

RESUME
(updated 4/08)

NAME: Daniel Kamykowski
TITLE: Professor
EDUCATION: 1963-67: BS Biology
Loyola University, Chicago, Illinois
1967-73: Ph.D. Oceanography
Scripps Institution of Oceanography
University of California, San Diego

PROFESSIONAL EXPERIENCE:

1973-75: Research Associate, Dalhousie University
1975-79: Assistant Professor in Botany, University of Texas at Austin, (stationed at the Port Aransas Marine Lab)
1978: Temporary Assistant Professor University of Washington (Friday Harbor Labs)
1979-85: Associate Professor Marine, Earth and Atmospheric Science, NCSU
1984: Tenure
1986-Pres.: Professor Marine, Earth and Atmospheric Sciences, NCSU

RESEARCH INTERESTS:

I study 1) various aspects of phytoplankton ecology, including harmful algal bloom species, dealing with the response of behavior and physiology to physical and chemical environmental conditions using field, laboratory and computer approaches; 2) improvements for satellite ocean color algorithms using proxy nutrient availability based on remotely sensed temperature; 3) the hyperspectral characterization of coastal and oceanic waters in the Galapagos archipelago; 4) the marine formation of organic aerosol.

REVIEWED PUBLICATIONS:

1. McCarthy, J. J. and D. Kamykowski, 1972. Urea and other nitrogenous nutrients in La Jolla Bay during February and April 1970. *Fishery Bulletin* 70: 1261-1274.
2. Kamykowski, D. 1974. Possible interactions between phytoplankton and semidiurnal internal tides. *Journal of Marine Research* 32: 65-87.
3. Kamykowski, D. 1974. Physical and biological characteristics of an upwelling at a station off La Jolla, California during 1971. *Estuarine and Coastal Marine Science* 2: 425-432.
4. Miller, J. R., K. S. Gordon and D. Kamykowski. 1976. Airborne water color measurements off the Nova Scotia coast. *Canadian Journal of Remote Sensing* 1: 42-47.

5. Kamykowski, D. 1976. Possible interactions between plankton and semidiurnal internal tides. II. Deep thermoclines and trophic effects. *Journal of Marine Research* 34: 499-509.
6. Kamykowski, D. and S.-J. Zentara. 1977. Diurnal vertical migration of phytoplankton through temperature gradients. *Limnology and Oceanography* 22: 163-166.
7. Zentara, S.-J. and D. Kamykowski. 1977. Latitudinal relationships among temperature and selected plant nutrients along the west coast of North and South America. *Journal of Marine Research* 35: 321-337.
8. Kamykowski, D. 1978. Organism patchiness in lakes resulting from the interaction between the internal seiche and planktonic diurnal vertical migration. *Ecological Modelling* 4: 197-210.
9. Kamykowski, D. 1979. The growth response of a model *Gymnodinium splendens* in stationary and wavy water columns. *Marine Biology* 50: 289-303.
10. Kamykowski, D. 1980. Sub-thermocline maximums of the dinoflagellates *Gymnodinium simplex* (Lohmann) Kofoid and Swezy and *Gonyaulax polygramma* Stein. *Northeast Gulf Science*, 4: 39-43.
11. Kamykowski, D. and J. L. Bird. 1981. Phytoplankton associations with the variable nepheloid layer on the Texas continental shelf. *Estuarine and Coastal Marine Science* 13: 317-326.
12. Zentara, S.-J. and D. Kamykowski. 1981. Geographic variations in the relationships between silicic acid and nitrate in the South Pacific Ocean. *Deep-Sea Research* 28: 455-465.
13. Kamykowski, D. 1981. Laboratory experiments on the diurnal vertical migration of marine dinoflagellates through temperature gradients. *Marine Biology* 62: 57-64.
14. Kamykowski, D. 1981. The simulation of a Southern California red tide using characteristics of a simultaneously measured internal wave field. *Ecological Modelling* 12: 253-265.
15. Kamykowski, D. 1981. Dinoflagellate growth rate in water columns of varying turbidity as a function of migration phase with daylight. *Journal of Plankton Research* 3: 357-367.
16. Flint, R. W. and D. Kamykowski. 1984. Benthic nutrient regeneration in South Texas coastal waters. *Estuarine, Coastal and Shelf Science* 18: 221-230.
17. Kamykowski, D. and S.-J. Zentara. 1985. Nitrate and silicic acid in the world ocean: Patterns and processes. *Marine Ecology Progress Series* 26: 47-59.

18. Kamykowski, D. and S.-J. Zentara. 1986. Predicting plant nutrient concentrations from temperature and sigma-t in the world ocean. *Deep-Sea Research* 33: 89-105.
19. Miller, R. L. and D. Kamykowski. 1986. Effects of temperature, salinity, irradiance and diurnal periodicity on growth and photosynthesis in the diatom *Nitzschia americana*: Light-limited growth. *Journal of Plankton Research* 8; 215-228.
20. Kamykowski, D. and S. A. McCollum. 1986. The temperature acclimated swimming speed of selected marine dinoflagellates. *Journal of Plankton Research* 8: 275-287.
21. Kamykowski, D. 1986. A survey of protozoan laboratory temperature studies applied to marine dinoflagellate behavior from the viewpoint of ecological implications. (Appendix: Kamykowski, D. and F. G. Giesbrecht, Confidence limits for predicted swimming speed at a given temperature from $S = S_A (1 - e^{-a(T-T_L)}) (1 - e^{-b(T_H - T)})$) In M. A. Rankin (ed.) *Migration: Mechanisms and Adaptive Significance*. Univ. of Texas (Austin) p. 176-194.
22. Miller, R. L. and D. Kamykowski. 1986a. Effects of temperature, salinity, irradiance and diurnal periodicity on growth and photosynthesis in the diatom *Nitzschia americana*: Light-saturated growth. *Journal of Phycology* 22: 339-348.
23. Miller, R. L. and D. Kamykowski. 1986b. Short-term photosynthetic and growth responses in the diatom *Nitzschia americana* to a simulated salinity environment. *Journal of Plankton Research* 8: 305-315.
24. Kamykowski, D. 1987. A preliminary biophysical model of relationships between temperature and plant nutrients in the upper ocean. *Deep-Sea Research* 34: 1067-1079.
25. Kamykowski, D., S. A. McCollum and G. J. Kirkpatrick. 1988. Observations and a model concerning the swimming speed of a photosynthetic marine dinoflagellate under variable environmental conditions. *Limnology and Oceanography* 33: 66-78.
26. Kamykowski, D., S. A. McCollum and G. J. Kirkpatrick. 1988. A comparison of the environmentally modulated swimming behavior of several photosynthetic marine dinoflagellates. In T. Okaichi, D. M. Anderson and T. Nemoto (eds.) *Red Tides: Biology, Environmental Science and Toxicology*. Elsevier (NY) p. 275-278.
27. Kamykowski, D. and S.-J. Zentara. 1989. Circumpolar plant nutrient covariation in the southern ocean: patterns and processes. *Marine Ecology Progress Series* 58: 101-111.

28. Kamykowski, D. 1990. A random walk model examining how phytoplankton distribute in the upper mixed layer. In E. Graneli, B. Sundstrom, L. Edler and D.M. Anderson (eds.) Toxic Marine Phytoplankton. Elsevier (NY) p. 183-188.
29. Kirkpatrick, G.J., T.B. Curtin, D. Kamykowski, M.D. Freezor, M.D. Sartin and R.E. Reed. 1990. Measurements of photosynthetic response to euphotic zone physical forcing. *Oceanography Magazine* 3: 18-22.
30. Kamykowski, D. and S.-J. Zentara. 1990. Hypoxia in the world ocean as recorded in the historical data set. *Deep Sea Research* 37: 1861-1874.
31. Yamazaki, H and D. Kamykowski. 1991. The vertical trajectories of motile phytoplankton in a wind-mixed water column. *Deep-Sea Research* 38: 219-241.
32. Kamykowski, D. and S.-J. Zentara. 1991. Spatio-temporal and process-oriented views of nitrite in the world ocean as recorded in the historical data set. *Deep-Sea Research* 38: 445-464.
33. Janowitz, G.S. and D. Kamykowski. 1991. An Eulerian model of phytoplankton photosynthetic response in the upper mixed layer. *Journal of Plankton Research* 13: 983-1002.
34. Kamykowski, D., R.E. Reed and G.J. Kirkpatrick. 1992. Comparison of sinking velocity, swimming velocity, rotation and path characteristics among six marine dinoflagellate species. *Marine Biology* 113: 319-328.
35. Yamazaki, H., G. Sugihara, G.J. Kirkpatrick and D. Kamykowski. 1994. Is the photosynthetic process nonlinear? *Journal of Plankton Research* 15: 1297-1308.
36. Kamykowski, D., H. Yamazaki and G.S. Janowitz. 1994. A Lagrangian model of phytoplankton photosynthetic response in the upper mixed layer. *Journal of Plankton Research* 16: 1059-1069.
37. Kamykowski, D. 1995. Trajectories of autotrophic marine dinoflagellates. *Journal of Phycology* 31: 200-208.
38. Liu, G., G. S. Janowitz and D. Kamykowski. 1996. A model of the effects of horizontal density gradients on mixing processes in the oceanic surface layer. *Journal of Geophysical Research* 101: 12193-12208.
39. Yamazaki, H. and D. Kamykowski. 1996. Dinoflagellate DVM from a Lagrangian point of view. *Kaiyou* 10: 142-146 (In Japanese).
40. Kamykowski, D., G. S. Janowitz, G. J. Kirkpatrick and R. E. Reed. 1996. A study of time-dependent primary productivity in a natural upper-ocean mixed layer using a biophysical model. *Journal of Plankton Research* 18: 1295-1322.

41. Kamykowski, D. and H. Yamazaki. 1997. A study of metabolism-influenced orientation in marine dinoflagellate diel vertical migration. *Limnology and Oceanography* 42: 1189-1202.
42. Kamykowski, D., H. Yamazaki, A. K. Yamazaki and G. J. Kirkpatrick. 1997. A comparison of how different orientation behaviors influence dinoflagellate trajectories and photoresponses in turbulent water columns. In D. M. Anderson, A. D. Cembella and G. M. Hallegraff (eds.) *The Physiological Ecology of Harmful Algal Blooms*. p. 581-599.
43. Yamazaki, A. K., D. Kamykowski, and H. Yamazaki. 1998. A new approach to plankton behavior modeling. *Journal Japan Society of Simulation Technology* 17: 69-75 (In Japanese).
44. Cambalik, J. J., D. M. Checkley, Jr., and D. Kamykowski. 1998. A new method to measure the terminal velocity of small particle: a demonstration using ascending eggs of the Atlantic menhaden (*Brevoortia tyrannus*). *Limnology and Oceanography* 42: 1189-1202.
45. Kamykowski, D. E. J. Milligan, and R. E. Reed. 1998. Biochemical relationships with orientation of the autotrophic dinoflagellate, *Gymnodinium breve*, under nutrient replete conditions. *Marine Ecology Progress Series* 167: 105-117.
46. Kamykowski, D. E. J. Milligan, and R. E. Reed. 1998. Relationships between taxis responses and diel vertical migration in autotrophic dinoflagellates. *Journal of Plankton Research* 20: 1781-1796.
47. Carder, K. L., R. F. Chen, Z. P. Lee, S. Hawes and D. Kamykowski. 1999. Semi-analytical Moderate-Resolution Imaging Spectrometer algorithms for chlorophyll a and absorption with bio-optical domains based on nitrogen depletion temperatures. *Journal of Geophysical Research* 104: 5403-5422.
48. Janowitz, G. S. and D. Kamykowski. 1999. An expanded Eulerian model of phytoplankton environmental response. *Ecological Modelling* 118: 237-247.
49. Kamykowski, D., Milligan, E. J., Reed, R. E. and Liu, W. 1999. Geotaxis/phototaxis and biochemical patterns in *Heterocapsa* (= *Cachonina*) *illdefina* (Dinophyceae) during diel vertical migrations. *Journal of Phycology* 35: 1397-1403.
50. Yamazaki, A. K. and Kamykowski, D. 2000. A dinoflagellate adaptive behavioral model: response to internal biochemical cues. *Ecological Modelling* 134: 59-72.
51. Liu, G., Janowitz, G. S. and Kamykowski, D. 2001a. A biophysical model of population dynamics of the autotrophic dinoflagellate *Gymnodinium breve*. *Marine Ecology Progress Series* 210: 101-124.

52. Liu, G., Janowitz, G. S. and Kamykowski, D. 2001b. The influence of environmental nutrient condition on *Gymnodinium breve* (Dinophyceae) population dynamics: A numerical study. *Mar. Ecol. Prog. Ser.* 213: 13-37.
53. Liu, G., Janowitz, G. S., Kamykowski, D. 2002. Influence of current shear on *Gymnodinium breve* (Dinophyceae) population dynamics. *Mar Ecol. Prog. Ser.* 231: 47-66.
54. Kamykowski, D., Zentara, S-J., Morrison, J. M., and Switzer, A. C. 2002. Dynamic global patterns of nitrate, phosphate, silicate, and iron availability and phytoplankton community composition from remote sensing data. *Global Biogeochemical Cycles*, 16(4), 1077, doi:10.1029/2001GB001640
55. Switzer, A. C., Kamykowski, D. and Zentara, S-J. 2003. Mapping nitrate in the global ocean using remotely sensed sea surface temperature. *Journal of Geophysical Research* 108:36-1,12. doi:10.1029/2000JC0000444.
56. Kamykowski, D. and Zentara, S-J. 2003. Can phytoplankton community structure be inferred from satellite-derived sea surface temperature anomalies calculated relative to nitrate-depletion-temperatures? *Remote Sensing of Environment* 86(4): 444-457.
57. Nagai, T., Yamazaki, H. and Kamykowski, D. 2003. A Lagrangian photoresponse model coupled with 2nd order turbulence closure. *Marine Ecology Progress Series* 265:17-30.
58. Yamazaki, A. K. and Kamykowski, D. 2004. Modeling planktonic behavior as a complex adaptive system. In Seuront, L. and Strutton, P. G. (eds.) *Handbook of Scaling Methods in Aquatic Ecology: Measurement, Analysis, Simulation*. CRC Press (Boca Rotan, FL) 543-557.
59. Schaeffer, B.A., Kamykowski, D., Milligan, E.J. McKay, L. 2004. Photosynthetic variation among eight different *Karenia brevis* clones. Steidinger, K. A., J. H. Landsberg, C. R. Tomas, and G. A. Vargo (Eds.). *Harmful algae 2002*. Florida Fish and Wildlife Conservation Commission, Florida Institute of Oceanography, and Intergovernmental Oceanographic Commission of UNESCO, St. Petersburg, Florida, USA.
60. Kamykowski, D. and Zentara, S-J. 2005. Changes in world ocean nitrate availability through the 20th century. *Deep-Sea Research I* 52/9 pp. 1719-1744, 10.1016/j.dsr.2005.04.007.
Kamykowski D. and Zentara, S-J. 2006. Corrigendum to 'Changes in world ocean nitrate availability through the 20th century' [*Deep-Sea Research I* 52 (2005) 1719-1744]. *Deep-Sea Research I* 53: 1578-1579.

61. Janowitz, G. S. and Kamykowski, D. 2006. Modeled *Karenia brevis* accumulation in the vicinity of a coastal nutrient front. *Marine Ecology Progress Series* 314:49-59.
62. Sinclair, G., D. Kamykowski, D. 2006. The effects of physiology and behavior on the near-bottom populations of *Karenia brevis* on the west Florida shelf: a numerical study. *African Journal of Marine Science*. 28(2): 361-364
63. McKay, L., Kamykowski D., Milligan, E., Schaeffer, B. and Sinclair, G. 2006. Comparison of swimming speed and photophysiological responses to different external conditions among three *Karenia brevis* strains. *Harmful Algae* 5: 623-636.
64. Sinclair, G.A, Kamykowski, D., Milligan, E., Schaeffer, B. 2006. Nitrate uptake by *Karenia brevis*. I. Influences of prior environmental exposure and biochemical state on diel uptake of nitrate. *Marine Ecology Progress Series* 328:117-124.
65. Sinclair, G.A, Kamykowski, D., Milligan, E., Schaeffer, B. 2006. Nitrate uptake by *Karenia brevis*. II. Behavior and uptake physiology in a nitrate-depleted mesocosm with a bottom nutrient source. *Marine Ecology Progress Series* 328: 125-131.
66. Schaeffer, B. A., Kamykowski, D., McKay, L., Sinclair, G., Milligan, E. J. 2007. A comparison among ten different *Karenia brevis* (Dinophyceae) isolates. *Journal of Phycology* 43(4): 702-714.
67. Sweet, W. V., Morrison, J. M., Kamykowski, D., B.A. Schaeffer, B. A., Banks, S., McCulloch, A. 2007. Water Mass Seasonal Variability of the Galápagos Archipelago. *Deep-Sea Res. I* 54: 2023-2035. doi:10.1016/j.dsr.2007.09.009.
68. Janowitz, G. S., Kamykowski, D., Liu, G. 2008. A Three Dimensional Wind and Behaviorally Driven Population Dynamics Model for *Karenia brevis*. *Continental Shelf Research* 28 (Special Issue): 177-188.
69. Van Dolah, F. M., Leighfield, T. L., Kamykowski, D., Kirkpatrick, G. J. 2008. Cell cycle behavior of laboratory and field populations of the Florida red tide dinoflagellate, *Karenia brevis*. *Continental Shelf Research* 28 (Special Issue): 11-23.
70. Schaeffer, B. A., Morrison, J. M., Kamykowski, D., Feldman, G. C., Xie, L., Lin, Y., Sweet, W., McCulloch, A., Banks, S. 2008. Phytoplankton biomass distribution and seasonal change within the Galapagos Marine Reserve. *Remote Sensing of Environment* (In Press).
71. Sinclair, G. A., Kamykowski, D. 2008. Benthic-pelagic coupling in sediment associated populations of *Karenia brevis*. *Journal of Plankton Research* doi:10.1093/plankt/fbn042.

72. Schaeffer, B. A., Kamykowski, D., McKay, L., Sinclair, G., Milligan, E. 2008. Lipid Biochemistry of *Karenia brevis* (Dinophyceae) during diel vertical migration. *Journal of Phycology* (In Review).
73. Van Dolah, F. M., Lidie, K. B., Monroe, E. A., Bhattacharya, D., Campbell, L., Doucette, G. J., Kamykowski, D. 2008. The Florida Red Tide Dinoflagellate *Karenia brevis*: New Insights into Cellular and Molecular Processes Underlying Bloom Dynamics. *Harmful Algae* (In Review).
74. Kamykowski, D. 2008. Estimating global phosphate concentrations using ARGO float temperature profiles. *Deep-Sea Research I* (In Review).
75. Sweet, W. V., Morrison, J. M., Kamykowski, D., Schaeffer, B. A., Banks, S. 2008. Tropical instability wave interactions within the Galapagos Archipelago. *Deep-sea Research I* (In Review).
76. Wolcott, T., Wolcott, D., Kamykowski, D., Waters-Lindqvist, L. 2008. Plankton mimics reveal how vertical migration of plankton modulates their horizontal transport in nature. *Oceanography* (In Review).

EDITOR

- Yamazaki, H., Kamykowski, D., Tandon, A. 2008. Special Issue: physical-Biological interactions in the Upper Ocean. *Journal of Marine Systems* 69(3-4): 163-337.

OTHER PUBLICATIONS:

1. Kamykowski, D. 1979. Comparison of the possible effects of internal seiches on the plankton populations of selected lakes. In S. E. Jorgensen (ed.) *State-of-the-Art in Ecological Modelling* (1979). 750 p.
2. Brooks, J. M., D. L. Kamykowski, P. L. Parker, R. S. Scalan, N. P. Smith and J. K. Winters 1981. Marine pelagic environment. In R. W. Flint and N. W. Rabalais (ed.) *Environmental Studies of a Marine Ecosystem: South Texas Outer Continental Shelf*. University of Texas Press (Austin, TX) Chap. 2, p. 15-35.
3. Boothe, P. N., D. L. Kamykowski, J. D. McEachran, E. T. Parker, P. L. Parker, L. H. Pequegnot, B. Presley, R. S. Scalan, P. Turk, J. K. Winters and J. H. Wormuth. 1981. Pelagic biota. In R. W. Flint and N. W. Rabalais (ed.) *Environmental studies of a Marine Ecosystem: South Texas Outer Continental Shelf*. University of Texas Press (Austin, TX) Chap. 3, p. 36-67.
4. Kamykowski, D. 1986. Some perspectives on ecological modeling focused on upper ocean processes. In J. D. Burton, P. G. Brewer, and R. Chesselet (eds) *Dynamic Processes in the Chemistry of the Upper Ocean*. Plenum Press (N.Y.). 197-213.
5. Yamazaki, H. and D. Kamykowski. 1994. Reply to Greg Holloway. *Deep Sea Research* 41: 961-963.

6. Yamazaki, A. K., Kamykowski, D. and H. Yamazaki. 1996. Adaptive behavior modelling for planktonic behaviors. Sess. 2-6 (In Japanese).
7. Reed, R. E., G. J. Kirkpatrick and D. Kamykowski. 1997. Short-period photophysiological responses of *Thalassiosira pseudonana* during photoacclimation to near surface irradiance. In *Ocean Optics XIII*, S. G. Ackleson and R. Frouin (eds.) Proc. SPIE 2963: 514-519.
8. Kirkpatrick, G. J., D. Kamykowski and R. E. Reed. 1997. Phytoplankton quantum yield measured on minute time scales in situ. In *Ocean Optics XIII*, S. G. Ackleson and R. Frouin (eds.) Proc. SPIE 2963: 868-873.
9. Morrison, J. M., D. Kamykowski, D.M. Datta, S-J Zentara, and A. C. Switzer. 2000. A northern Indian Ocean comparison between nutrient availability derived from AVHRR-SST and phytoplankton biomass/productivity based on SeaWiFS. The Fifth Pacific Ocean Remote Sensing Conference (PORSEC), 5-8 December 2000. Proceedings., NIO, DonaPaula, Goa (India), 2000, vol. 1, pp. 354-358.
10. Dutkiewicz, S., Beaugrand, G., Hoepffner, N., Kamykowski, D., Melin, F. & Sathyendranath, S. 2008. In IOCCG Working Group (eds). *Macroecology of the ocean: the role of ocean colour in the delineation and application of ecological provinces*. Chapter 6: Applications to biogeochemical cycles and global climate change.

BOOK REVIEW:

- Kamykowski, D. 1987. Review of M. J. Bowman, C. M. Yentsch and W. T. Peterson (eds.) 1986. *Tidal Mixing and Plankton Dynamics*. *Lecture Notes on Coastal and Estuarine Studies* 17: 502 p. *The Quarterly Review of Biology* 62: 208-209.

RESEARCH SUPPORT SUMMARY:

- 1974- The diurnal vertical migration of dinoflagellates through temperature gradients. National Research Council of Canada \$2,000 (Grant A-9686).
- 1975-1976 Phytoplankton ecology of the Gulf of Mexico. University of Texas Research Institute. \$8,900.
- 1977-1978 Chemical and biological survey component of the environmental assessment of the South Texas outer Continental Shelf: Phytoplankton and primary production. BLM. \$54,668 (Co-PI C. Van Baalen).
- 1977-1979 The diurnal vertical migration of dinoflagellates through temperature gradients as it contributes to their field patch structure. NSF \$72,587.
- 1978 Primary production to the nepheloid layer on the South Texas outer continental shelf. BLM \$24,113.

- 1978-1981 Three year integrated data report. BLM \$17,314.
- 1978 Travel to the State of the Art of Ecological Meeting, Copenhagen, Denmark. University of Texas at Austin Committee on Attendance at Meetings of Learned Societies. \$350.
- 1978 Travel to Panama City, Florida to work on the U.S. Navy Tower, STAGE I. Alfred P. Sloan Foundation \$644.
- 1980-81 Photosynthetic response of dinoflagellates to variable light regimes simulating diurnal vertical migration on internal waves. UNC Marine Science Council \$3,000.
- 1981-1983 The implications of nitrate excess at silicic acid depletion in Subantarctic Surface Water. NSF \$52,599.
- 1981-1982 The adaptation of marine dinoflagellate swimming speeds to different temperature. UNC Marine Science Council \$1,942.
- 1982-1985 Dinoflagellate swimming behavior in response to changes in temperature and other environmental factors. NSF/ONR \$95,106.
- 1982-1983 Geographic variation in the relationships of temperature salinity or σ_t versus plant nutrient concentration in the world ocean. NASA \$50,690.
- 1983-1985 Ibid. NASA \$52,719.
- 1985-1986 Dinoflagellate swimming behavior in responses to changes in temperature and other environmental factors. NSF \$157,512.
- 1985-1987 Ibid. ONR \$18,915.
- 1985 Supplementary funds toward the purchase of an EXPERTVISION Motion Analyses System. NCSU-ICRAC \$27,000.
- 1985 Supplementary funds toward the purchase of an EXPERTVISION Motion Analysis System. NCSU-Zoology Dept. \$1,800.
- 1985-1988 The ecology of phytoplankton moving in a natural mixed layer. Measurement and characterization. ONR \$219,926. (Co-PI: T. B. Curtin).
- 1986-1990 A continued analysis of the upper ocean plant nutrient information in the NODC data base. NSF \$141,133.

- 1988-1990 The ecology of phytoplankton moving in a natural mixed layer: Measurement and characterization. ONR \$131,200.
- 1989-1991 Environmental influences on dinoflagellate swimming behavior and photosynthesis. NSF \$204,265.
- 1992-1995 The application of a real-time biophysical model of phytoplankton photoacclimation in the upper ocean at sea. NSF and ONR \$266,482. (Co-PI: G. S. Janowitz & G. J. Kirkpatrick).
- 1992-1994 Small scale physical processes related to the photosynthetic response of phytoplankton in the euphotic zone of the ocean. ONR (SORP) \$43,363. (Co-PI: T. B. Curtin).
- 1993-1998 The influence of vertical mixing on the SeaWiFS algorithm. NASA \$453,908. (Co-PI: J. M. Morrison, G. S. Janowitz & G. J. Kirkpatrick).
- 1993-1996 Time-dependent changes in RuBPCase in single phytoplankton species (SUPA-related) under actual light conditions. ONR (AASERT) \$80,581. (Support for R. E. Reed).
- 1993 Upgrading SeaWiFS capability in North Carolina. CIFO \$1,200. (Co-PI: J. M. Morrison & G. S. Janowitz).
- 1993-1994 To assemble a facility to monitor the calibration of spectroradiometers used in support of SeaWiFS ocean color imagery. CIFO \$24,975. (Co-PI: J. M. Morrison & R. Patty).
- 1995-1996 Fellowship to visit Japan. Japan Society for the Promotion of Science \$10,000. (Co-PI: H. Yamazaki)
- 1995-1998 Dinoflagellate swimming orientation from an ecological perspective. NSF \$300,000.
- 1996 Invited Speaker at Bermuda HAB Meeting. NATO-ASI \$900.
- 1996-1997 A proposal to study red tide formation by *Gymnodinium breve* using remote sensing and behavioral techniques. Mote Marine Lab \$12,271. (Support for R. E. Reed)
- 1997-2000 Refining remote sensing estimates of nutrient concentrations based on temperature. NASA. \$189,527.
- 1997-1998 The role of behavior in *Gymnodinium breve* blooms. Mote Marine Lab. \$10,000. (Co-PI: T. Wolcott)

- 1998-2000 SeaWiFS data collection, calibration and processing for the Indian Ocean. NASA. \$102,000. (PI: J. M. Morrison, Co-PIs: E. Bohm, D. Kamykowski & S. Raman).
- 1998-2001 ECOHAB: Florida. EPA. \$122,000 (3 years). (Co-PI: G. S. Janowitz).
- 2000-2002 ECOHAB: Pfiesteria. NOAA \$40,000 (Co-PI: G. S. Janowitz).
- 2002 Small scale modeling of *Gymnodinium breve* process cruise data. ECOHAB: Florida 4th Year. EPA through Mote Marine Lab, \$15,000 (Co-PI: G. S. Janowitz)
- 2001-2005 Laboratory and numerical modeling studies of *Gymnodinium breve* to aid in predicting natural bloom events. NOAA (ECOHAB). \$481,463. (Co-PI: G. S. Janowitz)
- 2001-2007 Behaving drifters as *Gymnodinium breve* mimics. EPA (ECOHAB). \$423,493. (Co-PIs: T. G. Wolcott & G. S. Janowitz)
- 2002-2003 The Carolinas Coastal Ocean Observing and Prediction System (CaroCOOPS). NOAA. \$1,220,000. (PIs: L Pietrafesa, L Xie and J. M. Morrison)
- 2003-2004 The Carolinas Coastal Ocean Observing and Prediction System (CaroCOOPS). NOAA. \$1,220,000? (PIs: L. Pietrafesa, L. Xie and J. M. Morrison)
- 2003-2007 Climate and Weather Impacts on Society and Environment (CWISE) NOAA \$1,575,000 (\$375,000: first year) (Participant; PIs: L. Pietrafesa and Lian Xie)
- 2004-2008 Connectivity and Upwelling Dynamics In the Galapagos Marine Reserve (GMR), NASA, \$922,075 (PIs: J. M. Morrison, D. Kamykowski, L. Xie, S. Bank (Charles Darwin Research Station), Eva Danula (Charles Darwin Research Station), Gene Feldman (NASA Goddard).
- 2007-2010 Benthic Dinoflagellate Migration (BenDiM): Occurrence and Processes, NSF, \$560,000. (PIs: D. Kamykowski, G. S. Janowitz, C. Thomas, J. M. Morrison (UNCW))
- 2007-2010 Effect of Terrestrial and Marine Organic Aerosol on Regional and Global Climate: Model Development, Application, and Verification with Satellite Data, DOE, \$663,826. (PIs: N. Meskhidze, Y. Zhang, D. Kamykowski)

2008-2009 Initiation of an Inter-Institutional Environmental Observation Network System for North Carolina (NC-EONS). UNC-UNC Wilmington, \$36000. (PI: D. Eggleston)

GRADUATE STUDENTS

Jerry Bird	Ph.D.	1981	University of Texas
Richard L. Miller	Ph.D.	1984	NCSU
Gary J. Kirkpatrick	MS	1986	NCSU
Rose Ragnacci	MS	1990	NCSU
Ed Woloszyn	MS	1990	NCSU
Gary Kirkpatrick	Ph.D.	1990	NCSU
Leslie Dorworth	Ph.D.		NCSU (No Thesis)
Huaichin Chen	MS	1994	NCSU
Larry Settle	Ph.D.		NCSU (Incomplete)
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Kimberly Jones	Ph.D.	2007	UNCW/NCSU (Co-chair: W. Cooper)
Hayley Skelton	Ph.D.	2008	NCSU (Co-chair: J. Burkholder)
Geoff Sinclair	Ph.D.		NCSU
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