

Rachel Todd Noble

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Professional Interests

- Recreational and shellfish harvesting water quality
- Marine microbial ecology
- Coastal and estuarine water quality
- Environmental microbiology
- Microbial contaminants in recreational and shellfish harvesting waters
- Molecular applications and novel methods development

Summary of Qualifications

- Experienced in marine microbial ecology and environmental, aquatic, and molecular microbiology research and techniques
- Extensive work with microbiological water quality issues including pathogen fate and transport, inactivation and disinfection, expertise in development of rapid novel molecular approaches for pathogen and water quality assessment, regional and watershed-based water quality studies
- Large scale biological oceanography and estuarine research methods for both the laboratory and the field
- Large scale project and database management, and statistical approaches for data analysis.

Education

University of Southern California. Ph. D. Marine Biology, 1998.

Dissertation: *Fates of Viruses in the Marine Environment*

Carnegie Mellon University. B.S. Molecular Biology, 1991.

Professional Experience

Associate Professor

July 1, 2007-present

University of North Carolina at Chapel Hill, Institute of Marine Sciences: Joint appointment between the Institute of Marine Sciences and the Institute for the Environment

Assistant Professor

July 1, 2001-June 30, 2007

University of North Carolina at Chapel Hill, Institute of Marine Sciences: Joint appointment between the Institute of Marine Sciences and the Carolina Environmental Program

Post-Doctoral Fellow and Research Faculty

February 1998 to June, 2001

Joint appointment between the Southern California Coastal Water Research Project (SCCWRP) and the USC Wrigley Institute for Environmental Studies

Graduate Research Assistant

1991-1998

Department of Biological Sciences, University of Southern California

Visiting Researcher**1996-1997**

Danish Research Academy, University of Copenhagen

Honors, Fellowships, and Awards

Recipient of UNC Chapel Hill Junior Faculty Development Award, December 2006

Recipient of an ISEA Travel Grant Award for Young Investigators, August 2002

DIALOG III, October 1999, Selected to represent recent doctorates in Aquatic Sciences, Bermuda
Biological Research Station, Bermuda

Danish Research Academy, Visiting Research Fellowship, 1996-1997

ARCS Society Scholarship Award, 1995-1998

Trojan League Award, May 1996

Recipient of the Award for Southern California American Society for Microbiology Doctoral
Candidate Poster Presentation, 1993, 1994**Professional Affiliations**

American Society of Microbiology

The Oceanography Society

American Society of Limnology and Oceanography

American Association for the Advancement of Science

American Water Works Association

International Water Association

Recent Invited National and International Speaking EngagementsSociety for Aquatic Microbial Ecology 10, Keynote Speaker, University of Algarve, Faro, Portugal,
September 2007

American Public Works Association Invited Speaker, Wilmington, NC, September 2007

Duke University, Department of Ecology, November 2006

EPA BEACHES National Conference, Panel Member, Session Chair, Invited Speaker, Niagara
Falls, NY, October 2006

California and the World Ocean Conference, Long Beach, CA, September 2006

Woods Hole Oceanographic Institute Center for Oceans and Human Health, July 2006

Coastal Conference on Ecosystem-Based Approaches to Management in the Southeast Region, UNC
Wilmington, March 2006USDA-CSREES National Water Conference Research, Extension and Education for Water
Quality and Quantity, February 2006

North Carolina Water Resources Association, Raleigh NC, September 2005

EPA BEACHES Conference, San Diego, CA October 2004

Conference on Nutrients and Pathogens in Estuaries, Rutgers University, April 2004

Duke University Marine Laboratory Spring Seminar Series, March 2004, Beaufort, NC

National Oceanographic and Atmospheric Administration, Beaufort Laboratory Spring Seminar
Series, January 2004Symposium on Coastal Water Quality Issues, September 2003, Duke University Marine
LaboratoryPlenary Lecture, Rapid Microbiological Measurement Methods Development Workshop, Advanced
Coastal Technology, Monterey, CA, May 2003International Society for Exposure and Assessment National Meeting, Vancouver, Canada,
August 2002

American Society for Microbiology, National Meeting, May 2002

University of Georgia, Department of Marine Sciences Seminar Series, April 2002

Southern California Academy of Sciences Symposium, May 2001

National Water Research Institute Seminar Series, Irvine, CA January 2001

Invited Workshops and Invited Professor Opportunities

Visiting Professor, University of Ancona, Italy, Department of Marine Sciences, April 2006
Public Health Rapid Microbial Detection Workshop on Integrated Ocean Observing Systems, St. Petersburg, FL Jan 2006
Invited Visiting Professor, Theoretical and Practical Course - Enterovirus detection in aquatic samples using rapid filtration method and molecular techniques. CIMA-IMAR Advanced course May 2005, FCMA - University of the Algarve, Portugal
Visiting Professor, University of Ancona, Italy, Department of Marine Sciences, Viruses in Aquatic Systems, April 2003
Invited Workshop Participant for the Commission Internationale pour L'Exploration Scientifique de la Mer Mediterranee (CIESM), Ecology of Marine Viruses, March 2003, Banyuls-sur-Mer, France
National Microbial Source Tracking Workshop, February 2003, Irvine, CA
National Microbial Source Tracking Workshop, February 2002, Irvine, CA
National Stormwater Workshop, October 2001, Costa Mesa, CA

Peer-Reviewed Publications

O. C. Shanks, M. Sivaganesan, J. Lu, J. Santo Domingo, A. D. Blackwood, **R. T. Noble**, E. Atikovic, S. Seifring, R. A. Haugland. Quantification of Genetic Markers for Bovine Fecal Bacteria with Real-Time PCR. Accepted. Applied and Environmental Microbiology.

J. S. Fries, **Noble, R.T.**, Kelly, G.M., and Characklis, G.W. 2007. Sediment-water exchange of *Vibrio* sp. and fecal indicator bacteria: implications for persistence and transport in the Neuse River Estuary, North Carolina, USA. In press. Journal of Water Research.

Hsieh, J. L., Fries, J. S., and **R. T. Noble**. 2008. Dynamics and Predictive Modeling of *Vibrio* *Spp.* in the Neuse River Estuary, NC. Journal of Environmental Microbiology. 10(1):57-64.

Coulliette, A.D., A.D. Gronewold, E.S. Money, M.L. Serre, and **R.T. Noble**. 2007. Examining the relationship between wet weather and fecal contamination in a North Carolina estuary. Water Environment Federation Specialty Conference Series, TMDL 2007: Meeting Proceedings. Bellevue, Washington.

Gronewold, A.D., A.D. Coulliette, **R.T. Noble**, R.L. Wolpert, and K.H. Reckhow. 2007. Pollutant-Specific TMDLs: Developing a Bayesian Network Model for Supporting Fecal Coliform TMDL Assessments. Water Environment Federation Specialty Conference Series, TMDL 2007: Meeting Proceedings. Bellevue, Washington.

Bean, T., J. A. Morris, Jr., **R.T. Noble**, and P.K. Fowler. Comparative Microbial Dynamics in *Crassostrea virginica* (Gmelin, 1791) and *Crassostrea ariakensis* (Fujita, 1913). In press. Journal of Shellfish Research.

Kennish, M. J., S. B. Bricker, W. C. Dennison, P. M. Glibert, R. J. Livingston, K. A. Moore, **R. T. Noble**, H. W. Paerl, J. M. Ramstack, S. Seitzinger, D. A. Tomasko, and I. Valiela. 2007. Barnegat Bay-Little Egg Harbor Estuary: Case Study of a Highly Eutrophic Coastal Bay System. Journal of Ecological Applications. 17 (5) Supplement, pp S3-S16.

Hsieh, J., J. S. Fries, and **R. T. Noble**. 2007. *Vibrio* and phytoplankton dynamics in a eutrophying estuary. Journal of Ecological Applications. 17 (5) Supplement, pp S102-S109.

Fries, J. S., **R. T. Noble**, H. W. Paerl, and G. W. Characklis. 2007. Particle suspensions and their regions of effect in the Neuse River Estuary: Implications for water quality monitoring. *Estuaries and Coasts*. 30 (2):359-364.

Fuhrman, J. A. Patel, A., Steele, J. Hewson, I., Schwallbach, M. and **R. T. Noble**. 2007. Virus and prokaryote enumeration from planktonic marine environments by epifluorescence microscopy with SYBR® Green I. *Nature Protocols*. 2 (2): 269-276.

Fries, J. S., **R. T. Noble**, G. M. Kelly and J. L. Hsieh. 2006. Storage of *Vibrio sp.* in estuarine sediments following storm events: possible population shifts and future human health threats. *EOS*. Published by the American Geophysical Union. Feb 20, 2007 Issue. 88 (8): 93-95.

Fries, J. S., Characklis, G. W., and **R. T. Noble**. 2006. Attachment of Fecal Indicator Bacteria to Particles in the Neuse River Estuary, NC, USA. *Journal of Environmental Engineering*. 132(10): 1338-1345.

Gregory, J. B., Litaker, W. A., and **R. T. Noble**. 2006. A Rapid One-Step Quantitative Reverse Transcriptase PCR Assay for Enterovirus with a Competitive Internal Positive Control. *Applied and Environmental Microbiology*. 72 (6): 3960-3967.

Bean, T., J. A. Morris, Jr., **R.T. Noble**, and P.K. Fowler. 2006. Comparative Microbial Dynamics in *Crassostrea virginica* and *Crassostrea ariakensis*. NOAA Technical Memorandum NOS NCCOS 25. 32 pp.

Noble, R. T. Griffith, J. F., Blackwood, A. D., Fuhrman, J. A., Gregory, J. B., Hernandez, X., Liang, X., Bera, A. A., and K. Schiff. 2006. Multi-tiered approach using Quantitative Polymerase Chain Reaction for Tracking Sources of Fecal Pollution to Santa Monica Bay, CA. *Appl. Environ. Microbiol.* 72 (2): 1604-1612.

Noble, R. T., and S. B. Weisberg. 2005. A review of technologies being developed for rapid microbial detection in recreational waters. Review Article. *Journal of Water and Health*. 03 (2005): 381-392.

Bongiorni, L., Magagnin, M., Armeni, M., **Noble, R. T.**, and Danovaro, R. 2005. Viral production, decay rates and life strategies along a trophic gradient in the north Adriatic Sea. *Applied and Environmental Microbiology*. 71 (11): 6644-6650.

Fuhrman, J.A., Liang, X., and **R. T. Noble**. 2005. Rapid detection of enteroviruses from small volumes of natural waters by real time RT-PCR. *Appl. Environ. Microbiol.* 71 (8): 4523-4530.

Noble, R. T., I. M. Lee, and K. Schiff. 2004. Inactivation of indicator bacteria from various sources of fecal contamination in seawater and freshwater. *Journal of Applied Microbiology*. 96: 464-472.

Noble, R. T. , M. K. Leecaster, C. D. McGee, S. B. Weisberg, K. Ritter. 2004. Comparison of bacterial indicator analysis methods in stormwater-affected coastal waters. *Water Research*. 38:1183-1188.

Paerl, H. W., J. Dyble, P. H. Moisander, **R. T. Noble**, M. F. Piehler, J. L. Pinckney, T. F. Steppe, L. Twomey, L. M. Valdes. 2003. Microbial indicators of aquatic ecosystem change: current applications to eutrophication studies. *FEMS Microbiology Ecology*. 46: 233-246.

Noble, R. T., S. M. Allen, A. D. Blackwood, W.-P. Chu, S. C. Jiang, G. L. Lovelace, M. D. Sobsey, J. R. Stewart, and D. A. Wait. 2003. Use of viral pathogens and indicators to differentiate between human and non-human fecal contamination in a microbial source tracking comparison study. *Journal of Water and Health*. 1: 195-207.

Noble, R. T., Weisberg, S. B., Leecaster, M. K., McGee, C. D., Dorsey, J. H., Vainik, P. and Orozco-Borbón, V. 2003. Storm effects on regional beach water quality in southern California. *Journal of Water and Health*. 1 (1): 23-31.

Noble, R. T., Moore, D.F., Leecaster, M. K., McGee, C. D., Weisberg, S. B. 2003. Comparison of Total Coliform, Fecal Coliform and Enterococcus Bacterial Indicator Response for Ocean Recreational Water Quality Testing. *Water Research*. 37: 1637-1643

Noble, R.T., Weisberg, S. B., Leecaster M. K., McGee, C., Ritter, K., Vainik, P., Walker, K. 2003. Comparison of methods for measuring bacterial indicators of beach water quality. *Environmental Monitoring and Assessment*. 81 (1):301-312.

Noble, R. T., and J. A. Fuhrman. 2001. Enteroviruses detected in the coastal waters of Santa Monica Bay, CA: Low correlation to bacterial indicators. *Hydrobiologia*. 460:175-184.
Jiang, S. J., and **R. T. Noble**. 2001. Human adenoviruses and coliphages in urban runoff-impacted waters of Southern California. *Applied and Environmental Microbiology*. 67:179-184.

Noble, R. T., and J. A. Fuhrman. 2000. Rapid virus production and removal as measured with fluorescently labeled viruses as tracers. *Applied and Environmental Microbiology*. 66 (9) 3790-3797.

Noble, R.T., Dorsey, J., Leecaster, M., Reid, D., Schiff, K., Weisberg, S. W. 2000. A regional survey of the microbiological water quality along Southern California Bight Shoreline. *Environmental Monitoring and Assessment*. 64: 435-447.

Noble, R.T., and J.A. Fuhrman. 1999. Breakdown and microbial uptake of marine viruses. *Aquatic Microbial Ecology*. 20 (1): 1-11.

Noble, R. T., Middelboe, M., and J. A. Fuhrman. 1999. The effects of viral enrichment on the mortality and growth of heterotrophic bacterioplankton. *Aquatic Microbial Ecology*. 18 (2): 1-13.

Fuhrman, J. A., and **R. T. Noble**. 2000. Causative agents of bacterial mortality and the consequences to marine food webs. *Microbial Biosystems: New Frontiers. Proceedings of the 8th International Symposium on Microbial Ecology*. Bell, C. R., Brylinsky, M., and Johnson-Green, P. (eds.). Atlantic Canada Society for Microbial Ecology, Halifax, Canada.

Noble, R. T., and J. A. Fuhrman. 1998. Use of SYBR Green I for rapid epifluorescence counts of marine viruses and bacteria. *Aquatic Microbial Ecology*. 14 (2): 113-118.

Noble, R.T., and Fuhrman, J.A. 1997. Virus decay and its causes in coastal waters. *Appl. Environ. Microbiol.* 63 (1):77-83.

Fuhrman, J.A., and **R.T. Noble**. 1995. Viruses and protists cause similar bacterial mortality in coastal seawater. *Limnology and Oceanography*. 40(5):875-885.

Published Book Chapters

Weisberg, S. B., Griffith, J. F., and **Noble, R. T.** Chapter in *Manual in Environmental Microbiology*. 2007.

Noble, R. T., and G. F. Steward. 2001. Virus proliferation in aquatic systems. 2001. Textbook Chapter. *Methods in Microbiology*. Edited by John H. Paul. Academic Press, London.

Noble, R. T. 2001. Enumeration of marine viruses by epifluorescence microscopy. Textbook Chapter. *Methods in Microbiology*. Edited by John H. Paul. Academic Press, London.

Fuhrman, J.A., R.M. Wilcox, **R.T. Noble**, and N.C. Law. 1993. Viruses in marine food webs. In Guerrero, R. and C. Pedros-Alio (eds.). *Trends in Microbial Ecology*. Spanish Society for Microbiology, Barcelona. pp. 295-298.

Recent Published Abstracts

O. C. Shanks, E. Atikovic, M. Sivaganesan, S. Seifring, A. D. Blackwood, J. Lu, J. Santo Domingo, **R. T. Noble**, and R. A. Haugland. Development of real-time PCR assays for quantification of cow fecal pollution. ASM National Meeting 2007. Toronto, Ontario, Canada. ASM Press, Washington DC.

Coulliette, A. D., and **R. T. Noble**. ASM National Meeting 2007. Toronto, Ontario, Canada. ASM Press, Washington, DC.

Morris, J.A., Jr. T.J. Bean, **R.T. Noble**, P.K. Fowler. 2006. Comparison of bacteria uptake and depuration between *Crassostrea ariakensis* and *Crassostrea virginica*. *Journal of Shellfish Research*. 25(2): 756.

S. M. S. Mesquita, R. Miguel, M. P. Reis, **R. T. Noble**. 2006. Molecular Tools for *Microcystis* spp. Monitoring in Drinking Water Production and Raw Water Sources. ASM National Meeting 2006. Orlando, FL. ASM Press, Washington DC.

A. D. Coulliette, M. L. Serre, and **R. T. Noble**. 2006. An Application of Space/Time Estimation of Microbial Indicators with Respect to Rainfall in the Newport River Estuary, NC. ASM National Meeting 2006. Orlando, FL. ASM Press, Washington DC

A D. Blackwood, S. Yu, J. B. Gregory, **R. T. Noble**. Rapid QPCR Assays for *Escherichia coli* and *Enterococcus* in Recreational Waters: Equivalent to Existing Methods? ASM National Meeting 2006. Orlando, FL. ASM Press, Washington DC.

R. T. Noble, J.S. Fries, and J. L. Hsieh. Assessing the Role of Particle Attachment in Fate and Transport of Microbial Indicators and Pathogens in an Eutrophic Estuary. American Society for Limnology and Oceanography. Ocean Sciences Meeting, Honolulu, HI, February 2006.

R. T. Noble, T. J. Bean, A. D. Blackwood, D. E. Line, J. K. Parker, N. M. White. Source tracking studies: developing specific, quantitative markers for watershed studies. USDA National Water Conference, Invited Speaker, San Antonio, TX. February 2006.

Gregory, J. B., and **R. T. Noble**. 2005. A Rapid One Step Quantitative RT-PCR Assay for the Detection of Human Enterovirus with an Internal Positive Control for RT-PCR Inhibitors. ASM National Meeting. May 2005. Atlanta, GA. ASM Press.

Blackwood, A. D. and **R. T. Noble**. 2005. Comparison of TaqMan and Scorpion Multiplex Assays for use as Indicators of Fecal Contamination in Environmental Waters. ASM National Meeting. May 2005. Atlanta, GA. ASM Press.

Characklis, G. W., A. D. Blackwood, J. S. Fries, and **R. T. Noble**. The Role of Particle-Mediated Transport in the Ecology of Human Pathogens in the Neuse River Estuary, NC, USA. ASLO Summer Meeting. Savannah, GA. June 2004.

Gregory, J. B., A. D. Blackwood, and **R. T. Noble**. Quantitative Reverse Transcriptase PCR for the Detection of Enteroviruses in Environmental Samples One-Step versus Two-Step Approaches. ASM National Meeting. Abstract Q-417, Page 575. New Orleans, LA. May 2004

Blackwood, A. D., J. B. Gregory, and **R. T. Noble**. Development of a Multiplex Quantitative PCR Assay Using Species-Associated Bacterial Indicators with Specific Types of Fecal Pollution in Environmental Water Samples. ASM National Meeting. Abstract q-476, page 586. New Orleans, LA. May 2004

Noble, R. T. Blackwood, A D ; Gregory, J B. Combining traditional and novel molecular methods to discriminate and quantify fecal contamination in recreational and shellfish harvesting waters. ASLO Ocean Sciences Meeting. Honolulu, HI. February 2004