Temporal variability of dimethylsulfide and dimethylsulfoniopropionate in the Sargasso Sea. *Deep-Sea Research* 45:2085-2104.
29. McGillicuddy, D.J., A.R. Robinson, D.A. Siegel, H.W. Jannasch, R. Johnson, T.D. Dickey, J. McNeil, A. F. Michaels, A.H. Knap. (1998) Influence of mesoscale eddies on new production in the Sargasso Sea. *Nature* 394:263-266
30. Nelson, N, D.A. Siegel, A.F. Michaels. (1998) Dynamics of colored dissolved organic matter in the Sargasso Sea. *Deep-Sea Research* 45: 931-957.
31. Dickey, T., D. Frye, J. McNeil, D. Manov, N. Nelson, D. Sigurdson, H. Jannasch, D. Siegel, T. Michaels, R. Johnson (1998) Upper-Ocean temperature response to hurricane Felix as measured by the Bermuda Testbed Mooring. *Monthly Weather Review* 126:1195-2101
32. Dickey, T., D. Frye, H. Jannasch, E. Boyle, D. Manov, D. Sigurdson, J. McNeil, M. Stramska, A. Michaels, N. Nelson, D. Siegel, G. Chang, J. Wu, A. Knap. (1998) Initial results from the Bermuda Testbed Mooring program. *Deep-Sea Research* 45:771-794.

1997

33. Michaels, A.F., D. Malmquist, A.H. Knap, A. Close (1997) Climate Science and Insurance Risk. *Nature* 389:225-227

1996

34. McClintock, J.B., D.P. Swenson, D.K. Steinberg and A.F. Michaels. (1996) Feeding deterrent properties of common oceanic holoplankton from Bermudian waters. *Limnol. Oceanogr.* 41:798-801.
35. Michaels, A.F., D. Olson, J. Sarmiento, J. Ammerman, K. Fanning, R. Jahnke, A.H. Knap, F. Lipschultz, J. Prospero (1996) Inputs, Losses and Transformations of Nitrogen and Phosphorus in the Pelagic North Atlantic Ocean. *Biogeochemistry* 35:181-226.
36. Galloway, J.N., R.W. Howarth, A.F. Michaels, S.W. Nixon, J.M. Prospero, F.J. Dentener. (1996) Nitrogen and Phosphorus budgets of the North Atlantic Ocean and its watershed. *Biogeochemistry* 35:3-25.

37. Michaels, A.F. and A.H. Knap (1996) Overview of the U.S. JGOFS Bermuda Atlantic Time-series Study and the Hydrostation S Program. *Deep-Sea Research* 43: 157-198.
38. Karl, D.M. and A.F. Michaels (1996) Preface: The Hawaiian Ocean Time-series (HOT) and the Bermuda Atlantic Time-series study (BATS). *Deep-Sea Res.* 43:127-128.
39. Siegel, D.A. and A.F. Michaels (1996) Quantification of Non-Algal Light Attenuation in the Sargasso Sea: Implications for Biogeochemistry and Remote Sensing. *Deep-Sea Research* 43:321-345
40. Bates, N.R., A.F. Michaels and A.H. Knap (1996) Alkalinity changes in the Sargasso Sea: Geochemical evidence of calcification? *Marine Chemistry* 51:347-358
41. Bates, N.R., A.F. Michaels, A.H. Knap (1996). Seasonal and interannual variability of the oceanic carbon dioxide system at the U.S.JGOFS Bermuda Atlantic Time-series Site. *Deep-Sea Research* 43:347-383
42. Waser, N.A.D., M.P. Bacon and A.F. Michaels. (1996) Natural activities of ³²P and ³³P and the ³³P/³²P ratio in suspended particulate matter and plankton in the Sargasso Sea. *Deep-Sea Research* 43:421-436

1995

43. Ducklow, H.W., C.A. Carlson, N.R. Bates, A.H. Knap and A.F. Michaels (1995) Dissolved organic carbon as a component of the biological pump in the North Atlantic Ocean. *Phil. Trans. Roy. Soc. Lond. Ser. B - Biol. Sci.* 348:161-167
44. Galloway J.N., W.H. Schlesinger, H. Levy II, A.F. Michaels, J.L. Schnoor (1995) Nitrogen fixation: Anthropogenic enhancement-environmental response. *Global Biogeochemical Cycles* 9:235-252.
45. Siegel, D.A., A.F. Michaels, J.C. Sorensen, M.C. O'Brien, M.A. Hammer. (1995) Seasonal Variability of Light Availability and Its Utilization in the Sargasso Sea. *Journal of Geophysical Research* 100:8695-8713.
46. Michaels, A.F., D. A. Caron, N. R. Swanberg, F. A. Howse and C. M. Michaels. (1995) Planktonic sarcodines (Acantharia, Radiolaria and Foraminifera) in surface waters near Bermuda: Abundance, biomass and vertical flux. *Journal of Plankton Research.* 17:131-163
47. Caron, D.A., A. F. Michaels, N. R. Swanberg and F. A. Howse. (1995) Primary productivity by symbiont-bearing planktonic sarcodines (Acantharia, Radiolaria and Foraminifera) in surface waters near Bermuda. *Journal of Plankton Research.* 17:103-129

1994

48. Michaels, A.F., N.R. Bates, K.O. Buesseler, C.A. Carlson, A.H. Knap. (1994) Carbon System Imbalances in the Sargasso Sea. *Nature* 372:537-540
49. Michaels, A. F., A. H. Knap, R. L. Dow, K. Gundersen, R. J. Johnson, J. Sorensen, A. Close, G. A. Knauer, S. E. Lohrenz, V. A. Asper, M. Tuel, and R.R. Bidigare. (1994) Seasonal Patterns of Ocean Biogeochemistry at the U.S.JGOFS Bermuda Atlantic Time-series Study Site. *Deep-Sea Research* 41:1013-1038
50. Carlson, C.A., H.W. Ducklow, A.F. Michaels. (1994) Annual flux of dissolved organic carbon from the euphotic zone in the northwestern Sargasso Sea. *Nature* 371:405-408
51. Gust, G., A.F. Michaels, R. Johnson, W.G. Deuser, W. Bowles (1994). Mooring line motions and sediment trap hydromechanics: in situ intercomparison of three common deployment designs. *Deep-Sea Research* 41:831-857.
52. Buesseler, K.O., A.F. Michaels, D.A. Siegel, A.H. Knap. (1994). A 3-D time-dependent approach to calibrating sediment trap fluxes. *Global Biogeochemical Cycles* 8:179-193

1993

53. Michaels, A.F., D.A. Siegel, R.J. Johnson, A.H. Knap, J.N. Galloway. (1993) Episodic Inputs of Atmospheric Nitrogen to the Sargasso Sea: Contributions to New Production and Phytoplankton Blooms. *Global Biogeochemical Cycles* 7:339-351

1992

54. Lohrenz, S.E., G.A. Knauer, V.L. Asper, M. Tuel, A.F. Michaels and A.H. Knap (1992) Seasonal and interannual variability in primary production and particle flux in the northwestern Sargasso Sea: U.S. JGOFS Bermuda Atlantic Time Series. *Deep-Sea Research*, 39:1373-1391
55. Golomb, D.S., S.G. Zemba, J.W.H. Dacey and A.F. Michaels (1992) The fate of CO₂ sequestered in the deep ocean. *Energy Convers. Mgmt.* 33:675-683.
56. Galloway, J.N. and 36 other authors including A.F. Michaels. (1992) Sulfur and nitrogen levels in the North Atlantic ocean's atmosphere: A synthesis of field and modeling results. *Global Biogeochemical Cycles*, 6:77-100.

1991

57. Michaels, A.F. (1991) Acantharia abundance and symbiont productivity at the VERTEX Seasonal Station. *Journal of Plankton Research* 13: 399-418.

1990-1984

58. Michaels, A.F., M.W. Silver, M.M. Gowing and G.A. Knauer. (1990) Cryptic zooplankton "swimmers" in upper ocean sediment traps. *Deep-Sea Research*. 37:1285-1296

59. Michaels, A.F. and A.R. Flegal. (1990) Lead in Marine Planktonic Organisms and Pelagic Food Webs. *Limnology and Oceanography*. 35:287-295
60. Siegel, D.A., T.C. Granata, A.F. Michaels and T.D. Dickey. (1990) Eddy diffusion, particle sinking and the interpretation of sediment trap data. *J. Geophys. Res.* 95:5305-5312
61. Michaels, A.F. and M.W. Silver. (1988) Primary production, sinking flux and the microbial food web. *Deep-Sea Research* 35: 473-490.
62. Michaels, A.F. (1988) Vertical distribution and abundance of acantharia and their symbionts. *Marine Biology* 97:559-569.
63. Scranton, M.I., P.C. Novelli, A.F. Michaels, S.Horrigan and E.J. Carpenter. (1987) Hydrogen production and nitrogen fixation by *Oscillatoria thiebauti* during in situ incubations. *Limnology and Oceanography* 32: 998-1006.
64. Bernstein, R.E., P.R. Betzer, R.A. Feely, R.H. Byrne, M.F. Lamb and A.F. Michaels. (1987) Acantharian fluxes and strontium to chlorinity ratios in the North Pacific Ocean. *Science* 237: 1490-1494.
65. Carpenter, E.J., M.I. Scranton, P.C. Novelli and A.F. Michaels. (1987) Validity of N₂ fixation rate measurements in marine *Oscillatoria (Trichodesmuim)*. *Journal of Plankton Research* 9:1047-1056.
66. McCourt, R.M., A.F. Michaels and R.W. Hoshaw. (1984) Seasonality of symbiotic *Prochloron* (Prochlorophyta) and its Didemnid host in the northern Gulf of California. *Phycologia* 23: 95-101.

Other Publications (reviews, theses, book chapters, reports, popular publications and meetings proceedings)

2008

1. Buesseler, K.O., S.C. Doney, D.M. Karl, P.W. Boyd, K. Caldeira, F. Chai, K.H. Coale, H.J.W. deBaar, P.G. Falkowski, K.S. Johnson, R.S. Lampitt, A.F. Michaels, S.W.A. Naqvi, V. Smetacek, S. Takeda, A. J Watson (2008) Ocean Iron Fertilization – Moving Forward in a Sea of Uncertainty. *Science* 319:162 (policy forum)

2007

2. Michaels A.F. (2007) Highly Active Eddies. *Science* 316:992-993 (news and views)

2005

3. Pfirman, S.L., J.P. Collins, S. Lowes, A.F. Michaels (2005) To thrive and prosper: Hiring, fostering and tenuring interdisciplinary scholars. Project Kaleidoscope special report. Also available at:
http://www.pkal.org/documents/Pfirman_et-al_To-thrive-and-prosper.pdf?CFID=2

2003

4. Michaels, A.F. 2003. Ecological Stoichiometry – the biology of elements from molecules to the biosphere. *Science* 300:906-907 (book review)

2001

5. Hood, R.R., A. F. Michaels, D.G. Capone. (2001) Answers sought to the enigma of marine nitrogen fixation. *EOS Transactions* 81:133-139

2000

6. Malmquist, D. L., and A.F. Michaels (2000) Severe storms and the insurance industry. In: *Storms*, R. A. Pielke, Jr. and R. A. Pielke, Sr. (Eds),Routledge Press.

1998

7. Knap, A.H., Michaels, A.F. and others. (1998) BATS Methods Manual, Version 4. U.S.JGOFS Planning Office, Woods Hole, MA.
8. Bates, N.R., N.R., Knap, A.H., and Michaels, A.F., 1998. Carbon dioxide, climate change and hurricanes. *The Journal of the Forum for Environmental Law, Science, Engineering and Finance*. December Issue, publisher. M.A. Frodl, Washington D.C., U.S.A.

1997

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1992

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1991

28. Knap, A.H., Michaels, A.F. and others. (1991) BATS Data Report, BATS 1-12, October, 1988 to September 1989. U.S.JGOFS Planning Office, Woods Hole, MA

1989

29. Dacey, J.W.H., J.E. Craddock, L.P. Madin, A.F. Michaels, and J.R. Weinberg. (1989) Biological impact of deep sea carbon dioxide disposal. In: Feasibility, modeling and economics of sequestering power plant CO₂ emissions in the deep ocean. D. Golomb, H. Herzog, J. Tester, D. White and S. Zemba, MIT Energy Lab Report 89-003.

1988

30. Michaels, A.F. (1988) Acantharia in the carbon and nitrogen cycles of the Pacific Ocean. Ph.D. Dissertation. University of California, Santa Cruz, 226 pp.

1986

31. Coale, K.H., A.F. Michaels and R.L. Pinto. (1986) General blue water diving procedures and guidelines. In: J. Heine (ed.) *Blue Water Diving Guidelines*, California Sea Grant Publication T-CSGCP-014
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1983

33. Michaels, A.F. (1983) The evolution of algal-invertebrate symbioses with special reference to the *Prochloron-Didemnum* symbiosis. Masters Thesis, University of Arizona.

Teaching and Education Experience

2007

Co-Instructor – BISC 585, Scientific Writing and Reviewing, Equally co-taught with Dr. Dave Caron

Co-Instructor – BISC 599, Iron Biogeochemistry, Co-taught with Dr. Jim Moffett as lead instructor

2007

Co-Instructor – BISC 599, Communicating Ocean Science to Informal Audiences, Co-taught with Dr. Judy Lemus

Co-Instructor – BISC 530 – Advanced studies in plankton biology, modest instructional role with Dr. Dave Caron and Dr. Karla Heidelberg

Guest-Lecturer – BISC 102, Humans and the Environment. One lecture on global change

Guest-Lecturer – GEOL 107, Oceanography. One lecture on climate, hurricanes and insurance

2006

Co-Instructor – BISC 585, Scientific Writing and Reviewing, Equally co-taught with Dr. Dave Caron

Guest-Lecturer – BISC 102, Humans and the Environment. One lecture on global change

Guest-Lecturer – GEOL 107, Oceanography. One lecture on climate, hurricanes and insurance

2005

Co-Instructor – BISC 585, Scientific Writing and Reviewing, Equally co-taught with Dr. Dave Caron

Co-Instructor – BISC 582, Advanced Biological Oceanography, One lecture on the global carbon and nitrogen cycles.

Guest-Lecturer – GEOL 107, Oceanography. One lecture on climate, hurricanes and insurance

2004

Co-Instructor – BISC 530 – Advanced studies in plankton biology, Equally co-taught with Dr. Dave Caron (Fall 2004)

Guest-Lecturer – BISC 102, Humans and the Environment. One lecture on global change

2003

Co-Instructor – BISC 585, Scientific Writing and Reviewing, Equally co-taught with Dr. Dave Caron

Co-Instructor – BISC 581L Ran a seminar on the scientific proposal process for the incoming graduate students.

Co-Instructor – BISC 582, Advanced Biological Oceanography, One lecture on the global carbon and nitrogen cycles.

Guest-Lecturer – BISC 102, Humans and the Environment. One lecture on global change

Guest-Lecturer – BISC 290, Introduction to Biological Research

2002

Co-Instructor – BISC 581L Ran a seminar on the scientific proposal process for the incoming graduate students.

Co-Instructor – BISC 582, Advanced Biological Oceanography, One lecture on the global carbon and nitrogen cycles.

Guest-Lecturer – BISC 290, Introduction to Biological Research

2001

Co-Instructor – Thematic Option 103, Human Impacts on the Ocean Planet. Equally co-taught with Dr. Dave Caron in Fall 2001

Co-Instructor – ENST 440, Environmental Risk Assessment. Taught at the Wrigley Marine Science Center, Spring 2001 Catalina Semester. Equally co-taught with Dr. Robert Vos (Political Science)

Co-Instructor – BISC 530 Equally co-taught with Dr. Dave Caron in Spring 2001

Guest Lecturer – Environmental Studies 595. Graduate Seminar – Environmental Risk Analysis

Guest Lecturer – Sustainable Cities Graduate Seminar – Healthy Beaches, Environmental Risks and Market Mechanisms for Environmental Solutions

Guest Lecturer – Biological Sciences 419. Global Biogeochemical Processes

2000

Co-Instructor – ENST 440, Environmental Risk Assessment. Taught at the Wrigley Marine Science Center, Spring 2000 Catalina Semester. Equally co-taught with Dr. Robert Vos (Political Science)

Co-Instructor – BISC 581L Ran two seminars on the scientific proposal process for the incoming graduate students.

Designed a Thematic Option course entitled “Human Impact on the Ocean Planet” with Prof. Dave Caron. The course was approved in 2001 and will be first taught in Fall 2001.

1999

Co-Instructor – BISC 473L, Biological Oceanography. Taught at the Wrigley Marine Science Center, Spring 1999 Catalina Semester. Equally co-taught with Prof. Jed Fuhrman

Planning for creation of a Master of Science degree in Environmental Risk. This is as part of a Sloan Foundation grant awarded to USC for the creation of a set of professional masters degrees. The M.S. degree has been approved and is in the USC Catalog.

1998

Co-Instructor – BISC 473L, Biological Oceanography. Taught at the Wrigley Marine Science Center, Spring 1999 Catalina Semester. Equally co-taught with Jed Fuhrman and Dale Kiefer

Guest Lecturer – Environmental Studies Senior Seminar

Guest Lecturer – Graduate Seminar in Remote Sensing at UCSB. At the invitation of Professor David Siegel I gave a lecture on Hurricanes and Business Risk.

Guest Instructor – Zurich Risk Engineering. I presented 6 hours of lectures over 2 days on climate, hurricanes and other natural hazard risks.

1997

Guest Lecturer – Environmental Studies Senior Seminar

Guest Lecturer – Environmental Law

Designed an USC Environmental Studies course in Environmental Risk Analysis with Prof. Sheldon Kamieniecki. The course was approved in 1998 and was taught on Catalina Island starting in Spring 2000.

1996

co-P.I. and Coordinator - NSF Research Experiences for Undergraduates Site at BBSR. Provided coordination oversight and planning.

co-P.I. - NASA funded courses in the operation of a time-series station. Instructed small groups of scientists from foreign countries in the operation of an ocean time-series station and the appropriate analytical methods for ocean biogeochemistry.

Guest Lecturer - BBSR Elderhostel Program, visiting groups, local business and civic groups

1995

Instructor - Biological Oceanography, Graduate level summer course taught at the Bermuda Biological Station for Research. Co-taught with Dr. Deborah Steinberg.

co-P.I. and Coordinator - NSF Research Experiences for Undergraduates Site at BBSR. Provided coordination oversight and planning. Presented lectures on experimental design, statistics and biological oceanography. Provided general mentorship for a group of 8 undergraduates involved in a 12 week intensive period of independent research.

co-P.I. - NASA funded courses in the operation of a time-series station. Instructed small groups of scientists from foreign countries in the operation of an ocean time-series station and the appropriate analytical methods for ocean biogeochemistry.

Guest Lecturer - BBSR Elderhostel Program, visiting groups, local business and civic groups

1994

Instructor - Biological Oceanography, Graduate level summer course taught at the Bermuda Biological Station for Research. Co-taught with Dr. Mary Silver, UC, Santa Cruz.

co-P.I. and Coordinator - NSF Research Experiences for Undergraduates Site at BBSR. Provided coordination oversight and planning. Presented lectures on experimental design, statistics and biological oceanography. Provided general mentorship for a group of 8 undergraduates involved in a 12 week intensive period of independent research.

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co-P.I. - NASA funded courses in the operation of a time-series station. Instructed small groups of scientists from foreign countries in the operation of an ocean time-series station and the appropriate analytical methods for ocean biogeochemistry.

Guest Lecturer - BBSR Elderhostel Program, visiting groups, local business and civic groups

1992

Visiting Instructor - Summer Course on Ecological Time-series, Cornell, 1992. Presented a series of lectures over the course of one week on ocean biogeochemistry and time-series analysis.

co-P.I. and Coordinator - NSF Research Experiences for Undergraduates Site at BBSR. Provided coordination oversight and planning. Presented lectures on experimental design, statistics and biological oceanography. Provided general mentorship for a group of 8 undergraduates involved in a 12 week intensive period of independent research.

Guest Lecturer - BBSR Elderhostel Program, visiting groups, local business and civic groups

1991

Instructor - Biological Oceanography, Graduate level summer course taught at the Bermuda Biological Station for Research. Co-taught with Dr. Mary Silver, UC, Santa Cruz.

co-P.I. and Coordinator - NSF Research Experiences for Undergraduates Site at BBSR. Provided coordination oversight and planning. Presented lectures on experimental design, statistics and biological oceanography. Provided general mentorship for a group of 8 undergraduates involved in a 12 week intensive period of independent research.

Guest Lecturer - BBSR Elderhostel Program, visiting groups, local business and civic groups

1990

Instructor - Biological Oceanography, Graduate level summer course taught at the Bermuda Biological Station for Research. Co-taught with Dr. Mary Silver, UC, Santa Cruz.

Guest Lecturer - BBSR Elderhostel Program, visiting groups, local business and civic groups

1987-1984

Instructor - Summer Course in Marine Biology, University of California, Santa Cruz, 1987. Co-taught with Dr. Jim McClintock.

Teaching Assistant in many courses at the University of California, Santa Cruz, 1984-1987

1982-1983

Teaching Assistant in introductory biology courses at the University of Arizona

1979

Coordinator and lead instructor. The Wilderness Course, Muir College, University of California, San Diego. This was the only student-run course at UCSD under the oversight of Provost Stewart. As coordinator, I and one other student organized the entire course, ran the teacher training course in the Winter Quarter and coordinated the full course in Spring Quarter. The enrollment was approximately 200 students. I also taught one of the discussion sections where most of the instruction occurred.

1978

Discussion Leader. The Wilderness Course, Muir College, University of California, San Diego. This was the only student-run course at UCSD under the oversight of Provost Stewart. The enrollment was approximately 200 students. I taught one of the discussion sections where most of the instruction occurred.

Student and Postdoctoral Mentorship

University of Southern California

- Victoria Bertics (Biology Graduate Student, I am a member of her Ph.D. committee)
- Beverly Flood (Biology Graduate Student, I am a member of her Ph.D. committee)
- Julliete Finzi (Biology Graduate Student, I am a member of her Ph.D. committee)
- Jill Sohm (Biology Graduate Student, I am a member of her Ph.D. committee)
- Augie Vogel (Biology Graduate Student, I am a member of his Ph.D. committee)
- Diana Webster (Political Economics and Policy Graduate Student, I was a member of her Ph.D. committee)
- John Griffith (Biology Graduate Student, I am a member of his Ph.D. committee)
- Jake Riley (Biology Graduate Student, I was a member of his M.S. committee)
- Maria Echarte (Environmental Studies Graduate Student, member of thesis committee)
- Jamie Allshouse (Environmental Studies Graduate Student, member of thesis committee)
- Tina Cummins (Political Economics Graduate Student, I was a member of oral exam committee)
- Oleg Pavlov (Economics Graduate Student, I was the outside member of his oral exam and Ph.D. committees)
- Chona Sister (Biology Graduate Student, I was a member of her screening exam committee)

Bermuda Biological Station for Research.

As a research scientist at BBSR, I worked closely with a large number of graduate students from many different institutions (BBSR does not award degrees itself). For some of these students, I sat on their Ph.D. committees. For others, I was the local advisor, a position required by BBSR for all resident graduate students.

BBSR Graduate Students

Natalie Waser (member of Ph.D. committee, MIT-WHOI Joint Program), received Ph.D. 1992
Nick Bates (local advisor) University of Southampton, U.K., received Ph.D. 1995
Kjell Gundersen (local advisor) University of Southampton U.K., received Ph.D. 1998
Karen Orcutt (local advisor) University of Warwick U.K., received Ph.D. 1998
Rod Johnson (local advisor) University of Southampton U.K, received Ph.D. 2002

BBSR Postdoctoral Scientists (some later hired onto my grants as research scientists)

Dr. Deborah Steinberg
Dr. Nick Bates
Dr. Norm Nelson
Dr. Craig Carlson
Dr. Dave Malmquist
Dr. Fielding Norton