

Freshwater Mussels *and the* Connecticut River Watershed



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Ethan Jay Nedeau

in cooperation with the
Connecticut River Watershed Council
Greenfield, Massachusetts



Ethan Nedeau is the principal of Biodrawversity LLC, an environmental consulting and communications firm located in Amherst, Massachusetts. As an environmental consultant, Ethan has conducted freshwater mussel surveys in more than 350 waterbodies and well over 2000 locations in New England and New York since 1995. He has also produced publications on freshwater mussels of Maine, Connecticut, and western North America. Ethan is also a science writer, illustrator, and graphic designer and has helped produce many publications on ecosystems and biodiversity of northeastern North America.

Biodrawversity web site: www.biodrawversity.com

For more than fifty years, the **Connecticut River Watershed Council (CRWC)** has worked to attain a protected river ecosystem where human activity is in balance with the preservation of the region's natural resources. As a principal citizen advocate dedicated to promoting the restoration and sustainable use of the entire Connecticut River watershed, CRWC has played a seminal role in defending the River environment. CRWC undertakes actions and programs to protect critical natural resources, promote public support for and involvement in river conservation, and increase public understanding and enjoyment of the Connecticut River and its rich diversity of natural and cultural resources.

CRWC web site: www.ctriver.org

Produced cooperatively by the Connecticut River Watershed Council and Biodrawversity LLC

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Cover Inset: Yellow lampmussel. Ethan Nedeau

Inside Cover: Dwarf wedgemussel (left), yellow lampmussel (middle), and brook floater (right). Ethan Nedeau

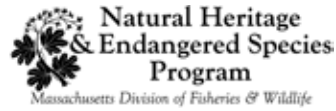
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*for my wife Kim, my daughter Brooke, and for the kindred souls
bound by a passion for the Connecticut River and all of its native biodiversity*

Photo: A tidewater mucket sits deeply embedded in a sandy spot, showing off its inhalent and exhalent apertures that it uses to filter the water.

André Martel, reproduced with permission of the Canadian Museum of Nature, Ottawa, Canada.



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Photo: A pair of tidewater mucket shells from the Salmon River, Connecticut. Ethan Nedeau

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Foreword

The Connecticut River Watershed Council (CRWC) is proud to sponsor *Freshwater Mussels and the Connecticut River Watershed* by Ethan Nedeau. As the Connecticut River's four-state watchdog, we are thrilled to partner with Ethan, an expert on mussels in our watershed.

At CRWC, we've been preserving and protecting the Connecticut River basin for more than half a century. Our work has focused on healthy water and river bottoms, farmlands and forests, stream banks, and the substrates that nurture fish and freshwater mussels. Information is our best ally in understanding this system and educating the public about what is best for the river. This new book provides something that has been missing: a usable guide to freshwater mussels and their habitats and a new window on the river.

Of the twelve freshwater mussel species found in the basin, eight are listed as endangered, threatened, or of special concern by one or more states, including the federally endangered dwarf wedgemussel. And, because mussels are sensitive to disturbance and pollution, they are used as "indicator species" to help determine the health of ecosystems. In short, their presence is often an indication of good water quality. But even more important, mussels play a strong role in improving water quality and maintaining a healthy ecosystem.

Finding and identifying these fascinating creatures will help preserve and restore habitats that benefit us all. The presence of mussels can influence permitting and land preservation. For example, in 2006, two people canoeing on the Connecticut River discovered some unusual mussels. This led them to the Department of Environmental Protection's freshwater mussel field guide that Ethan had produced and ultimately to the documentation of the *first live yellow lampmussels seen in the river in Connecticut in more than 80 years*. Now the species status in Connecticut can be changed from extirpated to endangered, allowing the state to give it due protection. Perhaps this book will lead to other such discoveries over time.

As a membership organization, CRWC's mission is a healthy Connecticut River watershed—land, water, people, fish and wildlife—nothing more, nothing less. Our programs include advocacy, habitat restoration, education, and outreach. As one of the oldest watershed organizations in the country, we understand the challenges and importance of preserving the natural heritage of our basin. We've witnessed first-hand the difference one person can make in fighting for the important things that people rarely see. Above all, we are committed to working in partnerships with people like Ethan—and you—for the best river possible.

CRWC and our partners have developed programs to fight the threats discussed in this book, including habitat loss and fragmentation, alteration of river flows, water pollution, invasive species, and more. You can find out more about our work and the ways you can make a difference in restoring our lands and waters at www.ctriver.org.

For Ethan Nedeau, freshwater mussels are "a resource that is often overlooked and underappreciated." But we know *you'll* appreciate this book. Use it as a tool to help protect the Connecticut River and its tributaries. And become a member of the Connecticut River Watershed Council to help further this fight.



Chelsea Gwyther
Executive Director, Connecticut River Watershed Council
Greenfield, Massachusetts



Preface

Why mussels and the Connecticut?

Of the hundreds of river miles and lakeshores I've swum in search of mussels, one of the most memorable was Cutler Mill Brook in Guildhall, Vermont, high in the Connecticut River watershed. It was late September. Reds and yellows were spreading through the northern forests and an early touch of frost had removed the canopy from legions of pumpkins on riverside farms. At night, molecules of warm river water drifted upward to meet cold air sinking into the valley, creating dense river fog that would gradually dissipate each morning. It was like seeing the river breathe, much like seeing my own breath on autumn mornings.

I spent many days and nights in the headwaters region that summer—the Nulhegan, Upper Ammonoosuc, Israel, Johns, Passumpsic, and Connecticut. A few weeks earlier, Carson Mitchell and I discovered a population of the federally endangered dwarf wedgemussel in the Johns River. This was only the third tributary population in the upper Connecticut River and the only one north of the Black River. We also found dwarf wedgemussels along an 18-mile portion of the Connecticut River that summer, a population that went undetected for more than 30 years until I found a handful of animals near the site of the old Bedell Bridge, a 396-foot two-span covered bridge erected by Moody Bedell in 1866 that succumbed to a violent windstorm in 1979. Heartened by discoveries in the Johns River and Connecticut River, I began to survey small tributaries in the upper watershed.

The previous night I fell asleep watching the stars over Maidstone Lake while thinking about my daughter who would be born later that autumn. I knew that someday her blueberry eyes would dampen my enthusiasm for a summer of swimming and campfires, unless the whole family could come along. I packed my tent by 6:30 the next morning. My damp wetsuit was in a heap in the back of my Subaru from the day before and I knew I'd go hypothermic if I didn't get my core temperature up before pulling on the wetsuit and spending the day underwater. I ran for a half-hour on the dirt road near the state park and then drove toward town for coffee. I followed Paul Stream down from the lake and then drove through farmland along the Maidstone Bends portion of the Connecticut River. River fog still shrouded the weathered barns and vast cornfields that looked like corduroy blankets draped over the fertile floodplain. My drives through the northern watershed remind me of a poem by Derek Walcott, "*...emptiness makes a companionable aura through the upstate village—repetitive, but crucial in their little differences of fields, wide yards with washing, old machinery—where people live with the highway's patience and flat certainty.*" I store these watershed images and pour them onto the dinner table during long housebound winters.

From the bridge over Cutler Mill Brook I could see the stream flowing out of a broad grassy and shrubby floodplain that soon gave way to a forest of spruce, poplar, and maple. Moose country. I sat on the guardrail for a long time and weighed my desire to learn more about dwarf

wedgemussels against the fear of swimming into the cloven hoof of a bull moose during the rutting season. I was alone in my decision. It could have been another 50 years before somebody contemplated looking for mussels in that stream. With a knotted stomach and a sense that I was stepping into a situation for which I had no defense, I pulled on my damp wetsuit and scrambled down to the water. My teeth were chattering from the cold...or the fear.

I have come to accept, and even embrace, some elements of danger in searching for freshwater mussels. I'm a capable swimmer and I understand the physics and hydraulics of rivers well enough to avoid danger. Swimming a river is like driving on the highway—it might look harrowing from shore because it moves fast past a fixed location, but things seem slow and manageable when you are going with the flow. I worry more about submerged trees and other underwater hazards, especially when water clarity is poor, and I'm careful to avoid dangerous conditions. I worry about pollution—especially downstream of industries, wastewater treatment plants, and cities. Bacterial pathogens, toxic chemicals, and heavy metals have almost certainly entered my body while swimming and I've wondered about the long-term health effects of such exposure. I am fortunate to have begun surveying mussels 23 years after the Clean Water Act was enacted, yet not all waters that I've swum in are considered swimmable.

My fear of moose is more palpable. Cutler Mill Brook is less than 20 feet wide and its banks are steep, with overhanging grasses and shrubs. As I swam upstream, I realized that much of the good mussel habitat was on the outsides of river bends and that the stream was highly sinuous. This meant that I was constantly swimming along the bank, often underneath overhanging vegetation, and I was blind to what could be standing on the bank above me. With a two-piece seven-millimeter wetsuit, hood, fins, mask and snorkel, and 25-pound weight belt, I was about as quick and agile as a freighter. My senses were stripped in this gear; I could hear very little and I had tunnel vision. Surveying mussels requires focusing on the bottom of the river, but my thoughts were painting vivid images of angry trampling moose.

I've seen plenty of moose before. I grew up in Maine and spent many wonderful days in the Moosehead Lake region, where moose watching was a big attraction. My first experience surveying freshwater mussels was in 1995 for the Maine Department of Inland Fisheries and Wildlife. They provided a truck, canoe, gazetteer, and instruction to survey portions of central, eastern, and northwestern Maine. It was a summer I could have only dreamed about. It infected me with an enthusiasm for discovery that has not diminished in the 13 years that have since passed. I saw more moose that summer than I could count. When surveying a portion of the Kennebec River with Jaime Haskins, he found a crushed mussel in a moose's hoof print. I kept thinking about the poor mussel on that day in Cutler Mill Brook; the mussel did not anger that moose—it was just at the wrong place at the wrong time. A moose would not have to be aware of my presence to cause harm—it could simply be crossing the stream at the time I was swimming past its crossing point. I desperately searched for a single dwarf wedgemussel so that I could confirm this piece of the puzzle and swim back to my car.

Friends, family, and colleagues often ask where my passion for freshwater mussels stems from. What enabled me to overcome claustrophobia to become a SCUBA diver, what motivates me to swim among leeches and wastewater, and what compels me to pull on a damp wetsuit on a cold morning and spend eight or more hours underwater? If I'm hurried I might give a curt cookie-cutter answer about the ecological importance of mussels, but that describes my *appreciation* for mussels, not my *passion*. The full answer comes during times of reflection, when the images I've collected are forefront in my mind and the thread that connects them is more lucid. To me, freshwater mussels represent hope—hope that our lakes and rivers can endure the onslaught of mankind, and hope that species can survive threats that were considered

insurmountable. Though aquatic ecosystems face myriad challenges, there is growing optimism that the worst has passed. I survey waters of the Connecticut River watershed hoping to find survivors—locating individuals and populations that endured years of abuse and that are poised to repopulate historic habitat if and when conditions become favorable. All too often, I lapse into a doom-and-gloom environmentalist and depress my wife with prognoses for our planet. But then I find endangered species in waters where people had described their demise, and I am consumed with emotion. I seek reasons to hope and causes to fight for.

I kept swimming upstream in Cutler Mill Brook—100 yards in 30 minutes, 300 yards after nearly two hours. I passed areas of the stream bank where grasses were trampled and the soil was recently disturbed by large cloven hooves. I found triangle floaters and creepers—two mussel species that I always find alongside dwarf wedgemussels. If these two species were in this stream then surely dwarf wedgemussels were too. My fear never diminished as I continued upstream; I was sure I'd encounter a moose and each moment that passed without seeing one meant that the encounter was that much more imminent. I started to shy away from the banks and I spent more time looking in that direction than at the bottom of the stream. "*You are not going to find mussels on the banks,*" I kept telling myself.

How much am I willing to sacrifice to find mussels? If I turned around out of fear of moose and dwarf wedgemussels went undiscovered in Cutler Mill Brook (if they even existed), would anybody care? I probably sacrifice more than I should by being away from home so often in the summer—it saddens me to think of my wife and daughter eating dinner alone together, or my wife having to explain to my daughter why daddy is away. My garden gets overgrown with weeds and zucchini get bloated even if I'm gone for a few days. But I can't seem to shake my compulsion for surveys. I'm reminded of a quote from J.R. Tolkien's *Fellowship of the Ring* when, in the Mines of Moria, Frodo laments to Gandalf that he wishes the ring had never come into his possession. Gandalf, with his infinite wisdom and soft compassionate voice, says, "...all we have to decide is what to do with the time that is given to us..." I try to make best use of the skills that I have and the time that I've been given.

I reached a point in the stream where I could hear water flowing over rocks, which meant a different habitat than the sandy unstable stream bottom that I had surveyed up to that point. My excitement was mounting because I thought dwarf wedgemussels would likely occur near this transition. But at that moment, I heard the alders shake and I looked up to see a towering set of antlers rise out of the shrubs as a bull moose got to its feet. Its flaring nostrils, black eyes, and sharp hooves were less than 25 feet away, poised to leap onto this strange black creature swimming toward it. My heart busted through my neoprene wetsuit. I spun around, took a deep breath, kicked to the bottom of the stream, and swam as fast and far as I could. I suspect I'll never return. I will always remember Cutler Mill Brook for the moose that guarded its waters than for the dwarf wedgemussels I was too scared to find.

I wrote this book to raise awareness about a resource that is often overlooked and underappreciated. I wanted to share my stories from eight years that I've surveyed mussels in the Connecticut River watershed, and to provide a compelling case for why and how freshwater mussels—and the watershed itself—can be protected and restored. In my experience, citizens have more questions about why they should care about mussels than how many species there are or what each species looks like. Therefore, I felt that a book about mussels and the watershed would promote conservation more than a simple field guide. The book is written primarily for people without a biology background or prior knowledge about mussels. I've challenged myself

to provide accurate and specific details without burdening the reader with a technical tone and unnecessary jargon. Nevertheless, portions of the text are technical. Mussels cannot be saved with poetry and prose—conservation and management requires a strong foundation of biology and ecology. I challenge readers to learn what is presented here and to explore additional information within the cited publications.

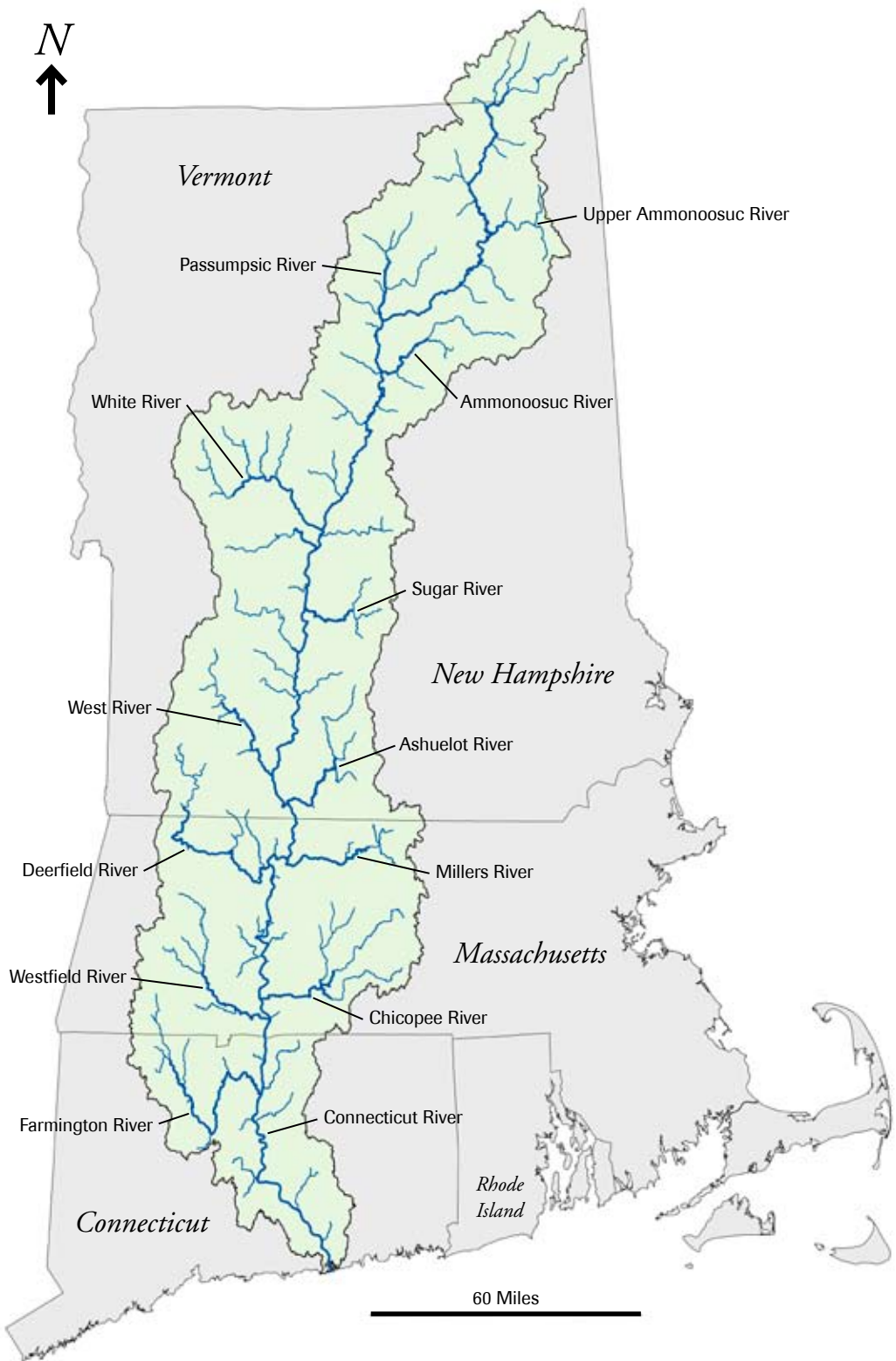
I chose to focus on the Connecticut River for several reasons. The 410-mile Connecticut River unites New Hampshire, Vermont, Massachusetts, and Connecticut. Environmental conditions at any location in the continuum from headwaters to tidewaters are influenced by what comes from downstream, upstream, the land, and the atmosphere. Preservation of its natural resources depends on the collective efforts of people throughout the watershed and in neighboring regions (in the case of airborne pollution). Freshwater mussels will benefit from conservation and management that transcends political boundaries and considers the watershed as an integrated ecological unit. Watershed-level planning and management should be mindful of the watershed-wide significance of populations whose ranges may lie within the boundaries of just a few municipalities. The vitality of freshwater mussel populations is also inextricably linked to day-to-day decisions of individual landowners, other citizens, and town governments that may not even be aware that mussels exist. It is important to have well-educated citizens that are aware of the natural resources of the Connecticut River and are mindful of their how day-to-day decisions affect these resources.

On a more personal level, I chose to focus on the Connecticut River watershed because I've spent eight years snorkeling and SCUBA diving in its waters, from tidal waters where I observed barnacles and striped bass to cold headwaters where I observed native brook trout and moose. My house sits on the clayey soils of the glacial Lake Hitchcock and from my house I can run to the top of the Holyoke Range and watch the river flow through the pastoral—but increasingly urban—landscape of the Pioneer Valley. I have dived below its placid waters, slid my stomach over its polished stones, and surfaced among wisps of river fog. I wanted to write this book for a watershed that I've shared so much of myself with. As stated so beautifully in the 2006 report by The Trust for Public Land (Clay *et al.* 2006), “...*the Connecticut River and the land that feeds it evoke a sense of place filled with passion, loyalty, and commitment.*” I hope that this book contributes to this sense of place and engages more people to become passionate stewards of the watershed.



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The Connecticut River watershed and its largest tributaries.

Acknowledgments

I want to thank the people who have given me the opportunity to follow my passion in the Connecticut River watershed. I've seen an underwater landscape that few people ever see, and looked for—and discovered—endangered species in new and unexpected places. But I was always guided by the vision of those people who believed that the Connecticut River had secrets worth finding, and who trusted my ability to assist in their conservation efforts. Five people are on my cell phone speed dial for times when I've discovered something exciting and want to share the news: Susi von Oettingen, Julie Victoria, Marea Gabriel, Mark Ferguson, and Michael Marchand. I would also like to thank the following agencies and organizations for their contribution to freshwater mussel conservation in the watershed and support of my work: U.S. Fish and Wildlife Service, New Hampshire Fish and Game Department, Vermont Department of Fish and Wildlife, Massachusetts Natural Heritage and Endangered Species Program, Connecticut Department of Environmental Protection, The Nature Conservancy, Connecticut River Watershed Council, Connecticut River Joint Commissions, U.S. Army Corps of Engineers, Farmington River Coordinating Committee, and the Kestrel Trust. In addition, many entities have contributed to freshwater mussel conservation through their compliance with state or federal endangered species laws.

It was heartening to receive such broad moral and financial support for this publication. I had to adjust the layout and devote an entire page to logos of the many agencies, organizations, and businesses that chipped in for printing and production costs. It is worth noting that The Nature Conservancy's support came from each of its four state chapters—Connecticut, Massachusetts, New Hampshire, and Vermont—as well as the Connecticut River Program. Producing a 150-page book on freshwater mussels—a taxonomic group represented by only 12 species in the watershed—may seem overkill, but we all know that this book is as much about the Connecticut River as it is about mussels. Too few rivers in North America have such a devoted and competent group of professionals working to protect all of its native biodiversity, and I feel fortunate to share my commitment with these people. We are all the Connecticut River.

Over the years, I have worked alongside a few diehard individuals who shared my passion for discovery and have endured and possibly even embraced long hours underwater: Paul Low, Carson Mitchell, Sean Werle, Steve Johnson, and Erik Nedeau. Several other people, aside from those already mentioned, have made notable contributions to our knowledge of freshwater mussel distribution in the watershed (listed alphabetically): Jay Cordeiro, Chris Fichtel, Jaime Haskins, Patricia Huckery, Paul Marangelo, Don Mason, Dave McLain, Christine O'Brien, Don Pugh, Douglas Smith, and Barry Wicklow.

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