

GABOURY BENOIT

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Education

- 1988 **Ph.D.**, Chemical Oceanography
Massachusetts Institute of Technology, Cambridge, MA/
Woods Hole Oceanographic Institution, Woods Hole, MA
- 1983-
1984 Predoctoral fellowship
Université de Paris VI, Laboratoire de Géochimie et Métallogénie, Paris
- 1985 **M.S.**, Civil Engineering - Water Resources
Massachusetts Institute of Technology, Cambridge, MA
- 1978 **B.S.**, Geochemistry
Yale University, New Haven, CT
Graduated *cum laude*, with distinction in geology.

Experience

- Nov 06-
June 09 Associate Dean for Research
School of Forestry and Environmental Studies, Yale University
- Aug 1991-
present Professor
School of Forestry and Environmental Studies, Yale University
Professor, Chemical Engineering (2000 - present) New Haven, CT
- Sep 1999-
present Director, Hixon Center for Urban Ecology
- 1993 - 2009 Founder and Director, Center for Coastal and Watershed Systems
- Feb 96 - Jan 98 National Academy of Sciences/ National Research Council,
Committee on Watershed Management
- May 1990-
July 1991 Assistant Professor
Department of Marine Sciences, Texas A & M University Galveston, TX
Department of Oceanography, Texas A&M University College Station, TX
- Feb 1989-
April 1990 Visiting Assistant Professor
Department of Marine Sciences, Texas A & M University Galveston, TX
- Nov 1987-
Jan 1989 Visiting Assistant Professor
Dept. of Environmental Engineering, Michigan State University E. Lansing, MI
- May 1978-
Sep 1981 Laboratory Manager.
EcoScience Laboratory (independent consulting lab) Norwich, CT

**Teaching
Experience**

Aquatic Chemistry, Environmental Chemistry, Watershed Science, Sustainable Development, Brownfield Redevelopment, Graduate Research Methods, Water Resources capstone courses at Yale's Environment School.

Taught Instrumental Analysis, Physical Geology, Marine Chemistry, Aquatic Chemistry courses at Texas A & M University, Dept. of Marine, Sciences and Michigan State University, Dept. of Civil and Environmental Engineering.

**Professional
Societies**

American Geophysical Union, American Society of Limnology and Oceanography, Estuarine Research Federation, American Society of Civil Engineers, Amer. Chemical Society, Geochemical Society, American Water Resources Association.

**Research
Interests**

Estuarine chemistry, trace metal chemistry, nonpoint source pollution, microplastics, litter, deicing salts, green infrastructure, metal speciation, sustainable land development, watershed management, environmental radiochemistry, paleolimnology

Much of my recent research focuses on how land development in urbanizing coastal areas affects water quality and hydrology. I am especially interested in (1) using continuous measurements to couple hydrology and chemistry to understand the special role of processes occurring at the land-sea interface, and (2) evaluating the effectiveness of green infrastructure.

**Peer
Review
Service**

Limnol. Oceanogr., *Geochim. Cosmochim. Acta*, *Environ. Sci. Technol.*, *Estuaries*, *Aquatic Geochem.*, *J. Great L. Res.*, *Sci. Total Environ.*, *Mar. Environ. Res.*, *J. Industrial Ecology*, *J. Environ. Sci. & Health*, *Toxic Hazard. Subst. Contr.*, MIT Press, NSF, EPA, DOE, Hudson R. Foundation, NOAA Sea Grant, Nat. Undersea Res. Center., US Dept. Agriculture, Connecticut DEEP, USGS.

**Recent
Invited
Lectures**

Stony Brook University, Gordon Research Conference, Amer. Chem. Soc., Geological Society of, Canada Institute for Ecosystem Studies, Argentum Conference, Univ. of Massachusetts, M.I.T., NOAA Sea Grant, Univ. of Connecticut, Wesleyan Univ., Univ. of Rhode Island.

PEER-REVIEWED PUBLICATIONS

To give a better sense of my research interests, my peer-reviewed publications, including 2 books, cover the following topics.

- ***Estuarine chemistry***: 1, 6, 9, 10, 11, 12, 13, 21, 24, 25, 29, 34, 35, 36, 37, 51, 53, 62, 63
- ***Metals, including their behavior, sources, and speciation***: 10, 11, 12, 13, 14, 15, 16, 18, 19, 22, 25, 26, 27, 28, 29, 30, 31, 34, 35, 36, 37, 41, 42, 44, 46, 48, 49, 50, 51, 52, 66, 67, 70, 76, 77

- ***Land use, watershed management, Green Infrastructure, and its impact on aquatic chemistry***: 23, 33, 47, 49, 53, 54, 55, 55, 56, 57, 58, 59, 60, 62, 63, 64, 65, 66, 67, 68, 69, 71, 72, 73, 75
- ***Radionuclides, including their behavior and dating methods***: 2, 3, 4, 5, 7, 8, 9, 24, 25, 32, 61, 63, 67, 68, 70, 77
- ***Analytical methods***: 5, 14, 17, 20, 22, 28, 32, 31, 38, 39, 40, 43, 45

Published Books

49. Balmori D. and G. Benoit (2007) Land and Natural Development (LAND) Code: Guidelines for Sustainable Land Development. John Wiley and Sons. 256 pp.
33. Graf W., C. Aichinger, B. Anderson, G. Benoit, P. Bisson, M. Garcia, J. Heaney, C. Johnston, L. Lane, C. Olsen, M. Pfeffer, L. Shabman, J. Stanford and S. Trimble (1998) *New Strategies for America's Watersheds: Integrating Ecological, Economic, and Social Factors*, National Academy Press, Washington D.C., 311 pp.

Research Articles (nearing submission)

76. Xuan Z. and G. Benoit (for submission to *Limnol. Oceanogr.*) Cobalt speciation and cycling in Linsley pond, Connecticut, USA.
77. Xuan Z. and G. Benoit (for submission to *Limnol. Oceanogr.*) Beryllium-7 investigation of sediment and cobalt dynamics in a Connecticut estuary with self-regulating tide gates.
66. Semrod K. and G. Benoit (for submission to *Journal of Environmental Management*) Stormwater amelioration by bioretention: Quantification with a before-after-control-impact experiment.
65. Wang. P and G. Benoit (for submission to *Ecological Modeling*) Modeling the comprehensive phosphorus cycle in a managed eutrophic lake.
70. Ye J., Z. Xu, L. Wang and G. Benoit (for submission to *Environ. Sci. Technol.*). Impact of inflow characteristics on the accumulation of clogging materials in subsurface-flow wetlands.
58. Wang. P and G. Benoit (for submission to *Environmental Management*) Total mass balance of phosphorus cycling in a eutrophic lake: Management options and limitations.

Research Articles (Submitted)

75. Dahms K. and G. Benoit (2020) Quantifying bioswale performance through field scale research: A case study from New Haven, CT. Submitted to *J. Environ. Mgmt.*
74. Peiyao XU, Mengdie YU, Kaixiang ZHANG, Shenghua ZHANG, Gaboury BENOIT (2020) Physiological and morphological response of *Aphanizomenon flos-aquae* to watermelon (*Citrullus lanatus*) peel aqueous extract. Submitted to *J. Environ Science.*
71. Ganz T., K. Covey, C. Bettigole and G. Benoit (2019) Chemical effects of snowmelt on an alpine lake in the Wind River Range, WY. Submitted to *Water, Air, Soil Pollut.*

Research Articles (Published, In Press, or Accepted)

72. Jianfeng YE, Hao CHEN, Yafei ZHOU, Zhongning WANG, Qilong JIA, Yunhan NIE, Lei LI, and Gaboury BENOIT (2020 in press) Alterations in CH₄ and CO₂ productions and emissions driven by pollution sources in municipal sewers: An assessment of the role of DOM components and microbiota.
73. Zhang S.H. and Benoit G. (2019) Comparative physiological tolerance of unicellular and colonial *Microcystis aeruginosa* to extract from *Acorus calamus* rhizome. *Aquatic Toxicology* **215**.
63. Benoit G. S. Bisson, and M. Hirschbeck (2020 in press) Beryllium-7 elucidates sediment dynamics of the Branford River estuary, Connecticut, USA. *Coasts and Estuaries*.
59. Demars S. and G. Benoit (2019) Leaching of ANC and chromium from concrete: Effect of aging simulated by sample carbonation. *Water Air Soil Pollut.* **230** (7), 159.
67. Benoit G. (2018) Mercury in dated sediment cores from coastal ponds of St Thomas, USVI. *Mar. Pollut. Bull.* **126**, 535-539.
64. Ye J., Z. Xu, H. Chen, L. Wang and G. Benoit (2018) Reduction of clog matter in constructed wetlands by metabolism of *Eisenia foetida*: process and modeling. *Environmental Pollut.* **238**, 803-811.
62. Benoit G. and P. Wang (2017) Laboratory investigation of mineralization of refractory nitrogen from sewage treatment plants: Implications for Long Island Sound hypoxia. *Environmental Management* **60**(6), 1171-1176.
61. Feingold B.J. and G. Benoit (2018) A novel method to infer historical DDT use on Cape Cod, Massachusetts (USA), based on Σ DDT degradation and ²¹⁰Pb dating in lake sediment cores. *J of Paleolimnology* **60** (4), 461-472.
60. G. Benoit and S. Demars (2018) Evaluation of organic and inorganic compounds extractable by multiple methods from commercially available crumb rubber mulch. *Water, Air, and Soil Pollution* **229** (3).
57. Adera S., G. Benoit, E. Twohig, K. Jagannathan, and A. Drizo (2018) Improving performance of treatment wetlands: Evaluation of supplemental aeration, varying flow direction, and phosphorus removing filters. *Water, Air, Soil Pollut.* **229** (3).
56. Wang. P and G. Benoit (2017) Modeling the biogeochemical role of photosynthetic sulfur bacteria in phosphorus cycling in a managed eutrophic lake. *Ecological Modeling.* **361**, 66-73.
55. Liu H., G. Benoit, T. Liu, Y. Liu and H Guo (2015) An integrated system dynamics model developed for managing lake water quality at the watershed scale. *J. Environ. Management* **155**, 11 – 23.
54. Schiff R., G. Benoit and J. MacBroom (2010) Evaluating stream restoration: a case study from two partially developed 4th order Connecticut, U.S.A streams and evaluation monitoring strategies. *River Research and Applications* **27**(4), 431-460.

53. Xu X.G., H.F. Peng, Q.Z. Xu, H.Y. Xiao and G. Benoit (2009) Land changes and conflicts coordination in coastal urbanization: A case study of the Shandong Peninsula in China. *Coastal Management* **37**, 54-69.
52. Clark H.F. and G. Benoit (2009) Legacy sources of mercury in an urbanized watershed. *Environ. Chem.* **6**, 235-244.
51. Clark H.F. and G. Benoit (2009) Current and historic mercury deposition to New Haven Harbor (CT, USA): Implications for industrial coastal environments. *Sci. Total Environ.* **407**, 4472-4479.
50. Twining B.S., S.E. Mylon, and G. Benoit (2007) Potential role of copper availability in nitrous oxide accumulation in a temperate lake. *Limnol. Oceanogr.* **52**, 1354-1366.
48. Hu H., Mylon S., and G. Benoit (2007) Volatile organic sulfur compounds in a stratified lake. *Chemosphere* **67**, 911-919.
47. Schiff R.K. and G. Benoit (2007) Effects of impervious cover at multiple spatial scales on coastal watershed streams. *J. Amer. Water Resour. Assoc.* **43**, 712-730.
46. Hu H., Mylon S., and G. Benoit (2006) Distribution of the thiols glutathione and 3-mercaptopropionic acid in Connecticut lakes. *Limnol. Oceanogr.* **51**, 2763-2774.
45. K. J. O'Keefe, N. M. Morales, H. Ernstberger, G. Benoit, and P. E. Turner (2006) Laboratory-dependent bacterial ecology: A cautionary tale. *Appl. Environ. Microbiol.* **72**, 3032-3035.
44. Morrison M. and G. Benoit (2005) Temporal variability in physical speciation of metals during a winter rain-on-snow event. *J. Environ. Qual.* **34**, 1610-1619.
43. Morrison, M. A. and G. Benoit (2004) Investigation of conventional membrane and tangential flow ultrafiltration artifacts and their application to the characterization of freshwater colloids. *Environ. Sci. Technol.* **38**: 6817-6823
42. Mylon, S.E., B.S. Twining, N.S. Fisher and G. Benoit (2003) Relating the speciation of Cd, Cu, and Pb in two Connecticut rivers with their uptake in algae. *Environ. Sci. Technol.* **37**, 1261-1267
41. Kramer J.R., G. Benoit et al. (2002) Environmental chemistry of silver. *In: Silver in the Environment: Transport, Fate, and Effects.* (A.W. Andren & T.W. Bober, eds.) SETAC Press.
40. Mylon S., H. Hu and G. Benoit (2001) Unsuitability of Cr(II) reduction for the measurement of sulfides in oxic water samples. *Anal. Chem.* **74**, 661-663.
39. Mylon S. and G. Benoit (2001) Subnanomolar detection of acid labile sulfides by the classical methylene blue method coupled to HPLC. *Environ. Sci. Technol.* **35**, 4544-4548.
38. Morrison M. and G. Benoit (2001) Filtration artifacts caused by overloading membrane filters. *Environ. Sci. Technol.* **35**, 3774-3779.
37. Rozan T.F. and G. Benoit (2001) Mass balance of heavy metal in New Haven Harbor, Connecticut: The predominance of nonpoint sources. *Limnol. Oceanogr.* **46**, 2032-2049.
36. Zelewski L.M., G. Benoit and D.E. Armstrong (2001) Mercury dynamics in Tivoli South Bay, a freshwater tidal mudflat wetland in the Hudson River. *Biogeochemistry* **52**, 93-112.

35. Rozan T.F. and K.S. Hunter (2001) Effects of discharge on silver loading and transport in the Quinnipiac River, Connecticut. *Sci. Total Environ.* **279**, 195-205.
34. Lee X., G. Benoit and X. Hu (2000) Total gaseous mercury concentration and flux over a coastal salt marsh in Connecticut. *Atmos. Environ.* **34**, 4205-4213.
32. Benoit G. and T.F. Rozan (2001) ^{210}Pb and ^{137}Cs dating methods in lakes: A retrospective study. *Journal of Paleolimnology* **25**, 455-465.
31. Rozan T.F., G. Benoit, H. Nash, and Y.-P. Chin (1999) Intercomparison of DPASV and ISE for evaluation of Cu complexation by natural DOM. *Environ. Sci. Technol.* **33**, 1766-1770.
30. Rozan T.F. and G. Benoit (1999) Geochemical factors controlling free Cu ion concentrations in rivers. *Geochim. Cosmochim. Acta* **63**, 3311-3319.
29. Rozan T.F. and G. Benoit (1999) Heavy metal removal efficiencies in a river-marsh system estimated from patterns of accumulation in sediments. *Mar. Environ. Res.* **48**, 335-351.
28. Rozan T.F., G. Benoit and G. Luther, III (1999) Measuring metal sulfides complexes in oxic river waters with square wave voltammetry. *Environ. Sci. Technol.* **33**, 3021-3026.
27. Benoit G. and T.F. Rozan (1999) The influence of size distribution on the particle concentration effect and trace metal partitioning in rivers. *Geochim. Cosmochim. Acta* **63**, 113-127.
26. Benoit G., E.X. Wang, W.C. Nieder, M. Levandowsky, and V. Breslin (1999) Sources and history of heavy metal contamination and sediment deposition in Tivoli South Bay, Hudson River, NY. *Estuaries* **22**, 167-178.
25. Benoit G., T.F. Rozan, P. Patton and C. Arnold (1999) Trace metals and radionuclides reveal sediment sources and accumulation rate in Jordan Cove, Connecticut. *Estuaries* **22**, 65-80.
24. Anisfeld S.C., M.J. Tobin and G. Benoit (1999) Sedimentation rates in flow-restricted and restored salt marshes in Long Island Sound. *Estuaries* **22**, 231-244.
23. Bormann B.T., D.S. Wang, F.H. Bormann, G. Benoit, R. April, and M.C. Snyder (1998) Rapid, plant-induced weathering in an aggrading experimental ecosystem. *Biogeochemistry* **43**, 129-155.
22. Benoit G., K.S. Hunter and T.F. Rozan (1997) Sources of trace metal contamination artifacts during collection, handling, and analysis of freshwaters. *Anal. Chem.* **69**, 1006-1011.
21. Anisfeld S.C. and G. Benoit (1997) Impacts of flow restrictions on salt marshes: An incidence of acidification. *Environ. Sci. Technol.* **31**, 1650-1657.
20. Rozan T.F., G. Benoit and R.H. April (1997) A selective dissolution analysis optimized for measurement of weathering products in a soil. *Soil Sci. Soc. Am. J.* **61**, 941-958.
19. Wang E.X. and G. Benoit (1997) Fate and transport of contaminant lead in spodosols: A simple box model analysis. *Water Air Soil Pollut.* **95**, 381-397.
18. Wang E.X. and G. Benoit (1996) Mechanisms controlling the mobility of contaminant lead in spodosols: Speciation studies of soil solutions. *Environ. Sci. Technol.* **30**, 2211-2219.

17. Benoit G. and H.F. Hemond (1996) Vertical eddy diffusion calculated by the flux gradient method: Significance of sediment-water heat exchange. *Limnol. Oceanogr.* **41**, 157-168.
16. Benoit G. (1995) Evidence of the particle concentration effect for lead and other metals in fresh waters based on ultraclean technique analyses. *Geochim. Cosmochim. Acta.* **59**, 2677-2687.
15. Wang E.X., F.H. Bormann and G. Benoit (1995) Evidence of complete retention of atmospheric lead in the soils of northern hardwood forest ecosystems. *Environ. Sci. Technol.* **29**, 735-739.
14. Benoit G. (1994) Clean technique measurement of Pb, Ag, and Cd in fresh water: A redefinition of metal pollution. *Environ. Sci. Technol.* **28**, 1987-1991.
13. Rozan T.F., K. Hunter and G. Benoit (1994) Industrialization as recorded in floodplain deposits of the Quinnipiac River, Connecticut. *Mar. Pollut. Bull.* **28**, 564-569.
12. Benoit G., J. Schwantes, G.S. Jacinto and M.R. Goud-Collins (1994) Preliminary study of the redistribution and transformation of HgS from cinnabar mine tailings deposited in Honda Bay, Palawan, the Philippines. *Mar. Pollut. Bull.* **28**, 754-759.
11. Benoit G., S.D. Oktay-Marshall, A. Cantu, Ii, E.M. Hood, C.H. Coleman, M.O. Corapcioglu and P.H. Santschi (1994) Partitioning of Cu, Pb, Ag, Zn, Fe, Al, and Mn between filter-retained particles, colloids, and solution in six Texas estuaries. *Mar. Chem.* **45**, 307-336.
10. Morse J.W., B.J. Presley, R.J. Taylor, G. Benoit and P.H. Santschi (1993) Trace metals in Galveston Bay: Water, sediments, and biota. *Mar. Environ. Res.* **36**, 1-37.
9. Baskaran M., P.H. Santschi, G. Benoit and B. Honeyman (1992) Scavenging of thorium isotopes by colloids in seawater of the Gulf of Mexico. *Geochim. Cosmochim. Acta* **56**, 3375-3388.
8. Benoit G. and H.F. Hemond (1991) Evidence for diffusive redistribution of ^{210}Pb in lake sediments. *Geochim. Cosmochim. Acta.* **55**, 1963-1975.
7. Benoit G. and H.F. Hemond (1990) ^{210}Po and ^{210}Pb remobilization from lake sediments in relation to iron and manganese cycling. *Environ. Sci. Technol.* **24**, 1224-1234.
6. Santschi P.H., G. Benoit, P. Hoehener, and M. Buchholtz-Ten Brink (1990) Chemical processes at the sediment-water interface. *Mar. Chem.* **30**, 269-316.
5. Benoit G. and H.F. Hemond (1988) Improved methods for the measurement of ^{210}Po , ^{210}Pb , and ^{226}Ra , *Limnol. Oceanogr.* **33**, 1618-1622.
4. Benoit G. and H.F. Hemond (1988) On Dilution of ^{210}Pb by organic sedimentation in lakes of different trophic states, and application to studies of sediment-water interactions, *Limnol. Oceanogr.* **33**, 299-304.
3. Benoit G. and H.F. Hemond (1987) Biogeochemical mass balance of ^{210}Po and ^{210}Pb in a New England Lake, *Geochim. Cosmochim. Acta.* **51**, 1445-1456.
2. Buesseler K.O., G. Benoit, and E.R. Sholkovitz (1985) A pore water study of plutonium in a seasonally anoxic lake, *J. Environ. Radioactivity*, **2**, 283-292.

1. Benoit G., K.K. Turekian, and L.K. Benninger (1979) Radiocarbon dating of a core from Long Island Sound, *Estuarine, Coastal, and Shelf Sci.* **9**, 171 - 183.

Manuscripts in preparation

Benoit G. (202#) Mercury in fish from St Thomas, USVI. Target journal: *Marine Pollution Bulletin*.

Benoit G. and D. Nemeth (202#) Export of sediment caused by land development in a Virgin Island watershed: Assessment via continuous stream monitoring. Target journal: *Earth Surface Processes and Landforms*

Benoit G. (202#) Land development induced watershed erosion as revealed by ¹³⁷Cs inventories in soils and sediment capture in coastal ponds of St Thomas, USVI. Target journal: *Earth Surface Processes and Landforms*

Anisfeld S. and G. Benoit (202#) Nitrogen removal by constructed wetlands. For submission to *Sci. Total Environ.*

CURRENT RESEARCH

Urban watersheds

- Assessment of hydrologic and water quality benefits of bioswales constructed to treat runoff from a downtown area served by combined sewers. [National Fish and Wildlife Federation – Long Island Sound Futures Fund]
- Design and evaluation of interdisciplinary restoration of an abandoned urban open space site: Yale Experimental Watershed.
- Deicing salt behavior and biological impacts [CT IWR-USGS]
- Litter capture and characterization [LIS Futures Fund - NFWF]
- Microplastics in storm runoff [Quinnipiac River Fund – pending]

Trace metals and their speciation

- Metals and sediment fluxes through tide-gated estuaries [NOAA Sea Grant]
- Mercury in fish of lakes and ponds of the Quinnipiac River watershed. [Quinnipiac River Fund – renewed 2019]
- Cobalt speciation and biogeochemistry in lakes

PROPOSALS SUBMITTED OR IN PREPARATION

- NSF: “Carbon and nitrogen flux dynamics through Connecticut coastal estuaries”
- Green infrastructure effectiveness in a suburban setting [EPA 319 program]

ADMINISTRATIVE EXPERIENCE

- Founder in 1993 of Yale’s Center for Coastal and Watershed Systems, and Director through 2009
- Faculty Director of Yale’s Hixon Center for Urban Ecology since 1999
- Associate Dean for Research for Yale’s School of Forestry and Environmental Studies from 2006 – 2009

- Director of Graduate Studies from 2006 - 2009 for Yale's School of Forestry and Environmental Studies, overseeing a doctoral program with approximately 70 students

GRANTSMANSHIP

Approximately 6 million dollars in successful grants obtained from NSF, EPA, USGS, Sea Grant, IWR, NERRS, Dreyfus Foundation, USFS, and many private foundations.

Synergistic Activities

- | | |
|-----------------|---|
| March 2007 | Published book detailing guidelines for developing land with minimal environmental damage and providing a quantitative evaluation/rating system: <u>The Land and Natural Development (LAND) Code</u> , 243 pp. John Wiley and Sons. |
| Feb 96 - Jan 98 | National Academy of Sciences/National Research Council,
Committee on Watershed Management |
| 2000 - present | Advisory committee to New Haven's Sound School (marine science high school) |
| 2010 - 2018 | Sponsored and hosted recent public conferences on (a) nonpoint source, and (b) point source pollution of Connecticut's Quinnipiac River, and (c) instream flow in Connecticut rivers, (d) urban green infrastructure, (e) 21 st century parks, (f) urban ecosystem services, (g) urban nature and human health, (h) urban resilience and sustainability, and (i) urban green infrastructure. |
| 1999 - present | Helped form citizen watershed group for New Haven's Mill River. Current Vice President |