THE HUDSON RIVER ESTUARY

The Hudson River Estuary is a comprehensive look at the physical, chemical, biological, and environmental management issues that are important to our understanding of the Hudson River. Chapters cover the entire range of fields necessary to understanding the workings of the Hudson River estuary; the physics, bedrock geological setting and sedimentological processes of the estuary; ecosystem-level processes and biological interactions; and environmental issues such as fisheries, toxic substances, and the effect of nutrient input from densely populated areas. This book places special emphasis on important issues specific to the Hudson, such as the effect of power plants and high concentrations of PCBs. The chapters are written by specialists at a level that is accessible to students, teachers, and the interested layperson. The Hudson River Estuary is a unique scientific biography of a major estuary, with relevance to the study of any similar natural system in the world.

Jeffrey S. Levinton is Distinguished Professor of Ecology and Evolution at Stony Brook University and has worked for many years as a researcher in marine ecology and as a textbook writer in Marine Biology. He has been a Guggenheim Fellow, a Fulbright Senior Fellow and has done research and lectured at many institutions throughout the world. He is also the recipient of the State University of New York Chancellor's award for excellence in teaching.

John R. Waldman is Professor of Biology at Queens College of the City University of New York. He is a well-known fisheries scientist and is the author of a number of popular books in natural science. Before coming to Queens College, he worked for twenty years as a senior scientist of the Hudson River Foundation.
River, take me along,
In your sunshine, sing me a song
Ever moving and winding and free;
You rolling old river, you changing old river
Let's you and me, river, go down to the sea.

Bill Staines
The Hudson River Estuary

Edited by

Jeffrey S. Levinton
Stony Brook University

John R. Waldman
City University of New York
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Preface

The glorious Hudson! No river in the United States has been more loved, nurtured, ridiculed and defended, and more often written off for dead. The Hudson is replete with legends and lacks only one about a raft with Tom Sawyer and Huck Finn; but its own may be more fantastic. To native Americans it was the wondrous Muhheakunnuk, “great waters constantly in motion” or “the river that flows both ways.” To the Dutch settlers of the valley it was a fertile wonderland, with many legends emerging from their lives and travels in the Hudson Valley and surrounding forests, fields, and mountains. Beneath the noisy bowlers that, according to legend, caused the thunderclaps atop Storm King Mountain, lay the sirenic fairies luring ships to the rocky shores of the Hudson Highlands, sending them to the deep watery grave of World’s End. It is a river that held the key to the geographic unification of the nascent American revolutionary colonies and also the place where great environmental controversies led to a modern-day sturm und drang, giving birth to an era of environmental activism. If this is too burdensome a legacy to bear, the Hudson also gives us its lightness of being: A fall day in a kayak or a ferry ride, or a refreshing swim, or even a big fish to catch. The Hudson valley has produced the greatest school of landscape painting in America and a host of novels with a strong sense of place, from those of Washington Irving to T. C. Boyle.

Many of us have desperately wanted a book that could address a crucial and more concrete need. The many scientific faces of Hudson River research have never been gathered effectively in a single place. Some excellent volumes have captured the natural history of the Hudson and we especially have Robert Boyle to thank for his dedication to the Hudson in his 1969 volume “The Hudson River, A Natural and Unnatural History.” Equally important is the more scientifically inclined treatment of Hudson River research compiled by Karin Limburg and others in 1986. This book set a high standard, but lacks many recent important findings.

With this background we sought to provide a comprehensive volume that covers a wide spectrum of topics, ranging from the physics of water movement, to the biology, to the current environmental problems created by human impacts on the Hudson. In 1998 I approached the Hudson River Foundation with such an idea, which was met with considerable enthusiasm and led to the pleasure of contacting a group of broad-thinking and highly competent colleagues who engaged the project with similar zeal. I later asked John Waldman to join me in editing this large and diverse array of contributions. Of the senior authors of the thirty chapters in this book, I can honestly say that virtually no one who was invited turned me down. All recognized the need for this book, but perhaps some had different schedules than others for completion. Hence, the invitations in 1999 were finally answered with the last typescripts in 2003. All but one were created de novo to fit the volume. The only exception is a very important paper (Baker et al., Chapter 24) describing the science behind the Polychlorinated Biphenyl (PCB) issue in the Hudson, which is reprinted here with slight modifications.

This book could not have been produced without the generous support of the Hudson River Foundation, which provided some support for me to design the scope of the volume and to contact prospective authors. I am especially grateful to the authors who so generously contributed their time and energy to producing the chapters that comprise the book. Clay Hiles and Dennis Suszkowski provided advice and support and provided crucial contacts and suggestions of chapter authors. We thank Susan
Detwiler and Peggy Rote for their preparation of the volume. Finally, we are very grateful to Kirk Jensen, formerly of Cambridge University Press, for his suggestions, support and encouragement and to Peter Gordon of Cambridge Press who completed the project.

I would especially like to thank John Waldman for joining me as an editor of this volume and we both are grateful to the patience and support of our families during the long time during which this book reached completion. I learned more and more every day I walked the shore with Cady.

Jeffrey Levinton
Stony Brook, New York
June 20, 2005
Contributors

Kenneth W. Able*, Rutgers University, Institute of Marine and Coastal Sciences, Marine Field Station, 800 Great Bay Blvd., Tuckerton, NJ 08087-2004, email: able@imcs.rutgers.edu

Michael Aucott, NJ Department of Environmental Protection, 401 East State Street, Trenton, NJ 08625-0409

Joel E. Baker*, Chesapeake Biological Laboratory, University of Maryland, Solomons, MD 20688, email: baker@cbl.umces.edu

Robin Bell*, Lamont-Doherty Earth Observatory, Palisades, NY 10964-8000, email: robins@ldeo.columbia.edu

Elizabeth A. Blair, New York State Department of Environmental Conservation, Bard College Field Station, Annandale, NY 12504

W. Frank Bohlen, University of Connecticut, Department of Marine Sciences, 1080 Shennecossett Road, Groton, CT 06340, email: bohlen@uconnvm.uconn.edu

Henry Bokuniewicz*, Marine Sciences Research Center, Stony Brook University, Stony Brook, NY 11794-5000, email: hbokuniewicz@notes.cc.sunysb.edu

Richard E. Bopp*, Department of Earth and Environmental Sciences Rensselaer Polytechnic Institute, Troy, NY 12180, email: boppbr@rpi.edu

Elizabeth W. Boyer, Department of Environmental Science, Policy, and Management, University of California, Berkeley, CA 94720, email: boyer@nature.berkeley.edu

Thomas M. Brosnan*, National Oceanic and Atmospheric Administration, 1305 East West Highway, Room 10355, Silver Spring, MD 20910, email: tom.brosnan@noaa.gov

Bruce Brownawell, Marine Sciences Research Center, Stony Brook University, Stony Brook, NY 11794, email: bbrownawell@notes.cc.sunysb.edu

Nina F. Caraco, Institute of Ecosystem Studies, 65 Sharon Turnpike, Millbrook, NY 12545, email: caracon@ecostudies.org

Suzanne Carbotte, Lamont-Doherty Earth Observatory, Palisades, NY 10964-8000, email: robins@ldeo.columbia.edu

Robert M. Cerrato*, Marine Sciences Research Center, Stony Brook University, Stony Brook, NY 11794-5000, email: Robert.Cerrato@sunysb.edu

Damon A. Chaky, Lamont-Doherty Earth Observatory of Columbia University, Palisades, NY 10964, email: chakyd@ldeo.columbia.edu

Robert Chant, Institute of Marine and Coastal Sciences, Rutgers University, 71 Dudley Road, New Brunswick, NJ 08901, email: chant@imcs.rutgers.edu

Steven N. Chillrud, Lamont-Doherty Earth Observatory of Columbia University, Palisades, NY 10964, email: chilli@ldeo.columbia.edu

J. Kirk Cochran*, Marine Sciences Research Center, Stony Brook University, Stony Brook, NY 11794, email: kcochran@notes.cc.sunysb.edu

Jonathan J. Cole*, Institute of Ecosystem Studies, 65 Sharon Turnpike, Millbrook, NY 12545, email: colej@ecostudies.org

Tracy Collier, Northwest Fisheries Science Center, 2725 Montlake Blvd. East, Seattle, WA 98112-2097, email: Tracy.K.Collier@noaa.gov

* Senior Author
LIST OF CONTRIBUTORS

Thomas F. Cooney, III, Hazen & Sawyer, 498 7th Ave, 11th Floor, New York, NY 10018, tel (212) 777-8400, email: tcooney@hazenandsawyer.com

Milene Cormier, Lamont-Doherty Earth Observatory, Palisades, NY 10964-8000, tel (845) 365-8827, fax (845) 365-8179

Christopher F. D'Elia, Environmental Science and Policy, University of South Florida, St. Petersburg, FL 33701, email: cdelia@spadmin.usf.edu

Jordi Dachs, 14 College Farm Rd., Rutgers University, New Brunswick, NJ 08901

Darin R. Damiani, U.S. Army Corps of Engineers New York District, Environmental Analysis Branch, Planning Division, 26 Federal Plaza, New York, NY 10278-0090, email: darin.r.damiani@usace.army.mil

Janet T. Duffy-Anderson, NOAA/National Marine Fisheries Service, Alaska Fisheries Science Center/RACE, 7600 Sand Point Way, NE, Bldg. 4 Seattle, WA 98115, email: Janet.Duffy-Anderson@noaa.gov

Stephen Eisenreich, 14 College Farm Rd., Rutgers University, New Brunswick, NJ 08901

Kevin J. Farley*, Environmental Engineering Department, Manhattan College, Riverdale, NY 10471, email: kevin.farley@manhattan.edu

Huan Feng, Dept. of Earth and Environmental Studies, Montclair State University, Upper Montclair, NJ 07043

Vicki Lynn Ferrini, Marine Sciences Research Center, State University of New York at Stony Brook, Stony Brook, NY 11794-5000

Stuart E. G. Findlay*, Institute of Ecosystem Studies, Box AB, Millbrook, NY 12545, email: Findlays@ecostudies.org

Roger D. Flood, Marine Sciences Research Center, Stony Brook University, Stony Brook, NY 11794-5000, email: roger.flood@sunysb.edu

W. Rockwell Geyer*, Woods Hole Oceanographic Institution, 98 Water Street, MS #12, Woods Hole, MA 02571, email: rgeyer@whoi.edu

Cari L. Gigliotti, 14 College Farm Rd., Rutgers University, New Brunswick, NJ 08901

Anne L. Golden, Department of Community and Preventive Medicine, Mount Sinai School of Medicine, New York, NY 10029

Kathryn A. Hattala, Hudson River Fisheries Unit, New York State Department of Environmental Conservation, 21 South Putt Corners Road, New Paltz, NY 12561, email: kahattala@gw.dec.state.ny.us

Leo J. Hetling, Adjunct Professor, Environmental and Energy Engineering, Rensselaer Polytechnic Institute, 10 Gladwish Road, Delmar, NY 12054, email: hetling@att.net

David J. Hirschberg, Marine Sciences Research Center, Stony Brook University, Stony Brook, NY 11794

Robert W. Howarth*, Department of Ecology and Evolutionary Biology, Cornell University, Ithaca, NY 14853, and The Ecosystems Center, Marine Biological Lab, Woods Hole, MA 02543

Andrew W. Kahnle, Hudson River Fisheries Unit, New York State Department of Environmental Conservation, 21 South Putt Corners Road, New Paltz, NY 12561-1620, email: awkahnle@gw.dec.state.ny.us

Erik Kiviat*, Hudsonia Ltd., P.O. Box 5000, Annandale, NY 12504-5000, email: kiviat@bard.edu

John W. Ladd, Hudson River National Estuarine Research Reserve, New York State Dept of Environmental Conservation, 43 Hudson Watch Drive, Ossining, NY 10562

Thomas R. Lake, New York State Department of Environmental Conservation, Hudson River Estuary Program, 21 S. Putt Corners Rd., New Paltz, NY 12561, email: trlake7@aol.com

Robin Landeck Miller*, HydroQual, Inc., 1200 MacArthur Boulevard, Mahwah, NJ 07430, email: rmiller@hydroqual.com
LIST OF CONTRIBUTORS

Phillip J. Landrigan*, Department of Community and Preventive Medicine, Mount Sinai School of Medicine, New York, NY 10029, email: phil.landrigan@mssm.edu

Jeffrey S. Levinton*, Department of Ecology and Evolution, Stony Brook University, Stony Brook, NY 11794-5245, tel (631) 632-8602, fax (631) 632-7626, email: levinton@life.bio.sunysb.edu

Karin E. Limburg*, State University of New York, College of Environmental Science Forestry, Syracuse, NY 13210, email: klimburg@esf.edu

Darcy J. Lonsdale, Marine Sciences Research Center, Stony Brook University, Stony Brook, NY 11794-5245, email: dlonsdale@notes.cc.sunysb.edu

Anne L. McElroy, Marine Sciences Research Center, Stony Brook, NY, 11794-5245, email: amcelroy@notes.cc.sunysb.edu

Cecilia McHugh, School of Earth and Environmental Sciences, Queens College, City University of New York, 65-30 Kissena Blvd., Flushing, NY 11367

Roxanne Marino, Department of Ecology and Evolutionary Biology, Cornell University, Ithaca, NY 14853, and The Ecosystems Center, Marine Biological Lab, Woods Hole, MA 02543

Steven G. Morgan*, Bodega Marine Laboratory, University of California at Davis, P. O. Box 247, Bodega Bay, CA 94923 USA, email: sgmorgan@ucdavis.edu

Rob Nairn, Baird & Associates, 627 Lyons Lane, Suite 200, Oakville, Ontario Canada L6J 5Z7, email: rmairn@baird.com

W. Charles Nieder, Hudson River NERR/New York State Department of Environmental Conservation, Annandale, NY 12504, email: wcnieder@gw.dec.state.ny.us

Michael L. Pace*, Institute of Ecosystem Studies, 65 Sharon Turnpike, Millbrook, NY 12545, email: pacem@ecostudies.org

Lisa Rosman, Coastal Protection and Restoration Division, NOAA, 290 Broadway, New York, NY 10007

William B. F. Ryan, Lamont-Doherty Earth Observatory, Palisades, NY 10964-8000

Robert E. Schmidt, Hudsonia Limited and Simon’s Rock College, 84 Alford Rd., Great Barrington, MA 01230, email: schmidt@simons-rock.edu

Shu Yan, 14 College Farm Rd., Rutgers University, New Brunswick, NJ 08901

Edward L. Shuster, Department of Earth and Environmental Sciences Rensselaer Polytechnic Institute, Troy, NY 12180, email: shuste@rpi.edu

H. James Simpson*, Department of Earth and Environmental Sciences, Lamont-Doherty Earth Observatory of Columbia University, Palisades, NY 10964, email: simpsonj@ldeo.columbia.edu

Leslie Sirkin, deceased

John P. St. John, HydroQual, Inc., 1200 MacArthur Boulevard, Mahwah, NJ 07430

Andrew Stoddard, Dynamic Solutions, LLC, 112 Orchard Circle, Hamilton, VA, 20158-9734, email: StudyWQ@aol.com

David L. Strayer*, Institute of Ecosystem Studies, PO. Box AB, Millbrook, NY 12545, email: strayerd@ecostudies.org

Dennis J. Suszkowski*, Hudson River Foundation, 17 Battery Place, New York, NY 10004, email: dennis@hudsonriver.org

Dennis P. Swaney, Department of Ecology and Evolutionary Biology, Cornell University, Ithaca, NY 14853

Joanne Thissen, Lamont-Doherty Earth Observatory, Palisades, NY 10964-8000, present address: Liberty Science Center, Liberty State Park, Jersey City, NJ 07305

Lisa A. Totten*, 14 College Farm Rd., Rutgers University, New Brunswick, NJ 08901, email: totten@envsci.rutgers.edu
Daryl A. VanRy, 14 College Farm Rd., Rutgers University, New Brunswick, NJ 08901

Roelof Versteeg, Lamont-Doherty Earth Observatory, Palisades, NY 10964-8000, present address: Idaho National Engineering and Environmental Laboratory, P.O. Box 1625, Idaho Falls, ID 83415

John R. Waldman*, Hudson River Foundation, 17 Battery Place, New York, NY 10004, present address: Department of Biology, Queens College, City University of New York, Flushing, NY 11367

James R. Wands, HydroQual, Inc., 1200 MacArthur Blvd., Mahwah, NJ 07430, email: jwands@hydroqual.com

Judith S. Weis, Department of Biological Sciences, Rutgers University, Newark, NJ 07102, email: jweis@andromeda.rutgers.edu

Cathleen Wigand, United States Environmental Protection Agency, Narragansett, RI 02882, email: wigand.cathleen@epamail.epa.gov

Isaac Wirgin*, Nelson Institute of Environmental Medicine, New York University School of Medicine, Tuxedo, NY 10987, email: wirgin@env.med.nyu.edu
THE HUDSON RIVER ESTUARY
View of the Hudson River from Olana (former home of artist Frederick Church), south of Hudson, New York. Photo by Heather Malcom.

Pickerel weed in flower, South Cove, with West Point in background.

A great deal has been learned from a Hudson River survey using multi-beam scanning of the river bed (see Chapter 5). Top: a false-colored scan of the bottom showing large sand waves (scale at bottom in 300 m). Bottom: One of a number of wrecks discovered in the survey. Scans provided by Roger Flood.
Moodna Creek Marsh, Orange County, New York. Photo by Stuart Findlay.

Constitution Marsh, showing patch of expanding Phragmites australis among larger stands of cattails. Photo by Jeffrey Levinton.

Air photo of Foundry Cove, Cold Spring, New York, during restoration in 1994. Marsh is dug out and new drainage established. Photo provided by Jim Rod.
Cattails, a dominant of freshwater tidal marshes. Photo by Jeffrey Levinton.

Muskrat lodge, Constitution Marsh. Photo by Eric Lind.

Left – Young-of-year menhaden (top) and gizzard shad. Right – White perch. Photos furnished by John Waldman.
Left – Marsh wren nest on cattails. Right – Sampling for benthic animals. Photos by Jeffrey Levinton.

Closeup of water chestnut, *Trapa natans*, bed; floating seed at lower left. Photos by Jeffrey Levinton.

Left: A nesting female snapping turtle, *Chelydra serpentina* (shell length ca. 36 cm long). Right: Same turtle, about 200 feet above marsh in rear, from which she climbed up a steep slope to get to this nesting site. Photos by Jeffrey Levinton.

Returning a shortnose sturgeon, *Acipenser brevirostrum*, to the river. Photo by Kristin Marcell.
A shad bake, organized by Hudson River Foundation educator Christopher Letts. Photo by John Waldman.

Seining for fish in the shallows of Tivoli South Bay next to a water chestnut bed. Jeremy Frenzel (right) takes a sample with his father while working as a Polgar Fellow in the Hudson River Estuarine Sanctuary. Photo by Karin Limburg. Sadly, Jeremy died in 2005.

The blue claw crab, *Callinectes sapidus*. Photo by Gregg Kenney.
These plates are available for download in color from www.cambridge.org/9780521207980

Chironomid larva. Photo by Eric Lind.

Damsel fly larva. Photo by Eric Lind.

*Daphnia* sp. Photo by Eric Lind.

Gammarid amphipods. Photo by Eric Lind.


Hydra budding. Photo by Eric Lind.