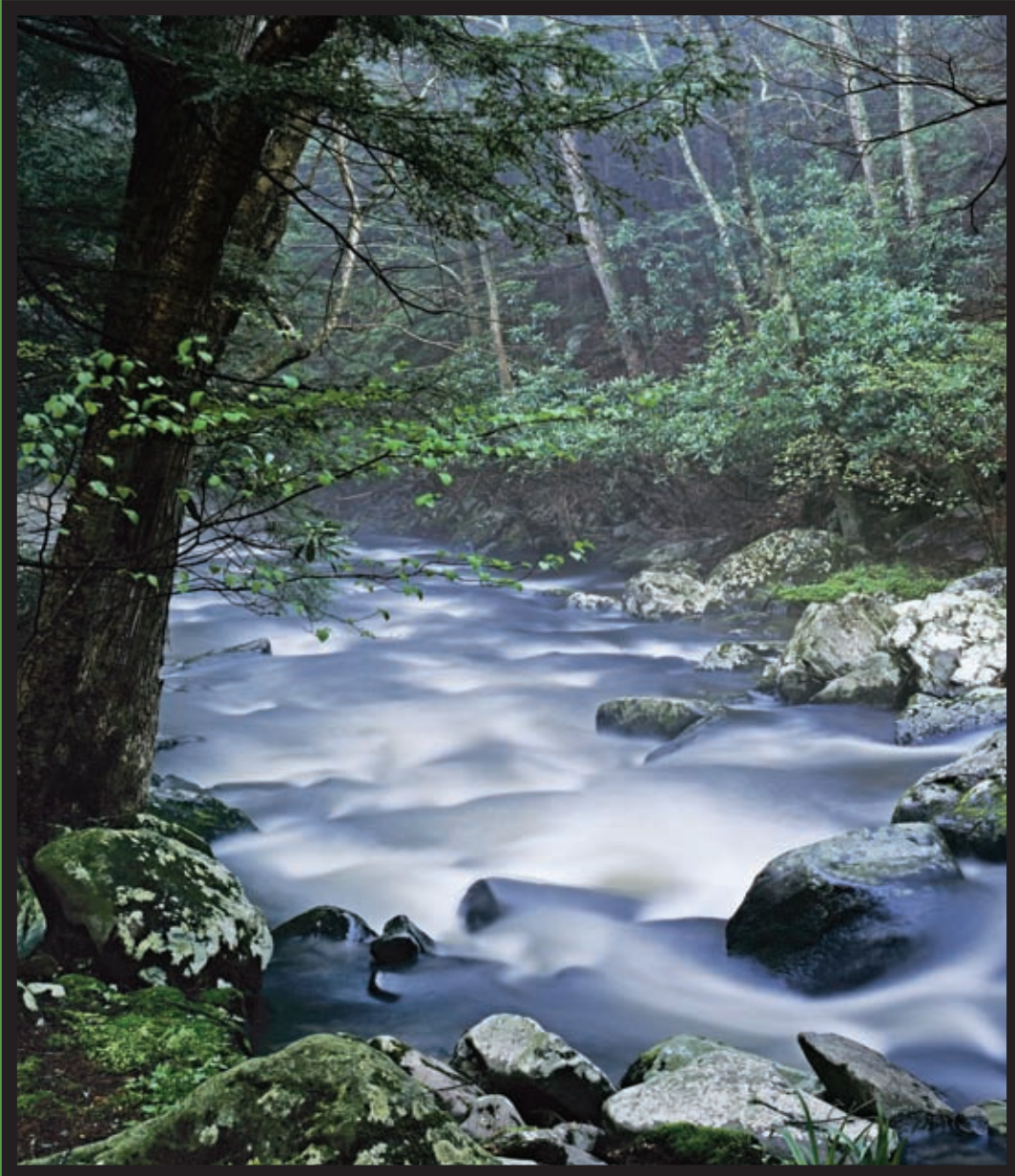


SUMMER 2010

SANCTUARY

THE JOURNAL OF THE MASSACHUSETTS AUDUBON SOCIETY



River Tops

The life of little-known streams

BOARD OF DIRECTORS

CHAIR

Jonathan Panek

VICE CHAIRS

Jared Chase
Nora Huvelle

PRESIDENT

Laura A. Johnson

CORPORATE SECRETARY

Kristin M. Barr

ASSISTANT CORPORATE SECRETARY

Elaine Kile

TREASURER

Jeffrey F. Peters

ASSISTANT TREASURERS

Gary R. Clayton
Nora Frank
Bancroft R. Poor

DIRECTORS

Julian Aygeman
Robert Ball
Walter (Jerry) Bird
Catherine Campbell
Alfred D. Chandler, III
Jared Chase
Dan Cheever
Richard Chute
William Coady
Donald Cooper
Nicholas d'Arbeloff
Nina Doggett
Scott Edwards
Thomas D. French
Nora F. Huvelle
Christopher Klem
Erik Knutzen
Beth Kressley Goldstein
Virginia Lawrence
William Madar
Deborah Miller
Jonathan Panek
Jeffrey F. Peters
Helen Pounds
John Riehl
Edgar Schein
Anne Snyder
James Sperling
Brooke Stevens
David Straus

COUNCIL CO-CHAIRS

Nora F. Huvelle
Beth Kressley Goldstein

COUNCIL

Priscilla Bailey
James Baird
Marygrace Barber
Peter Barber
Carl Beatty
Robert Bertin
Frank Bradley
Brian Brooks*
Sara Brydges
George Butterworth*
Charles C. Cabot III
Shawn Carey
Elliott Carr
Jennifer Charles
John W. Cobb
Jeffrey M. Collins
Franz Colloredo-Mansfeld*
Paula Cortes
Thomas A. DeMarco III
Alexander Ellis III
Barbara E. Fargo*
Marjorie M. Findlay
Jennifer Firth
Richard T. T. Forman
Ayla Gavins
Thaddeus Gillespie
John Green*
Lynn Harvey
Elizabeth Heide
Terilyn A. Henderson*
Chris Heye

Deborah V. Howard*

James Hoyte
Richard Johnson
Malcolm W. Johnston
Gillian S. Kellogg
Jared Keyes
John Kricher
Daniel W. Latimore
Edwin F. Leach II
James Levitt *

Ann Lewis
Donald Lewis
Thomas S. Litwin

George Cabot Lodge Jr.
David Lubin
William F. Macauley
Kate McCarey
William F. Macauley

Mary McFadden
Bernard J. McHugh
Ann McNay

Edward J. McNierney
Virginia L. Nicholas
Al Nierenberg

Charles Nims
Shelia Nutt
J. David Officer*

Ronald O'Hanley
Michael J. Pappone
George Pendergast

Patricia T. Poitras
George Putnam III*
Edward H. Raymond*

Mary Lou Roberts
Walter Rosenfeld*
Doug Sacra

Judy A. Samelson*
Jackie Jenkins Scott
Dedee Shattuck

David Sibley
Phyllis Solomon
Andy Solow

Lee Spelke*
Lisa Standley
Deborah Swenson

Jeffrey Swope*
Alexander L. Thorndike
John L. Thorndike*

Patricia Thornton*
Mrs. Richard D. Thornton*
Elizabeth Valentine*

Rosamond B. Vaule
Mrs. Jephtha H. Wade*
Simon (Chip) Walker*

Thomas T. Warren*
Anna S. Whitcomb
Jay Wickersham

Alan Wilson*
Bryan Windmiller
Kent Wosepka

Julia Yoshida

* = Honorary Director

HONORARY DIRECTORS

Kathleen S. Anderson
Robert C. Baron
Anne Brooke
Hamilton Coolidge
Eric Cutler
Lewis S. Dabney
Eugene B. Doggett
Mrs. Alexander Ellis
Charles H. Fargo
Dr. Robert L. French
John C. Fuller
Henry Lee
Shirley M. Jenkins
Mrs. George M. Lovejoy Jr.
Merloyd L. Ludington
Deborah W. Moses
John F. O'Connor
Lewis H. Parks
Herbert W. Pratt
David Starr
David Walsh
Nancy Weiss
Lawrence W. Zuelke

Our Freshwater Resources

Last March, the international observance of World Water Day took place in the same month that Massachusetts' record-setting rainfall wreaked havoc all over the state. It is ironic that an overabundance of water inundated Massachusetts at the same time that World Water Day called attention to the fact that billions of people in the world lack access to safe drinking water. Estimates are that by 2050 one-third of the global population will not have a clean secure source of water. How is that possible? Consider that only 2.5 percent of the world's water is actually freshwater—and of that less than 1 percent is available for use.

Massachusetts is located in the relatively water-rich northeastern United States, as illustrated by the many Mass Audubon sanctuaries named for a water feature, such as Ipswich River, Laughing Brook, Broad Meadow Brook, Burncoat Pond, and Eagle Lake. But in spite of the Commonwealth's comparative water richness, we still have a number of issues relating to freshwater and our rivers and streams.

Our freshwater resources are severely impacted by development and especially by storm water runoff that is no longer filtered by natural vegetation. As paved surfaces replace natural vegetation, the severity and frequency of flooding increases, affecting water quality and contributing to loss of groundwater recharge. Aquatic life can survive normal variations in natural systems; however, human activities add severe stresses to natural variations, diminishing the vitality of freshwater ecosystems.

Another Massachusetts issue is water withdrawals, especially from municipal water systems such as those in the Ipswich River watershed. In 2003, the Ipswich was named one of the ten most endangered rivers in the US by American Rivers. Excessive water withdrawals within the watershed put stress on the river during the summer, a time of natural low flow. A great deal of the demand is for lawn watering and swimming pools. As a result of low flows, estimates are that almost 50 percent of the native river fish species have been eliminated from the river.

In response to impacts of water withdrawal on the Ipswich River and other rivers across the state, and as a result of advocacy from Mass Audubon and many river protection groups, the state has created a Sustainable Water Management Initiative Advisory Committee, on which Mass Audubon serves as a member. This working group is charged with providing advice on the development of a sustainable water allocation system that examines contributing causes and solutions to low stream flow in our rivers.

Massachusetts' 3,000 dams have a tremendous impact on the ecology of the Commonwealth's rivers and streams. Since many dams are no longer needed, removing them safely can restore riverine habitats, help protect public safety, and eliminate flood hazards. During the worst of the March floods, *The Boston Globe* editorialized in favor of removing dams, especially the over 300 "high-hazard" dams in the state.

What can Mass Audubon members do to help the condition of our rivers, streams, and other freshwater resources in the Commonwealth? Be "water smart" and conserve whenever possible. Why? Our rivers and streams provide drinking water, flood protection, fish and wildlife habitat, recreational opportunities, and economic benefits.

Laura Johnson, President

SANCTUARY

Summer 2010

Volume 49 Number 4

**Time to Renew
Your
Membership?**

Try Auto Renew!

[www.massaudubon.org/
autorenew](http://www.massaudubon.org/autorenew)

STAFF

Editor:

John Hanson Mitchell

Associate Editor:

Ann Prince

Managing Editor:

Rose M. Murphy

Field Editors:

Thomas Conuel

Gayle Goddard-Taylor

Poetry Editor:

Genie Zeiger

Designer:

Lynne Foy

Cover: *Halfway Brook*

© Paul Rezendes



*Printed on recycled paper
with soy-based ink.*

FEATURES

All the Waters of the World 2
by John H. Mitchell

Shiners, Darters, and Dace 3
by Cliff Hauptman

Green Streams 6
by Teri Dunn

Upstream 9
by Joe Choiniere

Small Waters 11
by Thomas Conuel

Swimming with Stoneflies 13
by Michael J. Caduto

Brooks and Birds 16
by Wayne Petersen



© CHARLES H. JOSLIN

Swamp azalea

DEPARTMENTS

Poetry 19

At Our Sanctuaries 20
by Ann Prince

The Political Landscape 22
by Jennifer Ryan

Notes From the Real World 23
by Chris Leahy

Curious Naturalist 29
by Gordon Morrison

We are saddened to report that our poetry editor, Genie Zeiger, died on December 24, 2009, after a brief illness. Genie had a wide following in the poetry community and recruited many nationally known poets to *Sanctuary* pages, including Mark Doty, Mary Oliver, and others.

Sanctuary is a journal about natural history and the environment, which is published by Mass Audubon three times a year. Opinions expressed herein are those of the authors and not necessarily those of the Massachusetts Audubon Society. To respond to stories in this issue, email us at sancmag@massaudubon.org.

Sanctuary (ISSN 0272-8966), South Great Rd., Lincoln, MA 01773. Published three times a year. Memberships are \$750 guardian; \$500 patron; \$250 sponsor; \$150 protector; \$100 contributor; \$80 family plus; \$70 supporter; \$58 family; and \$44 individual. Postmaster: send address changes to *Sanctuary*, Mass Audubon, Lincoln, MA 01773, 781-259-9500. Periodicals postage paid at Lincoln, MA, and at additional offices. Reprints of this issue are available. Write or call the publications office at Mass Audubon, Lincoln, MA 01773, 781-259-2167; or email *Sanctuary* at sancmag@massaudubon.org. Printed in the U.S.A.



Mass Audubon works to protect the nature of Massachusetts for people and wildlife. Together with more than 100,000 members, we care for 34,000 acres of conservation land, provide educational programs for 225,000 children and adults annually, and advocate for sound environmental policies at local, state, and federal levels. Mass Audubon's mission and actions have expanded since our beginning in 1896 when our founders set out to stop the slaughter of birds for use on women's fashions. Today we are the largest conservation organization in New England. Our statewide network of wildlife sanctuaries, in 90 Massachusetts communities, welcomes visitors of all ages and serves as the base for our work. To support these important efforts, call 800-AUDUBON (283-8266) or visit www.massaudubon.org.

All the Waters of the World

Long ago I lived in a forest preserve in an empty quarter of the Berkshires where the hills sloped down to shaded valleys footed by wild streams. One of these, an aptly-named torrent called Hurricane Brook, came roaring down out of the hills to the north, curved westward, and eventually ran into the West Branch of the Farmington River, which rolled on to the Connecticut River, and thence to the Sound and the open sea.

One hot July day, having a little time on my hands, I decided to walk up Hurricane Brook to see if I could find out where it came from. This turned out to be no easy task; there were deep valleys and hills all along the route, bordered by thick woods and brushy tangles, and there were sharp skidding ravines around the brook so that I periodically had to make wide circuits as I worked my way upstream.

It was sweltering. I was scratched and mosquito bitten and getting tired, but, after half an hour or so of bushwhacking in this manner, I heard ahead of me a deep roaring, and, heartened, I pushed on. After another ten minutes, I came to a seemingly undiscovered savage place.

At the head of a sharp little defile, a wave of white water broke through a cut in the rocks and arched out in a spray-veiled stream and plunged into a deep rock-rimmed pool. At the head of the falls, just where the waters broke through, stunted hemlocks grew out of the rocks, shading the banks, and on the rocks below the waterfall there was a lush green carpet of mosses—sphagnum and pin cushion and a variety of species that I couldn't identify. The pool below looked deep and inviting, and since I was hot and scratched I decided to take a dip.

The waters were icy, hardly tolerable in fact, but I plunged in and made my way along the moist banks and stood under the falls for a while. Then, just as I was about to climb out, I saw an orange lizardlike form in a mossy crevice. I had an idea what it was and grabbed it.

It was a spring salamander, an uncommon species here, at the northern end of its range. It had shining, beady eyes and was a pale orange color, its body flecked with light brown dots—the only real color in that gloomy cavernous forest. I let it go, but instead of crawling off to its lair it turned and stared back at me.



Small waterfall on intermittent brook

© PAUL REZENDES

I don't know what level of consciousness salamanders are able to attain—probably not much. But, if I were to anthropomorphize the event I would have to say that it stared back at me in amazement, sizing me up. I was after all, no doubt, the first human being it had ever seen.

Chilled by this time, I crossed the stream and climbed up onto the western bank, where I could see a patch of summer sun. I sat there drying off, and contemplated the wild emptiness of this spot.

I was certainly not the first human being to come to this place, but at that moment it seemed to me that I was alone in all the world in a huge expanse of time. Surely this stream, this cascade, this cold

pool, had existed for at least 10,000 years, ever since the glaciers pulled back and shaped these green hills and valleys with all their running brooks and rocky isolated waterfalls and pools.

Thinking about all this as I watched the great noisy volume of water plunge over the falls, I began to wonder about other such places. These waters flowed southward to the larger course of the Farmington and thence to the sea. But how many other little-known streams and brooks, fed by how many smaller rills and springs and seeps all across New England, flowed down to the myriad named and unnamed small rivers and tributaries, feeding the mainstem rivers of the region; and all of them ultimately feeding into the sounds and bays and the open Atlantic and then rising again into the sky and the clouds and then falling once more to earth in a great endless, unbreakable, and unstoppable cycle.

There is nothing new in this revelation: "All rivers run to the sea, yet the sea is not full; unto the place from whence the rivers come, thither they return again." But as is often the case with such simple realities, the basic facts of the interconnectedness of all things are often lost in the chaotic daily stream of life.

JHM

Shiners, Darters, and Dace

A little tale of small fish

by Cliff Hauptman

© ROBERT SEAMAN



Common shiner

My father, may he rest in peace and be forgiven his transgression, was often a bait fisherman. In my summer salad days, he would take a Thursday off from work each month so we could go fishing for bass and pickerel. We loaded the Chevy with our five-horse Johnson outboard and its gas tank, two vinyl seat cushions that were purported to double as floatation devices, a galvanized minnow bucket with a hinged and perforated lid, and our rods and reels and tackle boxes. Then we drove an hour or so to the lake, where we would rent a rowboat for the day.

About four-fifths of the way there, we always stopped at a small bait shop to check on the available live bait. On the luckiest days, as far as I was concerned, they had frogs: two-inch pickerel frogs that, when cast just off the lily pad patches, would bring the big largemouth bass and chain pickerels out, trailing wakes like homing torpedoes. The frogs made enjoyable, if extremely short-term, playmates, until my father pressed them into service, one by one. On my least favorite days, the bait shop had hellgrammites, the aquatic larval stage of dobsonflies—big, black, and evil looking, with fierce pincers and an eagerness to use them. Most often, though, they had only silvery little minnows, called shiners, with which we filled our bucket and resumed our drive to the lake, to the sound of gentle sloshing.

It was not until many years later, long after I had abandoned live bait to fish only with lures, and then abandoned lures to fish only with flies, that I began to pay closer attention to the prey of gamefish in lakes and streams, particular-

ly aquatic insects and the abundant nongame fish. And I wondered, “What actually were those little fish we bought for bait?” Sure, they were minnows, but isn’t any little fish a minnow? And, yes, we called them shiners, but wasn’t that just because they were shiny?”

As it turns out—and contrary to our inexact common parlance whereby any little fish of a couple of inches or less is dubbed a minnow—scientific nomenclature has given the name “minnow” to a distinct family of fish. It happens to be the largest family of fish in North America, containing species known commonly as chubs, dace, shiners, fallfish, stonerollers, carp, goldfish, and, yes, minnows. But it is, nonetheless, a distinct, taxonomic grouping known as the

Cyprinidae, or minnow family, characterized by freshwater fish with a generally elongated body, a dorsal fin having no true spines, a forked tail, and no teeth on the jaws. Size is not a factor; although many minnow species do remain no longer than one’s finger even as adults, many species rival in size the gamefish we anglers pursue. Our streams are full of minnows.

Those of us who fish streams in Massachusetts do so because they also contain trout. The vast majority of those trout, however, are present in the streams only because the Massachusetts Division of Fisheries and Wildlife puts them there. If not for the continual restocking of brook, rainbow, and brown trout, relatively few streams in the Commonwealth would harbor year-round populations of native trout. Rainbow trout are native only to the western parts of our country, and brown trout were introduced from Germany.

In fact, the only trout native to our area is the brook trout, populations of which can still be found surviving, without human management, in some of our less-tormented streams and ponds. Some holdover stocked rainbows and browns do reside in our streams, much to the delight of the surprised anglers who occasionally hook into those hefty survivors, but we have made most of our streams too inhospitable for those to be common. So, if we omit from our census those seasonal visitors trucked in by tankers for our sporting and dining pleasure, what fish species do abide naturally in our local streams?

One of the first flies I learned to tie, when I began learning the art of fly tying, was a streamer called the

Black Nose Dace. A streamer is a fly that imitates a minnow rather than an aquatic insect, as most flies do. The names given to artificial flies, you should understand, can be quite imaginative, often chosen for their lyricism or evocativeness rather than their association with anything living. The Mickey Finn, Grey Ghost, Zonker, and Orange Blossom Special are all streamer flies meant to imitate minnows or young gamefish, but no living fish are called by any of those names.

The fly called the Black Nose Dace is a good one for beginning tyers to start with because it involves not much more than layering three little bundles of bucktail hairs on a long hook. What you end up with is an inch-and-a-half, fishy-looking thing with a brown back, black lateral stripe, and white belly. The black stripe goes all the way to its nose, hence the name, which I at one time mistakenly took to be a corruption of what I imagined someone had named the fly as a claim to its trout-catching ability—the Blacknosed Ace.

There really is a fish called the blacknose dace, though, and it is one of the most abundant, naturally occurring minnows in our fast-moving streams. As an adult, it attains a length of about two inches and, not surprisingly, has a brown back, black lateral stripe, and white belly, making it one of the more attractive little fish in our streams. The eponymic fly is among the most effective and consistent catchers of trout in my fly box. The actual fish frequents both riffles and pools and is an omnivorous eater, favoring not only worms and insects but also algae. Thus, like small rodents on land, these minnows serve as a link in the food chain between plants and carnivores.

The other especially ubiquitous species of dace in Massachusetts streams is the longnose dace. It lacks the sharp-dressed character of the blacknose dace, being



Tessellated darter

© ROBERT SEAMAN

fairly uniform above in olive-drab with white below, and lends its name to no specific fly of which I am aware. Yet its name is apt, for its snout appears lengthened as a result of its underslung mouth, which makes it better adapted to feeding on the bottom of streams. In fact, the longnose dace stays well down among the stones and gravel where it can find respite from battling the very swift waters it prefers. Although fairly widespread, it is most abundant in headwaters, where the gradient is steep, the current fast, and the blackfly larvae are thickly matted upon the submerged stones.

What it lacks in flamboyance, the longnose dace more than makes up for in efficacy, for its predation on those incipient pests makes it a godsend. Both the longnose and blacknose dace are plentiful in the streams of New England and constitute an important food source for trout and other gamefish such as smallmouth bass.

Not particularly chubby, the creek chub *is* particularly abundant. Another silvery minnow of no distinction except for a dark spot at the base of its dorsal fin, the creek chub can get a lot bigger than the dace. One local stream I used to fish apparently excelled as creek chub habitat. On nearly every cast to a fast riffle, a creek chub grabbed my dry fly and battled valiantly all the way to the net. Most amazingly, they were no smaller than the trout I was expecting to catch—about eight or nine inches. In breeding season, the male creek chub grows prominent and copious tubercles on each side of his head, builds a pile of small stones to serve as a nest, mates, and guards the eggs.

A common minnow that gets even larger than the creek chub is the fallfish. This fish challenges the common notion of “minnow” by growing to lengths of a foot or more in the larger streams where some consider them a sport fish. However, these larger individuals prefer deeper slower water than the juveniles, which compose bounteous populations in fast-running Massachusetts streams. The “fall” in fallfish refers not to autumn but rather to waterfalls and rapids, which the young frequent. These minnows look similar to creek chubs but lack the spot at the base of the dorsal fin. Fallfish males also build mound nests of stones and gravel in shallow water, some as large as a yard across and

Blacknose dace



© ROBERT SEAMAN

© ROBERT SEAMAN

*Brook trout*

a foot tall. The males are known to pick up stones in their mouth and carry them to the nest.

Challenging the blacknose dace for the title of most abundant trout-stream fish in Massachusetts is the common shiner. It is common, it is as shiny as a new dime, and it is the fish I spent my childhood staring at in my father's minnow buckets. Dusky backed and silver sided, this minnow looks not much different from many others in the family of Cyprinidae, but for being slightly deeper bodied. There are more fish in the minnow family commonly called "shiner" of one descriptor or another (bigmouth, bridle, comely, emerald, golden, mimic, pugnose, redbfin, rosyface, sand, spottail, and striped, to list just a few) than any other name, including "minnow." But in the fast-moving streams of Massachusetts, you are unlikely to find any except the common shiner. These can get as large as the creek chubs—eight inches or more—but abound as two-inchers to the delight of the trout that eat them and the fishermen who use them as bait.

Somewhat less enamored of these little fish are the fly fishermen whose dry flies the scrappy little shiners will strike as they pursue insects on the surface of the water as readily as those beneath. On several occasions, I have lifted my fly from the stream to backcast and found myself giving a highly exhilarating carnival ride to a nearly inconspicuous tiny shiner attached by its lip.

Although members of the minnow family may be the most plentiful fish that live naturally in our fast-running streams, they do not have a monopoly. Small stream-dwelling members of the perch family are not uncommon, and these are known as darters. The tessellated darter is the one most likely encountered in trout streams, although they do prefer the slower-moving sections. You will not confuse the tessellated darter with any of the minnows. First, it is not shiny or silvery; it is sandy colored and checkered with darker X-shaped markings on its sides. Secondly, it has two separated dorsal fins instead of one, and, thirdly, its tail is slightly rounded instead of forked.

Just as shiners are shiny, darters dart. No fish is harder to follow with the eyes. In one instant it is lying quite still

over this stone, and in the same instant it is gone, reappearing a foot away over that patch of gravel. Darters never seem to swim; they just disappear and rematerialize in a different place, instantaneously. Facilitating this ruse are the darters' oversized pectoral fins and underdeveloped swim bladder, both of which allow the fish to hold still against the bottom and move extremely fast without rising. The tessellated darter feeds on insects and crustaceans and is in turn eaten by trout and bass. It grows to about three inches in length.

In some ways similar to the darters but in no way related are the sculpins. Like darters, sculpins have two dorsal fins, a rounded tail, and disproportionately large pectoral fins. While the swim bladders of the bottom-dwelling darters are underdeveloped, the swim bladders of sculpins are nonexistent. Sculpins have no buoyancy and are further kept against the bottom of streams by their dorsally flattened body and broad pectoral fins. The head of a sculpin, in fact, is wide and somewhat wedge shaped so that when the fish faces upstream, as most fish do in moving water, the current presses it down against the bottom. That and its cryptic coloration, which matches the mottled stony bottoms on which it rests, make the sculpin one of the least-noticed small fish of our streams.

Yet, sculpins—the slimy sculpin is the most common sculpin in Massachusetts—may outnumber the minnows in some waters. One of the most popular trout flies, the Muddler Minnow, is a large-headed, deer-hair and turkey-wing-feather creation designed to imitate a sculpin. Usually about three inches long or less, sculpins are a preferred food of trout and smallmouth bass.

In addition to these unsung piscine denizens of our trout streams, there are many others, including several species that are more often regarded as stillwater fish. Fish such as redbfin pickerel, redbreast sunfish, bluegills, pumpkin-seeds, and white suckers often seek out the quieter flowing sections of trout streams. I know because I have caught all of those species while fly fishing for trout in local streams.

Observant anglers who wade out into streams and take the time to look at the abundant life around them have enjoyed the company of small native species everywhere they have fished. It is safe to say that any permanent stream in Massachusetts, as long as it is large enough to stay flowing all year long, will hold one species or more of these small fish. Their sticky eggs are transported on the feet of wading birds, mink, and raccoons. So their offspring can end up just about anywhere. Even in bait buckets.

Cliff Hauptman writes on natural history topics and is author of several books including Basic Freshwater Fishing and How to Fly-Fish.

Green Streams

Certain species of plants favor the moist banks of watercourses.

by Teri Dunn



© GORDON MORRISON

Common witchhazel

When I was a kid growing up in southern California, streams and creeks were irresistible. They were a refuge from the heat and noise of civilization, and clear evidence that there was another world in my landscape, a natural world. Long hours could be spent following one of these waterways upstream into the hills, all the while observing the plants and animals that lived in this unique environment, and sometimes, in springtime, “accidentally” getting wet along the way.

Settled here in Massachusetts, I now live in a totally different environment, but some of my early impressions of upland streams strike me as universal. They are still a passageway into the natural world, and careful observation does reveal their specialized habitat. Only the players have changed—particularly the plants.

One of the first things to be learned about naturally occurring streams is that, with not much practice, you can easily identify their presence from a distance. There is a ruff of green plants bordering or buffering most every watercourse since most plants tend to avail themselves of the precious or additional moisture. I am reminded of the story of how the capital of Idaho got its name. Evidently, in the early 1800s, some French Canadian mountain men called the river that flowed through, with verdant vegetation flanking the riverbed, “la riviere boisée”—“the wooded river.”

You can also correctly intuit the presence of running water while tramping through the forest. You may hear it, especially in the springtime after a good snowmelt, the rushing, hurtling, gurgling sounds lifting your spirits and

beckoning you onward. Sometimes you can even smell it since fresh running water has a different less pungent scent than that of standing or stagnant water of ponds, swamps, and wetlands. Running water is oxygenated and lively and, to my nose, wafts a bracing, mineral, ironish smell. It makes my pulse pick up—perhaps an instinctive response to finding fresh cooling water.

But the surest way to identify a stream habitat is by the plant species present. Unlike the fauna in or around the water, the flora doesn’t move around or flee—it’s not elusive. Even if the stream slows down or dries up later in the season, some identifiable remnant of a plant may remain. I have gotten to know the local streamside plants over my years in this region, and the sight of them always gladdens me.

I am compulsively inquisitive about plants and have managed to dig up some interesting facts that will

enrich your appreciation of streams when you go exploring or happen upon them.

Pausing over these plants and recognizing their affinity for fresh moving-water habitats is also a way to teach children to observe nature with care. I cannot guarantee, however, that the kids will not “accidentally” blunder into the stream and get wet—botany lesson notwithstanding.

Probably the most common resident of the upland stream habitat is northern spicebush. It typically reaches several feet high and wide but can attain a full 10- by 10-foot growth in some cases. The leaves are medium green in color, and when crushed they emit a spicy aroma. In mid-spring, the small, yellow, star-shaped flowers appear along the stems in clusters. It turns out the plants are actually dioecious, which means male and female flowers appear on different plants. In late summer and early fall, the female plants produce small, red, oval fruits.

Another lovely streamside plant is common witchhazel. Often large enough to be considered a small tree, it may reach 12 feet high. The leaves, up to 6 inches long, are broadly oval, nearly rounded, with distinctive wavy-toothed margins. Medium green for most of the season, they turn yellow in the fall, when they are joined by the small, spidery, yellow flowers. These are clustered along the stems and waft a faint fragrance. The woody, urn-shaped, seed capsules take a year to mature; these harbor only two small, hard, black seeds, which forcefully eject up to 20 feet away! You may have seen a clear liquid labeled Witch Hazel for sale in pharmacies. Long popular as an aftershave, this extract from the leaves is also soothing on abrasions, insect bites, and sunburns.

Alders faithfully indicate the presence of water, whether wetland, swamp, or waterway. In the upland stream habitat, they tend to be rangy and bushy, usually about 5 feet high, clinging to the banks, drooping over the water, or even wading in a few inches. The dark green leaves are toothed and sticky when young. The easiest way to identify alders is by their catkins (technically separate male and female flowers, the males’ being a bit larger). These emerge tiny, cone-like, and green but turn dry and brown by fall.



Cardinal flower

There are several species here in New England, including common alder, speckled alder, and non-native hazel alder—but they are hard to tell apart sometimes because they readily hybridize. Native Americans used to boil fresh alder bark for a tea that induced vomiting while the dried powdered bark was used to staunch bleeding from minor cuts.

Stream banks host herbaceous plants too, taking advantage of the moist and humid atmosphere to grow quickly and often producing pretty flowers as well. My favorite is cardinal flower, a tall wildflower, usually between 3 and 5 feet. The medium to dark green, oblong, slightly serrated leaves are several inches long and get smaller as they ascend the vertical stalk. In midsummer or so, the bright flowers appear. They are usually cardinal red, but there is plenty of natural variation, from magenta and ruby to soft pink and even white.

© GORDON MORRISON

© GORDON MORRISON



Indian cucumber-root

Horticulturists have worked with these diverse hues, and now some garden centers offer named varieties to anyone interested in growing them in a damp spot in their home landscape. One big delight of these flowers, no matter the color, is that hummingbirds adore them. You're actually more likely to observe hummingbirds careening around your garden varieties since these tiny fast-moving birds tend to be more elusive in the wild.

Another plant you may see in these settings is marsh marigold. A member of the buttercup family, it produces classic yellow flowers in clusters, so a colony in bloom is quite a cheery sight. The plant is low and mounding in habit, and the stems are hollow, which helps the plants stay more or less upright if they wander into shallow or moving water. The succulent green leaves are lily pad shaped. Marsh marigolds tend to go dormant if the stream volume is reduced or dries up later in the season; and they disappear from sight but return faithfully the following spring. For the gourmet cook: the pickled flowerbuds have been used as a substitute for capers in salads, pastas, and other recipes.

Indian cucumber-root, another safe-to-eat streamside plant, is a graceful if not terribly showy wildflower in the lily family and has classic Liliaceae features such as ribbed leaves and tiny, yellowish green, nodding flowers with reflexed petals and red stamens. It's easiest to identify by the way the leaves appear in two sets of whorls on the slender stems. The berry-like fruit, a tiny red-purple drupe, is often overlooked.

The thought that freshwater habitat supports only attractive and edible plants, alas, doesn't hold up. Highly poisonous Indian poke and the stinky skunk cabbage are also found in this habitat. Indian poke, aka false hellebore, is a daunting plant indeed, not to be trifled with. It can grow as tall as a person and sports correspondingly large leaves up to a foot that clasp the stem and get smaller as they ascend. At the top, above the leaves, are large clusters of greenish white star-shaped flowers.

Not surprisingly, the fruits that follow are big, too, up to an inch long. They split open when the flat-winged seeds within are ripe. From the lowest leaf to the flower clusters to the stems to these seeds, all plant parts contain toxic alkaloids that cause vomiting, lowered blood pressure, and a slowed heart rate. I've read that Native Americans and early settlers tried to harness these qualities, but getting the doses just right without harming or killing the patient often proved dicey.

As for good old skunk cabbage, you will find it in upland stream areas because it loves moist ground. The signature lush, maroon-mottled leaves begin coiled but open broad. They are truly smelly when stepped on or crushed, hence the common name. Some plants get as big as 3 feet wide and tall. If you don't want to examine the plant closely, you will have to take my word for it that there is a greenish yellow spadix nestled inside those dramatic leaves that is considered by some the first flower of spring.

Even if you don't care to approach this plant closely, you can observe a rather unique quality—surrounding snowmelts in a circle around young plants thanks to heat generated by emerging flowerbuds from respiration. The warmth hastens the plant's development and releases volatile chemicals that attract pollinators. The protective hood, or spathe, appears to act as an insulator. In any event, the fruit that eventually develops by late summer is a compound fruit, with individual dark-colored seeds about the size of marbles. These are sometimes eaten by wildlife, notably pheasants and grouse.

As you survey this cast of characters, you may well ask yourself, What is it about running water that attracts these plants or nurtures them and meets their needs? An upland stream moves water through the landscape, sometimes at a fast clip. The soil on its banks is likely well drained and vulnerable to erosion, so it is safe to say that these "indicator plants" prefer such conditions as opposed to standing, less oxygenated water, and they are tenacious.

Because some upland streams slow down or even dry up in the summer months, these plants are resilient too. They can sprout, flower, and produce seed quickly while water is abundant, and then slow down or even go dormant later. It's still a good life, you have to admit—they can thrive and provide food, shelter, and beauty when things are going swimmingly.

Teri Dunn lives on Cape Ann and is the author of 100 Favorite Garden Wildflowers.

Upstream

In search of unmapped streams

by Joe Choiniere

Late last July, on a rare ramble amid the relentless rain, I walked off the map. The journey was upstream, headlong against a flooding freshet toward headwaters that rarely appear on topographic maps. I wasn't lost; I was just following water from a place where water wasn't supposed to be to a place I wasn't sure it even existed.

My imagined destination was the purported place from which emanated these rushing waters—whether as molecule, droplet, or trickle—to begin its passage downhill. I had resolved to follow this watercourse now, in summer, when temperatures might not drive me indoors before I reached its source, as happened earlier in spring when I traced the same snowmelt-swollen stream unsuccessfully, ending with a numb and drenched finish by my woodstove.

The Burnshirt Hills are a prime location for my quest. Ranging from 900 to over 1,300 feet, these north-south-oriented parallel ridges are cut through with permanent streams flowing southward, the westernmost of which is the Burnshirt River, just eight miles in length. Really a branch of the Ware River, the Burnshirt, I suspected, would have various tributary streams that were short, sweet, and powerful—beginning near the crest of the ridge to the east and descending hastily to the permanent watercourse.

The waters of this particular stream's ultimate rush to join the river, swollen now by the constant spring rains, was braided out across a flat boulder field, a former riverbed perhaps. I began the journey just upstream, where the heel of the hill steepened and a narrower channel advanced between two boulders to a plunging small cataract. At this point the stream and river appeared as blue threads on the topographic map but were unnamed—already a step toward total oblivion. It is the temporary nature of these streams that leaves them unexplored, unnamed, and unmapped.

The terrain here was not at all like the smooth slope charted by the cartographers—a stone wall at right angles and odds to the stream had created a terrace fifty feet wide and a hundred feet long. Here the stream



© PAUL REZENDES

Tributary of the Swift River, Ashfield

smashed against the wall and divided, moving north and south along the barrier before pouring over in two separate channels thirty feet apart. One channel flowed off and away to the river by some other path. Silt had built up behind the other, and upstream of the rock dam at this point the shallow water had created a small-scale habitat for ostrich fern and towering great angelica.

The subsurface nature of headwater streams in summer is something I have often encountered. At times the only evidence of its presence is the sound of running water deep within the boulders and rocks and the alternating appearance and disappearance of water along the stream's channel. Ground water and surface water are connected under streams and other wetlands in a habitat known as the hyporheic, combining the greek words *hypo* (below) and *rheos* (flow). Miniature organisms such as protozoans, insects, worms, copepods, and tiny crustaceans live and thrive in such habitats, some of which move from surface to subsurface and others of which dwell wholly underneath.

I once dug down into East Wachusett Brook, a far larg-



© PAUL REZENDES

Mossy stream

er and more permanent stream, when dry summer conditions had reduced the brook to interspersed pools where brook trout lurked. Within a few inches I found running water. Higher up in the even drier headwaters of the same stream at the base of Wachusett Mountain, I heard the sound of water trickling under schistlike platters of stone stacked only a foot deep against bedrock. Moving stones to find the water, I encountered a number of leadback phase redback salamanders. The bone-dry surface of the woods lacked its typical moist log undersides so the amphibians had moved the short distances to the headwater streams' wetness, closer to the capillaries of the forest.

Even the smallest headwaters, far from any mapped wetlands, hatch winter stoneflies in the first three months of the year. With or without flowing water, these seemingly insignificant freshets create a lush habitat for certain species.

Above the raceway on the freshet feeding the Burnshirt River, I came to a spot where a deep, wide, slow, and seepy tannic flow met the main stream's clearer faster waters. I went back downstream at this point

to see whether this brown water was even noticeable, and found a definite color difference.

Moving upslope along almost any headwater stream in a watershed one may encounter confluences of this sort: most freshets are composed of others likewise built and joined together. These meeting places of waters may vary in character and origin drastically, or sometimes only slightly, but they are a reality of the nature of these headwater streams.

When a stream forks, which branch should I follow? Above, there may be other unnamed streams, perhaps dozens or more, and the longest should be the true source, but there's no way to tell. Flow rate is deceiving—I have seen it vacillate with the seasons at a confluence. Some freshets are spring fed; others consist of rain runoff or snowmelt. Waters observed at any one point are, for the most part, already mixed. As a result, bright new themes and dark shades are added as the stream rolls on, trickling in, unseen from their upstream sources, adding to a volume that may have taken hours or days to reach this particular point, mixing untraceably but building with time and descent.

When permanent streams divide, the waters are hydrologically defined by their order from first to second order and so on upstream. Most of the unmapped streams that I follow have shrunk to almost nonexistent, and one realizes that often there is no single source save the last remaining channel observed, and by then so many side channels are present that the quest for an original font is rendered futile.

That day above the Burnshirt River tributary in the rain, I had reached the fourth order, a stream still wide enough to challenge its crossing, when I realized that there would be no one source. The spring-fed seeps and countless hillside rivulets were all equal parts of this freshet. My path had become watery again, a terrain of tiny flowing streamlets networking across the landscape. These were rills, features I often noticed in March when snow melted into a network of runoff channels.

After a short uphill trudge against these downhill flows, I topped that first hillock and began to move downstream for the first time in a few hours, following more rills. By the second hillock I realized how confused I was—the rills no longer defined any recognizable path; they were mere strings ramifying through the forest. The whole forest was a landscape of water. I had followed the headwater stream to its source and found it to be the land itself.

The path of a drop of rainwater or snowmelt falling in the Burnshirt Hills is fortuitous, but it will coalesce with others and travel downhill, join a rill, feed a brooklet, and eventually find ancient rocky vernal stream channels, winding through dingle and dell as streamlet. These streams are indeed habitats. Though little appreciated and virtually unknown, they are vital parts of the watershed.

Joe Choiniere is property manager at Wachusett Meadow and Broad Meadow Brook wildlife sanctuaries.

Small Waters

Small headwater streams are critical to mainstem river systems, but they remain unprotected.

by Thomas Conuel

The Connecticut River, New England's largest river, begins its 410-mile journey to Long Island Sound and the Atlantic Ocean as a narrow stream trickling through marsh grass, on the southern side of a moss-covered pond called Fourth Connecticut Lake in northern New Hampshire, near the border with Canada.

Stand close to the beginning of this stream on a hot June morning with your boots together toe to heel and you can almost block the thin ribbon of water meandering from the pond. Walk several hundred yards through thick brush and red maples and follow the stream that begins the Connecticut River, and you will see small feeder streams, some no wider than an arm, emptying into the main stream flowing from Fourth Connecticut Lake. The "Great River," as the native Americans called it, grows from this spot, gathering waters from thirty-eight major tributaries, starting with the Mohawk River near the headwaters in New Hampshire and ending with the 150-mile-long Eightmile River near the Connecticut coast.

The Connecticut River and its tributaries, draining 11,250 square miles across four states, are watched over, scrutinized, and protected by numerous watershed councils and multiple state and federal agencies. Indeed, several years ago members of the Connecticut River Watershed Council, the active umbrella organization that keeps watch over its namesake river, decided to start a list of groups and organizations connected to or concerned with the river. However, says Andrea Donlon, river steward for the Massachusetts section of the Connecticut, "There is just no way to keep track of all the organizations connected to the river and its tributaries."

Almost every river in the United States has its guardian organization, but what of the small feeder streams, the capillaries that reach deep into the heart of a river's watershed and in tiny increments create the major tributaries that in turn form a great river such as the Connecticut?

Who watches over them?

The answer is nobody. These streams are often unno-



Pitcher plant

ticed and unmapped. Many of these obscure bodies of water, like vernal pools, are isolated, ephemeral, watery links that surge to life in the spring, weaving through wooded landscapes before finding their way to small rivers that in turn feed into the larger rivers that become a part of a region's history. Nurturing biological riches, these Lilliputian torrents of spring were for many years ignored or undiscovered even though they are the true beginnings of any river. Some run year-round with reduced flow in the summer; some go dry.

Betsy Colburn, a researcher at Harvard Forest, is cur-

© LARS JONSSON

rently studying the impact of small streams on the larger rivers into which they feed. There are currently no specific regulations governing these small feeder streams, though there should be, according to Colburn. A major hurdle to regulating feeder streams is that many do not appear on geologic maps.

"You can see a small tributary stream on a geologic map, follow it along, and then go to the next quadrant over on a different map and it's not there," she says. The maps are inconsistent. There is no good way to document small feeder streams. They appear and disappear in different quadrants. Aerial surveys aren't effective in dense woods.

"How can you pass regulations based on maps that are inaccurate?" asks Colburn. "You'll end up with public policy based on bad information."

An emerging technology called LIDAR (Light Detection and Ranging), a remote sensing system with many scientific applications, is now used in some instances for collecting topographic data and is helping track and map the once nearly invisible feeder streams. The LIDAR sensor works by recording the time difference between the emission of a laser beam and the return of the reflected laser signal to an aircraft sweeping low over an area. It's a technology used by the National Oceanic and Atmospheric Administration and NASA to document topographic changes along shorelines.

But LIDAR can also be used to sweep fields and forests, finding and following the small sometimes-seasonal seeps that turn into streams. Dense brush and trees do not hinder the system as they do aerial surveys. The use of LIDAR is growing and will help solve the problem of inconsistent topographical maps that often ignore small

aspects of the landscape such as feeder streams.

Protecting small streams near headwaters has emerged in recent years as a cause. The American Rivers organization offers on its website a feature "Where Rivers are Born" that outlines the science behind protecting small streams (www.americanrivers.org/library/reports-publications/where-rivers-are-born.html).

Headwater streams and wetlands are critical to river life. They help maintain water levels and recharge ground water; they provide natural flood control zones, absorbing rain and snow runoff. They trap excessive sediment, helping to keep the waters clean and clear while reducing the amount of sediment transported downstream, and they sustain downstream ecosystems by reclaiming and recycling dead plants and animals and microorganisms into the aquatic food web. For all that, though, they have no special protections.

The Clean Water Act of 1972 mandated protection of the nation's waters. And while the scope and interpretation of the Clean Water Act is now under question with several courts focusing on the word navigable to limit protection, the small feeder streams that pour volumes of water into major tributaries every spring go unregulated mostly because few know or care about their existence.

"Until we get those streams on the maps, nobody really knows how many there are or how many need protection," says Betsy Colburn. Like vernal pools, feeder streams pack a big environmental impact in a small area.

Thomas Conuel is a field editor for Sanctuary magazine.

Out of Nowhere, Then

by Wendy Drexler

Purple-brown skunk cabbage
stampede the meadow:

an astonishment of pursed
and swollen spathes, putrid

fists, ugly, unreticent,
and inside, the knotted swarm
of yellow flowers.

Slugs, snails, five-lined skink,
blue-bottled fly dine avidly

on the cud of bruised leaves
whose stench is salvage.



Skunk cabbage

How long winter slung itself
over my shoulder, each rogue thing
obstinate, returning—

Wendy Drexler's poems have appeared in *Barrow Street*, *The Big Ugly Review*, *The Brooklyn Review*, *The Comstock Review*, *HeartLodge*, *Nimrod*, *Peregrine*, *Poetry East*, and *Off the Coast*, among other journals. Her chapbook *Drive-Ins, Gas Stations, the Bright Motels* (Pudding House 2007) was nominated for a Pushcart Prize.

© GORDON MORRISON

Swimming with Stoneflies

A short guide to aquatic insects.

by Michael J. Caduto



© RICHARD SARDINHA

Rushing stream, habitat for aquatic insects

“It is as if we looked down into the surface of any stream and failed to find our own reflection there.”

John Hay, *In the Company of Light*

Some years ago, I had the good fortune to take a field trip led by William H. Amos, the well-known author of *Life in Ponds and Streams* and other popular books about aquatic life. As with any foray with avid naturalists, there was a heightened sense of expectation that we would encounter some things for the first time and experience the familiar through new eyes.

Following a brief introduction, Bill Amos pulled out a palm-sized round object that was covered with black rubber and attached to a wire with headphones on the end.

“This is a hydrophone,” he explained. “It picks up underwater sounds and transmits them to this set of headphones.”

Listening through those headphones was mesmerizing. It made me realize that everything I’d learned about life in a stream up to that point came from bits and pieces gleaned from someone looking in from the outside. When I heard the rush of water, the grating of sand, and the clicking of pebbles rolled by the current, I closed my eyes and imagined swimming with the stoneflies. I could feel the current bending my antennae. No longer anchored by booted feet, I clung by tiny hooks while cool rushing water washed over me and drew me into an aqueous world that flowed relentlessly toward the sea.

Stream insects themselves entertain no such superfluous thoughts. Awareness serves only to survive. To that end an insect’s compound eyes contain as many as 30,000 individual elements called ommatidia (from the Greek *ommat*, for eye). The resolution of images seen by insect eyes is not very good, but their eyes are extremely sensitive to movement and changing light levels.

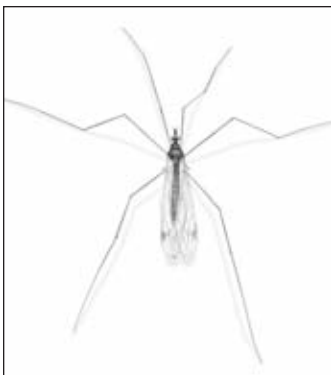
It is in fact the antennae that are the true marvels of a stream

insect’s sensory organs. They sense everything from sound and scent to movement and orientation in the water. Knowing which way is up or down, as well as upstream or downstream, is critical for surviving the challenges of dwelling in a constantly moving medium.

Flowing water exerts tremendous force. With one wrong step, a fragile insect can become dislodged and battered against rocks and sticks. The normal functions of life—eating, breathing, moving or holding fast, laying and hatching eggs—are all more difficult in a stream.

The current is also a blessing. As streams flow over the rough bottom, they become giant mixers, saturating the water with air. Water, being a universal solvent, bathes stream life in a dilute soup of vital dissolved nutrients. Most of these come from algae growing on the rocks, leaves fallen into the stream, and soil runoff. Some have even called

© RICHARD SARDINHA

*Crane fly*

stream water “liquid soil.”

These nutrients are cycled many times as they move downstream. They are consumed by plants and animals along the way, and then they’re released when they die and decompose in quiet pools, creating a kind of nutrient spiral along the length of a stream. The waste products of life are flushed away by the current.

Heavily shaded banks and many cold springs help to keep stream water cool. Since water can absorb much heat with little temperature change, the churning flow remains cool from top to bottom. This is especially important because the amount of oxygen and other gases that water can hold is inversely related to its temperature. A cooler stream can hold more dissolved oxygen, which is often the limiting element for aquatic life.

Stream insects have been adapting to these environments for eons. Some share a lineage that goes back beyond 300 million years when the earth’s land mass was a single continent called Pangaea. Because of this common ancestry, and as proof that form often follows function along the evolutionary road, many aquatic insects that look very similar can be found from the headwaters of our local rivers to the Congo in Africa and the Yellow River in China.

A journey in search of these ancient mini-beasts begins with a walk to a nearby stream or upland river. Some insect lives revolve around the film on top of the water that is created by surface tension. While we can easily poke a finger through the surface film, it is a daunting barrier to diminutive insects. It is also a unique habitat for surface dwellers, which are called the neuston.

Look for the familiar water striders. The feathery tips of their legs skate along on the surface as they prow for unlucky insects that have fallen in. Tiny claws, which are set back on the legs to avoid breaking the surface film, are used to handle captured insects. Striders use the water’s surface much as a spider uses its web; they sense vibrations made by struggling prey that have become trapped in the surface film. Once a victim is captured, the strider uses piercing sucking mouthparts to finish off the meal. It injects dissolving enzymes into the prey’s body then siphons off a liquefied insect gruel.

The next time you’re watching some water striders, catch one of the many mosquitoes that are no doubt biting you and toss it into the stream. Then watch the striders’ feast begin.

In the bend of a lazy meander, you may encounter some other common denizens of the stream’s surface—a group of frenetic gyrating whirligig beetles. These shiny bluish black beetles dart erratically across the water in large groups. As each day of the season progresses, they move gradually farther into the open water. Whirligigs

are the only beetles that swim on the water’s surface. When handled, some species give off a sweet applelike scent while others emit a foul-smelling secretion.

The soft aquatic larvae of whirligig beetles breathe by the diffusion of oxygen through their skin. Some whirligig larvae will pierce submerged plant tissue in quest of air. Mature larvae pupate at the water’s edge.

Life as an adult whirligig beetle is frenzied and competitive: an incessant search for food. They skitter along the water’s surface on oarlike legs that beat sixty times per second. Uniquely, they have two pairs of eyes that enable them to see both above and below the water simultaneously. Occasionally, a beetle will dive using a bubble of air trapped under the abdomen as an aqualung. When air in the bubble becomes depleted, more oxygen diffuses into the bubble—to replenish the supply so the surface of the bubble acts as a kind of physical gill.

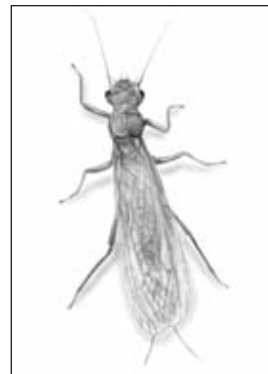
As you crouch along the streambank, shift your gaze to look beneath the surface, beyond the creatures whose movements interrupt the reflection of forest and sky. There you may see some tiny quarter-inch blackfly larvae attached to a rock and swaying downstream in the current. Blackfly, aka buffalo gnat, larvae are unmistakable—their bulbous butts anchored firmly in place with silk threads and strong legs. Sievelike hairs project from each side of the head to strain algae, tiny animals, and plant debris from the water. If dislodged, the larvae will creep like spiders back up the current on a silken thread.

If you’re lucky, you may also see what looks like a tube of sand or a scratch of tiny leaf pieces moving along the bottom. Of all the insects encountered in the lucid pools and rolling ripples of the streambed, none are more curious, ingenious, and inspiring than the omnivorous larvae of the caddisflies. Although a few species are free swimming, most caddisflies either build a case out of material found along the bottom or weave tiny underwater nets to glean food from the current. Caddisfly larvae are among the few insects that can be found crawling around on the surface of the stream bottom by daylight.

Tube-dwelling caddisfly larvae construct their homes by weaving an intricate stocking of silk threads that is closed at one end. Depending on the species, either sand grains, leaf pieces, or small sticks are glued to the silk tube, often in a neat spiral pattern. These elaborate cases supply protection and ballast.

Caddisfly cases are among the most remarkable forms of natural architecture. One species that’s easy to recognize is the snailcase caddisfly (*Helicopsyche borealis*). The spiral shape of its sand-grain case, which is only one-fifth of an inch long, caused it to be identified as a snail when it was first discovered in 1834.

The log cabin caddisfly (*Brachycentrus americanus*)

*Stonefly*

© RICHARD SARDINHA

uses minute pieces of sticks to construct a home that looks like a miniature log cabin—square in cross section and gradually tapering toward the closed end. The fly-fishing lure that mimics the adult of this species is called the American Sedge.

Although free-swimming caddisfly larvae are often predaceous, the larvae of net-spinners and casemakers are mostly herbivorous, eating moss, algae, and dead leaves. Abdominal gills are used for breathing, which is aided by the undulating motion of larvae in their cases to help keep freshwater circulating.

Other aquatic insects that spend long periods of their lives submerged can be found amid the rocks, gravel, and plants beneath the roiling water. Since most of these creatures are nocturnal, they remain well hidden during the day.

Wading in from shore, and searching through some leaves and branches in the shallows, you may find a nymph of the giant black stonefly, *Pteronarcys dorsata*—North America's largest stonefly. I have found nymphs that were nearly two and one-half inches long. This nymph has such a profusion of billowing gills on the abdomen that it looks bearded. Despite their somewhat daunting size, they eat only plants and detritus. Anglers use them as bait for trout. The short-lived adult giant stoneflies are nocturnal and do not eat. This is also true of most adult summer stoneflies.

Stepping farther into the stream channel and turning over a few rocks, you may find a member of the family known as "common stoneflies." At one and a half inches, nymphs of the great brown stonefly (*Acroneuria lycurias*) are not as big as those of *Pteronarcys*, but they have a voracious appetite and predatory nature, coming out at night to feed on mayflies, caddisflies, midges, and others. In fact, this nymph's mottled markings evoke the spots on a tiger. If great brown stonefly nymphs become stressed because there is not enough oxygen in the water, they start doing push-ups, which circulates water over the thoracic gills in an attempt to obtain more oxygen.

When viewed from the side, the nymphs of common stoneflies, and many other stream insects, are nearly flat. This allows them to exist in the boundary layer, a thin film of water that's a fraction of an inch thick where friction between the rock and the moving water slows the current considerably. Crawling around in this narrow zone of calmer water prevents insects from being washed downstream.

Stonefly nymphs have two, thin, tail-like appendages called cerci that are thought to be used for defense and reproduction. The nymphs of most species of mayfly, however, have three cerci and bear gills on their abdomen. Depending on the species, stonefly and mayfly nymphs spend one to two years foraging along the stream bottom. All mayflies, and some stoneflies, are herbivorous.

Mayfly nymphs hatch into ephemeral subadults called duns, or subimagos, and then molt into adults whose sole purpose is to reproduce. In fact, most adult mayflies have reduced or nonexistent mouthparts and guts—they don't eat at all. They mate in a frenzied one or two days, after which

the male dies and the female often perishes while trying to re-enter the water to lay eggs on the bottom.

If you keep turning over rocks, you will soon discover why so many science fiction movies feature alien species with outlandish interpretations of insect anatomy.

Of all these, dobsonflies, *Corydalus* spp, are among the most bizarre. The larvae, called hellgrammites, are more than 2 inches long and have 8 pairs of spiky-looking filaments running down the sides of their abdomens. They're very lively when used for fishing and so have earned the name "bass bait." The male adults are 3 inches long and sport a pair of horrific-looking hooked mandibles thrice the length of the head that they use for defense and courtship.

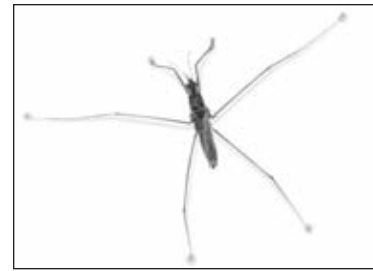
Some of the most wormlike larvae in the stream are those of the crane flies. They are up to 2 inches long, maggotlike, cream colored, and fleshy. Protuberances on the tail look oddly like the proboscis of a star-nosed mole. The two dark spots nearby are spiracles, openings that can be used like a snorkel to breathe in shallow water. Some crane fly larvae are predaceous while others are scavengers. Adult crane flies, which are known as "mosquito hawks," often hover in the shady hollow of a tree or flutter on screen doors at night. Although they look like giant mosquitoes, crane fly adults don't bite. Some actually feed on flower nectar.

Few insect larvae are more adept at sliding along well within the protective boundary layer than the brownish black, oval-shaped water penny. At about a third-inch across, water pennies are not easy to spot where they cling closely to the undersides of rocks, moving slowly while eating algae and other plants. Adult water penny beetles creep along in riparian plants and on rocks in the shallow swift waters.

Trout are adept at plucking water pennies from their tight purchase along the rocky streambeds. In their world, water pennies and other herbivorous stream insects are near the bottom of the aquatic food chain. They are eaten by other insects, salamanders, fish, crayfish, turtles, birds, and, eventually, people who like to eat their catch of the day.

It only takes a few minutes to turn over some rocks, to search the plants or piles of debris in the shallows. With a little practice, you'll begin to know where to look for different kinds of insects based on the microhabitats they prefer. The shift of perspective from land to stream carries us but a short distance, but it's the doorway to a strange fascinating world.

Michael J. Caduto is the author of Pond and Brook: A Guide to Nature in Freshwater Environments. One of the many programs he offers through his website www.p-e-a-c-e.net is Minibeasts of the Stream.



© RICHARD SARDINHA

Water strider

Brooks and Birds

All life depends on moving water.

by Wayne Petersen

Who does not love the sound of moving water, be it a babbling brook, a rapidly running stream, or a fast-flowing river? There's something soothing about water on the move. In Massachusetts, most brooks and streams find their source in seeps and springs that emanate on upland slopes; in more mountainous regions it is melting snow or permanent glaciers that provide much of the lifeblood for these small tributaries. In either case, gravity is critical to the maintenance of a running brook or stream; the steeper the slope, the faster the flow.

Rapid, continuous flow is one of the things that makes brooks and streams such dynamic environments. In many areas, moving watercourses fail to freeze in the winter, thereby readily supporting life even in the coldest weather. If an eastern phoebe is going to survive a Massachusetts winter, it will almost invariably spend some of its time near a boggy seep or an open brook since these habitats are among the few hibernal nooks that can sustain hardy flying insects even under the most frigid conditions.

As an ornithologist having encountered fast-running waters in far-flung corners of the planet, it is hard for me not to notice congruence in the birdlife of such environments. In Quebec's Gaspé Peninsula, a bird best characterizing fast-moving upland torrents is the harlequin duck, while in Peru, the torrent duck occupies a similar niche. In New Zealand's fast-moving streams, it is the rare blue duck, and in Zimbabwe, the African black duck typifies swift inland waters.

It is not only stream-loving waterfowl that associate with quickly flowing water. There are land birds, too. No songbird is more characteristic of rushing water than the dipper, whether it is the American dipper in our own Rocky Mountain West, the white-throated dipper of the European Alps, the brown dipper of the mountains of Asia, or the white-capped dipper of the South American Andes. All are similar in form and all share similar adaptations and unique behaviors. Closer to home is the Louisiana waterthrush—a songbird more closely associated with running streams and rivers than any other in eastern North America. In Africa the mountain wagtail occupies habitats similar to those chosen

by the Louisiana waterthrush, and in South America it is the unassuming little torrent tyrannulet that typifies streamsidings befitting its name.

If one is willing to explore the chilly waters in a rushing brook, it is the diversity of arthropod fauna beneath the water's surface at any season of the year that is particularly remarkable, either in the detritus on the stream bottom or attached to stones in the water. Stonefly, mayfly, and caddisfly larvae, as well as a plethora of small mollusks and crustaceans, remain active year-round in open freshwater streams. It is these organisms and the larvae of other waterborne insects that constitute the primary diet of birds such as the harlequin duck, American dipper, and Louisiana waterthrush at varying times throughout the year.

How birds obtain these organisms is necessarily quite different because of their differing structures and characteristics. Harlequin ducks breeding among the tumbled debris and stumps adjacent to upland rushing



Acadian flycatcher

© MICHAEL DIGIORGIO

© MICHAEL DIGIORGIO

*Canada warbler*

streams forage by diving and picking up their prey while underwater, or else by half swimming and half walking while facing into the current with their head beneath the water while searching for food. As most New England birders know, Harlequin ducks are powerful swimmers and divers, as exhibited by their winter behavior of routinely diving and feeding in pounding ocean surf adjacent to emergent rocks, or over submerged rocky reefs.

American dippers employ a different strategy. As a passerine species, they lack the webbed feet of the harlequin duck, but still they are uniquely adapted for swimming underwater, walking on the bottom of a stream, or actually floating on the water while picking prey from the surface. During their submarine foraging ventures, dippers are successfully able to remove aquatic insect larvae off the surface of stones or gravelly stream bottoms. Occasionally, they also employ a technique used by harlequins of slowly walking against the current with only their heads underwater while searching for prey. Harlequins and dippers both possess transparent nictitating membranes over their eyes that allow them to see underwater while at the same time protecting their otherwise sensitive eyes. Foraging by the Louisiana waterthrush is less dynamic than by the dipper, since most of its food is obtained by wading in shallow water or by flipping over moist leaves and other detritus found along a stream's edge. To assist their semiaquatic, ambulatory, foraging style, waterthrushes

have notably long legs—a feature that is shared by few other wood-warblers aside from the closely related ovenbird.

The spotted sandpiper is another frequent inhabitant of stream and riverbanks. Being a typical shorebird, a spotted sandpiper has the same long legs and counter-shaded coloration typical of most members of its tribe; however, its choice of feeding sites is frequently quite different than those of most of its sandpiper relatives. Spotted sandpipers regularly tiptoe among the rocks or shorelines of large streams and rivers in search of aquatic insects or crustaceans, much like oversized waterthrushes.

This is the only Massachusetts shorebird that regularly forages in this manner, although the wandering tattler occupies a similar niche while on its summer breeding grounds in Alaska. Not coincidentally, perhaps, spotted sandpipers, mountain wagtails, and Louisiana waterthrushes share the somewhat curious habit of constantly bobbing their tails and rear ends when walking. Even the American dipper regularly bobs, or appears to do deep knee bends, while moving about the rocks of a rushing stream. No one seems to know for sure why so many species inhabiting streamside habitats engage in this behavior. It has been suggested that the constant moving and bobbing of their posterior body or tail may make them slightly less conspicuous when moving along

the edge of running water, thereby affording them a modest degree of camouflage, or possibly even a subtle foraging advantage. Whatever the reason, it is a behavior shared by a number of streamside bird species worldwide.

Although the list of birds regularly inhabiting upland watercourses is relatively short, there are many species whose habitat preferences regularly include the presence of running water. The rocks, logs, and overturned stumps bordering shaded brooks and streams provide perfect habitat for the tiny insects and other invertebrates that constitute the diet of the diminutive winter wren. Acadian flycatchers are well known for their habit of regularly placing their rather poorly constructed nests in the forks of branches in shrubs or small trees over water. In Massachusetts such nests are frequently found in ravines containing a small brook or stream, often where hemlock or American beech trees are also present. In fact, the first Acadian flycatcher nest ever found in Massachusetts was located in a tupelo over a small forest brook.

Needless to say, when addressing the conservation needs of uncommon or rare Massachusetts breeding species such as the Acadian flycatcher, an understanding of their nesting ecology is critical. Another example is the state-listed northern parula, which prefers nesting habitat where slow-moving streams pass through woodlands and old man's beard lichen is conspicuously present on the trees. Because parulas almost exclusively use this locally distributed lichen for their nests, most of the few breeding northern parulas in Massachusetts

© MICHAEL DIGIORGIO

*Louisiana waterthrush*

are located on Cape Cod and the Islands where the lichen is most prevalent. Understanding the association between the warbler and the lichen is tantamount to protecting the species' habitat.

Other birds with a penchant for running water in their habitat include the red-shouldered hawk, barred owl, veery, and Canada warbler. Each of these undoubtedly has its own "reason" for preferring moving water within its territory, even though the reasons may not always be apparent to an ornithologist. Although these species are all characteristic of swampy woods and bottomland forests, only the Canada warbler regularly locates its nest along a stream bank or overturned nearby stump. No doubt the abundance of tiny gnats and other small flying insects in such habitats is of primary importance to this highly animated fly-catching warbler.

In the case of red-shouldered hawks and barred owls, it is their taste for amphibians such as wood and green frogs and salamanders like red efts that routinely inhabit quiet pools and mossy banks along wooded brooks and streams that possibly draws them to moving water. In addition to amphibians, small mammals are regularly attracted to moving water for drinking, bathing, and, in some cases, foraging. There is no mammal more closely associated with coldwater upland brooks than the curious little American water shrew. These tiny and often reclusive creatures are uniquely adapted for foraging on both land and underwater where they are adept swimmers, using oversized and partially webbed hind feet for active pursuit of submarine prey, especially small fish and aquatic insects. Aside from several salamander species, few vertebrates other than fish are more closely tied to forested brooks and streams

than the diminutive water shrew.

Since the return of the beaver to many Bay State regions, a number of forested brooks and streams have been gradually converted to beaver ponds. Once a stream has been dammed by these industrious rodents, the resulting beaver pond becomes an important wetland in its own right. Immediately a nursery for a myriad of aquatic insects and other tiny invertebrates, beaver ponds eventually become reservoirs capable of supporting everything from fish, reptiles, and amphibians to great blue herons, wood ducks, and tree swallows. Mink regularly ply their borders for aquatic prey, and in remote areas moose occasionally browse the shallows of beaver ponds for aquatic vegetation. And all the while busy beavers relentlessly attempt to stop the flow of the life-giving stream that made possible

the beaver pond in the first place. Few forested wetland habitats support the biodiversity found in an active beaver pond.

As the downhill flow of brooks and streams gradually slows and widens, the surrounding countryside tends to also change. Different birds and other wildlife replace the signature species typical of smaller upland watercourses. Along large streams and small rivers, common mergansers regularly raise their young in summer, sometimes sporting broods of outlandish proportions as a result of dump nesting by wayward females. Where clay banks occur along river edges, bank swallows often excavate their nest burrows and forage on the wing for flying insects over the water. Sometimes a nesting belted kingfisher will share a suitable clay bank with a bank swallow colony, although the kingfisher's foraging involves plunge diving for small fish rather than catching insects on the wing. In some areas, even a lordly osprey may patrol a wide stream or narrow river in its search for fish of a size larger than those manageable by the kingfisher.

Regardless of the location, size, width, or depth of a brook, stream, or river, moving water will always hold a secure place in our living world. Without small and ever-widening water channels, life on earth as we know it would cease to exist. Water is a precious resource and a sustainer of life. Not only is the survival of birds and other wildlife dependent upon moving water, it is also essential for humanity. May our brooks and streams run pure forever!

Wayne Petersen is director of the Important Bird Areas program for Mass Audubon.

Poetry



© PAUL REZENDES

The Brook

Alfred Tennyson (1809-1892)

I come from haunts of coot and hern,
I make a sudden sally,
And sparkle out among the fern,
To bicker down a valley.

By thirty hills I hurry down,
Or slip between the ridges,
By twenty thorps, a little town,
And half a hundred bridges.

Till last by Philip's farm I flow
To join the brimming river,
For men may come and men may go,
But I go on for ever.

I chatter over stony ways,
In little sharps and trebles,
I bubble into eddying bays,
I babble on the pebbles.

With many a curve my banks I fret
by many a field and fallow,
And many a fairy foreland set
With willow-weed and mallow.

I chatter, chatter, as I flow
To join the brimming river,
For men may come and men may go,
But I go on for ever.

I wind about, and in and out,
with here a blossom sailing,
And here and there a lusty trout,
And here and there a grayling,

And here and there a foamy flake
Upon me, as I travel
With many a silvery waterbreak
Above the golden gravel,

And draw them all along, and flow
To join the brimming river,
For men may come and men may go,
But I go on for ever.

I steal by lawns and grassy plots,
I slide by hazel covers;
I move the sweet forget-me-nots
That grow for happy lovers.

I slip, I slide, I gloom, I glance,
Among my skimming swallows;
I make the netted sunbeam dance
Against my sandy shallows.

I murmur under moon and stars
In brambly wildernesses;
I linger by my shingly bars;
I loiter round my cresses;

And out again I curve and flow
To join the brimming river,
For men may come and men may go,
But I go on for ever.

*The Brook is reprinted from English Poems. Ed. Edward
Chauncey Baldwin. New York: American Book Company,
1908.*

At Our Sanctuaries Sacred Landscape

by Ann Prince

Across Massachusetts religious groups are permanently saving natural lands in their ownership with the assistance of conservation groups. Mass Audubon's Attleboro Springs Wildlife Sanctuary at La Salette is one of the success stories in the progressive statewide initiative. This exquisite and ecologically diverse new sanctuary in the city of Attleboro will formally open this fall.

Protecting their land was a perfect fit for the priests at the National Shrine of Our Lady of La Salette. "Our community began on top of an alpine mountain in the French Alps," says Father Ron Gagne MS, "so you can see why we have consistently established our ministry close to nature. We have founded parishes and shrines where people can pray, reflect, and find reconciliation with themselves, with each other, and with God." The La Salette order's mission of reconciliation now extends to reuniting humanity with nature. "Stewardship of all life encompasses people, animals, and the earth," says Father Gagne. "Embracing this world view, we want to draw people to the beauty of our own land, offering a holistic approach to ecology—spiritual, theoretical, and practical."

A 2005 conference held by the Religious Lands Conservancy provided the framework to facilitate the land-protection process for individuals at La Salette, the local Attleboro Land Trust, and city residents who were already considering various options for the 117 acres in the backyard of the shrine. Father Roger Plante MS, then-director of the La Salette Retreat Center in Attleboro, attended the conference and came away with information and contacts that would be instrumental in realizing the concept. His goal was not only to safeguard the land and its environmental integrity but also to keep it as a sacred space and improve its accessibility to enhance the ministry of the shrine. "Nature can be a transformative experience through a contemplative walk," he says. "People like to have a bold vision of the Almighty speaking to them,



Brothers Pond, Attleboro Springs

but the tiniest grain of sand, flower, or insect can put you in touch with God."

Among Father Plante's contacts was Dominican Sister Chris Loughlin, director of the Crystal Spring Center for Earth Learning, who founded the Religious Lands Conservancy in 2002 with the Massachusetts Land Trust Coalition. Sister Loughlin recognizes that many congregations feel a growing responsibility to initiate a new relationship with their lands and acknowledge the interdependence of human life and natural systems. The Religious Lands Conservancy is helping church communities to preserve their lands permanently as places where people can rediscover the solitude of natural places

and ensure a lasting legacy for future generations.

"I think this is the great work of our time," says Sister Loughlin, "certainly being a voice for the voiceless." Sister Loughlin and her Dominican sisters in Plainville have set an example themselves, placing 32 acres of their Crystal Springs property under conservation restriction to preserve it in perpetuity.

Like-minded, the La Salette community in Attleboro began meeting with representatives of other groups with a common goal. "Sometimes things line up in the right way," says Sister Loughlin. "Father Plante made the right connections in order to make it happen, but we needed experts." Serendipitously, Oak Knoll Wildlife Sanctuary was just a mile down the road, so Mass Audubon became an indispensable partner in the project. Mass Audubon Land Protection Specialist Charlie Wyman and then-Oak Knoll Sanctuary Director Sarah Slack were enlisted to join the roundtable.

"We all began meeting and exploring options, and over time we formulated a plan to match our goals," says Wyman. "A key to the project's positive result is that La Salette placed a higher priority on realizing a good conservation outcome than receiving compensation. Simply putting a conservation restriction on the land would have been easy, but that wasn't their vision; they wanted a place where people could take a meditative walk and learn about

© RICHARD JOHNSON

nature, as well as a site that would be well cared for.”

A stewardship trust was the solution. The collaboration among religious and secular groups made it possible. Everyone gives Charlie Wyman high marks for his expertise that facilitated the steps to procure the necessary funds required to ensure that La Salette’s land would benefit from permanent stewardship. Sister Loughlin calls Wyman’s participation “a beautiful act of humility” for offering the knowledge to carry the project forward and embracing reconciliation, which was at the core of this undertaking.

To endow the property and pay for trails and other improvements to enhance visitors’ enjoyment of its natural features, La Salette sold a conservation restriction to the city of Attleboro and the Attleboro Land Trust. A state grant provided roughly two-thirds of the purchase price—nearly a half-million—and foundations and private contributors donated another \$290,000. La Salette then turned over the day-to-day management of the property and the entire purchase price to Mass Audubon to establish the new sanctuary. “The closing was in June of 2009 when all of this came together,” says Wyman. “La Salette will continue to own the property while the stewardship trust conveys to Mass Audubon the responsibility to manage the sanctuary forever for wildlife and people.”

Congregations elsewhere in Massachusetts are pursuing similar results. In Holyoke, The Trustees of Reservations recently accepted a gift from the Sisters of Providence of 25 acres of farmland and woods on the Connecticut River. Named Land of Providence, this new reservation includes rich agricultural fields used by the urban farming program Nuestras Raices, a grassroots organization meaning “our roots.” This gift of arable land and riverine forest is part and parcel of the sisters’ call to make decisions “in light of women, earth, and the poor.”

On the Buzzards Bay coast in Wareham, 300 acres will soon be protected, thanks to efforts by The Congregation of Sacred Hearts of Jesus and Mary, Mass Audubon, the Wareham Land Trust, the Department of Conservation and Recreation, the town of Wareham, and neighboring landowners. Central to preserving the Wareham land is Sacred Hearts’ willingness to sell a conservation restriction on 95 acres of their retreat center—coastal beach, freshwater wetlands, and forest—at a fraction of its value. Abutters are donating conservation restrictions on their land while private, federal, state, and local funds are helping complete the transaction. Mass Audubon and the Wareham Land Trust will oversee the conservation assemblage, with Mass Audubon maintaining a self-guided nature trail for public use.

The grand opening of Attleboro Springs Wildlife Sanctuary at La Salette is scheduled for October 2, and Sanctuary Director Tara Henrichon, also director of Mass Audubon’s Oak Knoll, is working to get the property ready for the general public. A visitor information



© BLAIR NIKULA

Ruby meadowhawk

**Join Us for the Opening Celebration of Attleboro
Springs Wildlife Sanctuary at La Salette
on Saturday, October 2, 2010**

Cultural and natural history walks
Ponding platform demonstrations at Attleboro Springs
Make-and-take craft projects at Oak Knoll
and more...

**For information: 508-223-3060
oakknoll@massaudubon.org**

pavilion will welcome people at the entrance, from which trails will lead out into the sanctuary. Renowned trail designers Peter Jensen and Associates are creating a loop trail that will be universally accessible. It will circle Brothers Pond, which is habitat for dragonflies, frogs, birds, turtles, and fish; a viewing platform will enhance observation of these species; and a boardwalk will skirt several vernal pools inhabited by wood frogs.

Mass Audubon South Shore Property Manager David Ludlow is constructing an outer loop with the help of volunteers. It will traverse a constructed waterway that abounds with green frogs and wetland plants such as fragrant spicebush, and will fork off to provide trail access into the sanctuary for people at the La Salette Retreat Center. The trail will take walkers through the forests of the sanctuary, passing old stone walls constructed of large rocks and leading through habitat for breeding birds such as wood thrushes, eastern woodpeckers, red-eyed vireos, scarlet tanagers, and ovenbirds.

The world over, the wild and magnificent grounds of La Salette have traditionally been conducive to peaceful reflection. Like the spring in the Alps where the La Salette order was founded, the perpetually running spring at the new sanctuary in Attleboro has long been valued as healthful water for the body and soul. Mass Audubon’s Attleboro Springs Wildlife Sanctuary at La Salette will continue that legacy, making the healing qualities of the natural world available for the people who come to find respite in this expansive, quiet, green space in the city. At the same time the land will be loved and nurtured.

Ann Prince is associate editor of Sanctuary.

The Political Landscape Lost Waters

by Jennifer Ryan

“Water, water, everywhere, Nor any drop to drink.” That is not where we want to find ourselves!

In 2003, the United States General Accounting Office did a survey of the states—36 are expected to run into water shortages either statewide or locally, with Massachusetts water managers expecting, and experiencing, local water shortages. We don’t want to be like Atlanta, which could theoretically have enough water but due to poor planning—including putting in a theme park that uses millions of gallons to make artificial snow and massive growth in the suburbs—is running out of water. Local officials have held prayer vigils in front of the Georgia State House, asking for rain.

There are, needless to say, other solutions, such as smarter uses of water resources and better conservation.

Water shortages have played out in a few high-profile areas of the Commonwealth—the dry riverbed of the Ipswich being the poster child—but many other streams suffer similar conditions on an all-too-regular basis. Even though we average 45 inches of rain in Massachusetts per year, rivers like the Ipswich do run dry. Contributing reasons are many, but they can be broken down into one simple equation. We withdraw water faster than it can be naturally replenished. We pump too much for home use such as watering lawns, especially in the summer when streams and groundwater are lower naturally. And we cover the land with pavement and buildings, directing polluted runoff quickly toward the ocean rather than allowing it to soak back into the ground. Furthermore, a great deal of wastewater isn’t treated locally and put back into the ground; it gets pumped to treatment plants and discharged in the lower reaches of rivers or out to sea. We are taking the water out and not putting it back.

And then there’s the weather and flash flooding, which is becoming more regular as the climate changes at a rapid pace. As the oceans get warmer, they evaporate more, and that evaporated water comes back down as more frequent violent storms. Towns close to the coast have seen this firsthand. Our stormwater systems can’t handle the heavy rainfall, and water overflows the sewer lines and pours into rivers, and sometimes streets, ultimately flowing right out to the ocean. Then heavy rains are interspersed with droughts, leaving groundwater, and the rivers and streams that tie into groundwater supplies, dry.

Solutions are available to resolve these problems, including low-impact development techniques that

direct runoff into vegetated areas where it can percolate slowly into the ground and feed aquifers and streams during dry periods. Such methods also more effectively clean polluted runoff while reducing infrastructure construction and maintenance costs.

When rivers and streams are unnaturally low, fish and other aquatic life suffer. Water temperature goes up, and warmer water bubbles out its oxygen, making it harder for fish to “breathe.” Then the occasional flash floods come, scouring the riverbeds and eroding the banks, leaving sand, dirt, and rocks along the riverbed and smothering mussels and other animals that can’t move quickly.

This is compounded by many dams that break up rivers across Massachusetts. With over 3,000 dams in the state, we have the highest concentration of dams in the country. These dams stop fish from moving upstream to spawn and, obviously, change the natural flow of rivers. Rivers that are broken up by dams are even in greater trouble with a warming climate since fish can’t escape warmer downstream water by swimming upstream to cooler waters.

All these troubles came to a head in late 2009 when environmental groups, protesting actions made by the Patrick Administration, walked out of negotiations on how to define an environmentally safe amount of water that a water supplier can pump. In response, the Administration convened a sustainable water initiative, bringing together water suppliers, conservation groups, academics, and others to map out the best way forward to ensure a water policy that can meet both the needs of wildlife and people.

Mass Audubon is participating in these meetings and results will be in this fall. A three-pronged approach is being discussed: better water conservation efforts, limits on water withdrawals that are sensitive to the needs of wildlife and people, and protection of green infrastructure such as wetlands that buffer communities from storms or removal of dams to improve fish habitat. Funding mechanisms to make these approaches viable have to be developed—water suppliers make more money the more water they sell, and raising rates is always difficult. But there are other solutions available, such as levying a small fee on new water uses and using that money to fix pipes and for other conservation projects.

To find out more about Mass Audubon advocacy work on water and other conservation initiatives, sign up for the Beacon Hill Weekly Roundup by emailing action@massaudubon.org.

Jennifer Ryan is Mass Audubon’s legislative director. She is also a conservation biologist.

Notes From the Real World
The Last Dipper

by Chris Leahy



© ROGER CHARLWOOD

Rufous-throated dipper

In late November 2004, at the height of the southern spring, I flew into San Salvador de Jujuy, a pleasant little city in the Andean foothills of northern Argentina. My mission during the next week was to scout localities for a new natural history tour that would traverse the great range from the subtropical Yungas forests at the base of the eastern slope, up across the crystalline deserts and alpine bogs above 10,000 feet, and then down through the Chilean chaparral to the blue Pacific. I picked up a small but sturdy-looking VW Gol, and a couple of empanadas from the airport food stand, and headed north with no plans aside from my initial goal: to explore the valley of the Rio Yala, habitat of the rare rufous-throated dipper.

I'm not sure that I can explain why landing at a remote airport, finding a car, and heading off into the

hills with only a vague itinerary should so reliably produce in me a state of quiet euphoria. In addition to a touch of escapism, there is about it an aspect of magical quest, of stepping through the looking glass and arriving in a place that is somewhat familiar, yet also new and strange, a place containing something very special that you are obliged to find.

From Jujuy, I followed Ruta Nacional 9 along the aptly named Rio Grande up through the Quebrada de Humahuaca, whose bizarre forms and changing colors meet the highest standards of topographical fantasy—the walls of the vast ravine obviously painted by giants with wide ribbons of reds and yellows rising above the jade and turquoise torrent below. Rivers are ideal companions for the kind of quest I had embarked on. They embody the spirit of the journey, going where they

please, usually not by a direct route, and changing direction, garb, and mood as weather and other factors demand. And they are trustworthy guides.

The world's five species of dippers all reside in high temperate and mountainous regions, one each in Europe, Asia, and North America, and two in South America. None are "beautiful" in a painted bunting sort of way, though "handsome" is an acceptable description of their tasteful grays and browns, in two cases with splashes of white. Rather, it is the behavior of dippers that makes them both fascinating and winsome. Not satisfied like other species of riverine songbirds to hover above the torrent or teeter on emergent rocks, they are true swimmers and divers that habitually seek insect larvae, fish eggs, and other benthic prey among the cobbles of the stream bottom.

Their physical adaptations to this extreme life are notably subtle—no webbed feet or flippers, but efficient modifications such as short wings with extra-strong muscles for what amounts to underwater flying in punishing currents; super flexible lenses for spotting prey both above and below the surface; nostril flaps to inhibit drowning; and a jumbo oil gland for frequent waterproofing. Watched from the shoreline, a dipper's frantic activity—now bobbing on a boulder, now plunging into the cascading water, now apparently being carried away at the stream's mercy only to explode from the water and rocket upstream—suggests a novelty circus act, a corpulent wren trained to do water tricks!

The rufous-throated dipper is more like other dippers than not. It has a band of white at the base of the primary feathers that shows in flight and when the wings are flicked open—a typical dipper gesture. And of course there is the throat, a dab of color unique to the family. But the species' real standout quality is its rarity. It occurs only in a narrow band of the Andes in southern Bolivia and northern Argentina in a scattering of very small populations that together comprise no more than 3,000 to 4,000 individuals; and it is declining. Just one other thing about this particular dipper: as of November 2004 it was the only member of its family that I had never seen.

An especially appealing aspect of dipper seeking is that they are among those bird species about which it can be said that if you are watching one in the wild you are quite likely to be in an unusually dramatic landscape. The Rio Yala enters the Rio Grande at a village of the same name. The river here is a well-shaded, shallow, cobble-bottomed stream of the babbling sort. I have seen dippers in places like this—in the English Lake District, and also in a cold stream running through a tropical cloud forest in Veracruz—but none appeared to me in this part of the river, despite diligent searching.

This was not especially disappointing. For one thing there were many other exquisite Andean birds to look at in the thin woodlands. For another, it is customary, perhaps even necessary, to suffer a certain amount of

failure when questing after exalted treasures (see *Knights of the Grail*), lest the eventual discovery lack the proper gravitas and dramatic denouement. But most crucially, this was not the dreamscape habitat in which I had imagined seeing my first rufous-throated dipper.

As the road climbed, the setting improved substantially. Some high peaks emerged behind a long vista of ocher and silver foothills. The river steepened and deepened and began to take more frequent and acute bends with more white water alternating with deep pools. And then in one broad bend, the riverbed opened up into a broad fork forming a narrow island between two channels. There was a footpath to the river, wide sightlines up and down stream, picturesque boulders framing the lotic vista, and an irresistible selection of perching rocks strewn across the scene—some spotted with avian whitewash! Dipper Central.

I was still thinking: "too easy," but I needn't have worried. I kept watch on the island for two hours—more than content to be pursuing such a delightfully useless enterprise in this stunning corner of the Argentine Andes. In addition to keeping a sharp eye on all possible dipper entrances and exits, I made notes on a mauve dragonfly for future identification; I ate a cold empanada; I "got ducked" in a deep (and icy) pool. And then, another sensation appeared: doubt. Maybe the birds no longer nest on this stretch of the river. Suppose this is not ecstatic idleness but just a workaday waste of time!

Now the afternoon glow was beginning, bringing its enriched colors and sense of immanence. I decided to wade across to a well-placed boulder for no better reason than it would be rather difficult to get to and therefore possibly count as additional dues paid. And as I reached the rock and was about to clamber aboard, I heard the unmistakable metal-on-metal contact note of a dipper.

I regret that I must give this tale that most unlikely and unimaginative ending: a scene of complete triumph and fulfillment. The bird after all might have called once, flitted past, and disappeared upstream never to be seen again. Instead, it flew to a rock barely ten yards from my own (once present dippers are not shy). It bobbed; it called; it showed off its singular throat (a strange shade of salmon at the center fading to peachy pink at the edges); it flashed its white wing patches; it picked off some flies from a nearby rockface; it dove into the stream and remained under for twenty of its reputed capacity of thirty seconds—and then it returned to the nearby rock for at least another full minute. Finally, a second bird arrived, appeared to address a brief but pointed remark to its mate, and then led him—or her—off in whirring dove-like haste around a distant bend.

Chris Leahy holds the Gerard A. Bertrand Chair of Natural History and Field Ornithology at Mass Audubon.

Summer Fun Creates Lifelong Memories



Mass Audubon's
16 day camps
and our overnight camp



are the perfect place for
your child to experience
summer camp.

Visit our website
www.massaudubon.org/camp
to find a camp near you.

Birding Programs

BERKSHIRE SANCTUARIES

Lenox, 413-637-0320

Canoe Meadows Bird Walks

September 3, 10—8-10 a.m.

BOSTON NATURE CENTER

Mattapan, 617-983-8500

Fall Bird Walk

October 2—8-10 a.m.

BROAD MEADOW BROOK

Worcester, 508-753-6087

Birds and Brewery Tour

September 26—10 a.m.-3 p.m.

BROADMOOR

South Natick, 508-655-2296

Hawk Watch at Pack Monadnock

September 18—10 a.m.-3 p.m.

Preregistration required

CONNECTICUT RIVER VALLEY

Easthampton, 413-584-3009

Migrating Nighthawks and Ice Cream

August 20—6-9 p.m.

Hawk Watches at Mount

Sugarloaf State Reservation

September 11—9 a.m.-noon

Hawk Watch at Blueberry Hill

September 19—9 a.m.-1:00 p.m.

DRUMLIN FARM

Lincoln, 781-259-2206

Shades of Brown Field ID Series

September 9—7-9 p.m.

September 11—8 a.m.-3 p.m.

IPSWICH RIVER

Topsfield, 978-887-9264

Warm Water Seabirds of

Stellwagen Bank

August 6—8 a.m.-1:30 p.m.

JOPPA FLATS

Newburyport, 978-462-9998

Wednesday-Morning Birding

Every Wednesday starting

August 1—9:30 a.m.-12:30 p.m.

SOUTH SHORE

Marshfield, 781-837-9400

Fall Returns: A Free Walk in Honor of

Daniel Webster Wildlife Sanctuary's

25th Anniversary

September 11—8 a.m.

WACHUSETT MEADOW

Princeton, 978-464-2712

Hawk Watching from Brown Hill

September 19—12:30-3 p.m.

WELLFLEET BAY

South Wellfleet, 508-349-2615

Shorebirds of Cape Cod Field School

August 10-13

Birding North Monomy and

Nauset Marsh

Weekly tours June, July, August, and

September

*Call the individual sanctuaries for more
information, fees, and to register.*

For a full listing of Mass Audubon programs
and events, visit our online catalog at
www.massaudubon.org/programs.





Natural History Travel



**Traveling with Mass Audubon supports
conservation in Massachusetts and abroad. Join us!**



© RON MAGILL

2010 US TOURS

Mount Greylock and Beyond:

July 23-25

For more information, contact Broad Meadow Brook, 508-753-6087

Birds of the Ipswich River Family Campout:

July 24-25

For more information, contact Ipswich River, 978-887-9264

Wonderful Wetlands Family Campout:

August 7-8

For more information, contact Ipswich River, 978-887-9264

Shorebirds Workshop:

August 17-21, with David Larson and Wayne Petersen

For more information, contact Joppa Flats, 978-462-9998

Family Camping Trip:

August 21-22

For more information, contact Broad Meadow Brook, 508-753-6087

The Nature of Cape Cod:

September 24-26

Cosponsored with Habitat Wildlife Sanctuary

For more information, contact Broadmoor, 508-655-2296

New Hampshire's Isles of Shoals:

August 27-29

For more information, contact South Shore Sanctuaries, 781-837-9400

Birding Washington's Olympic Peninsula:

September 9-16, with Bill Gette and David Larson

For more information, contact Joppa Flats, 978-462-9998

Block Island Adventure:

October 1-3

For more information, contact South Shore Sanctuaries, 781-837-9400

Birding the Mid-Atlantic Coast:

October 26-31, with René Laubach

For more information, contact Berkshire Sanctuaries, 413-637-0320

2011 International Birding and Nature Trips

Amazon Riverboat:

January 28-February 6

Uganda Birding and Gorilla Safari:

February 9-25

Birding trips to Belize, Costa Rica, Honduras, and Panama
(February-April)

**For detailed itineraries, email: travel@massaudubon.org
or call 800-289-9504**

THERE ARE NO BOUNDARIES WHEN IT COMES TO PROTECTING THE NATURE OF MASSACHUSETTS

Safeguarding our natural treasures requires identifying and protecting open spaces—those valuable landscapes that make Massachusetts unique. Mass Audubon offers a variety of ways that you can help save critical parcels of land before they are lost forever. Get involved in land protection by making a gift today.

- Contribute to the Mass Audubon Land Fund, supporting urgent land protection projects
- Achieve your charitable giving intentions while also establishing an income stream for yourself with a life-income gift arrangement
- Remember Mass Audubon in your will or estate plan

For further information, please contact:

Mass Audubon Development Office
208 South Great Road, Lincoln, MA 01773
(781) 259-9500, or development@massaudubon.org

Family Programs

BERKSHIRE SANCTUARIES

Lenox, 413-637-0320

Evening at the Beaver Ponds

August 11—7-8:30 p.m.

September 1—6:30-8 p.m.

Twilight World of Bats

July 23—7:30-9 p.m.

August 5—7-8:30 p.m.

BOSTON NATURE CENTER

Mattapan, 617-983-8500

Nuts about Squirrels

October 16—2:30 p.m.

BROAD MEADOW BROOK

Worcester, 508-753-6087

Animal Babies

August 21—10-11 a.m.

BROADMOOR

South Natick, 508-655-2296

Wild about Turtles

September 12—1-2:30 p.m.

Preregistration required

CONNECTICUT RIVER VALLEY

Easthampton, 413-584-3009

Perseid Meteor Shower at Laughing

Brook and Hampden Town Hall

August 13—7:30-9:30 p.m.

DRUMLIN FARM

Lincoln, 781-259-2206

Friday Evening Hayride

July 23—4-5:30 p.m. or 6-7:30 p.m.

August 13—4-5:30 p.m. or 6-7:30 p.m.

HABITAT

Belmont, 617-489-5050

Ice Cream and Insects

August 4—6-7:30 p.m.

JOPPA FLATS

Newburyport, 978-462-9998

Seashore Science at Joppa

Oceanographers Ahoy:

July 27-29—9:30 a.m.-1:30 p.m.

Psyched about Salt Marshes:

August 10-12—9:30 a.m.-1:30 p.m.

Family Ecology Cruises aboard the Yankee Clipper

July 24, August 14, 28

Family Day at the Bird Banding Station

August 21, September 12, 19

LONG PASTURE

Cummaquid, 508-362-1426

Aquatic Exploration Cruises

Every Thursday from

July 15-August 12—1:30-3:30 p.m.

Preregistration is required

Cuttyhunk and Elizabeth Island Cruises

August 29, September 12, and 19—9 a.m.-5 p.m.

Preregistration is required

MOOSE HILL

Sharon, 781-784-5691

Carve a Pumpkin!

October 21—6-8:30 p.m.

Pumpkins will be used in our Halloween event, but you can pick yours up afterwards

SOUTH SHORE

Marshfield, 781-837-9400

Duxbury Beach Programs

Every Saturday in

July and August—9:30 a.m.

WACHUSETT MEADOW

Princeton, 978-464-2712

The Buzzing of Nighttime Insects

September 4—6:30-8 p.m.

WELLFLEET BAY

South Wellfleet, 508-349-2615

Seashore Ramble

Offered several times weekly;

please call for exact times and dates.

Cape Cod Bay Marine Life Cruise

Offered several times weekly;

please call for exact times and dates.

Call the individual sanctuaries for more information, fees, and to register.
For a full listing of Mass Audubon programs and events, visit our online catalog at www.massaudubon.org/programs.

MASS AUDUBON'S BIRDSEED DAY FUNDRAISER

Help support your local sanctuary's education and conservation programs with your purchase of birdseed. Call for an order form and information about dates and times of sales.

BERKSHIRE SANCTUARIES

Lenox, 413-637-0320

Ordering deadline:

October 20

Pickup:

November 6—9 a.m.-1 p.m.

BROADMOOR

South Natick,

508-655-2296

Ordering deadline:

October 20

Pickup: November 6

Get ready for fall... FEEDER SALE

Double discount for Members
on feeders and accessories!

August 10-15

Audubon Shop at

Drumlin Farm Wildlife Sanctuary

Route 117, Lincoln, MA 01773

781-259-2214

Tuesday-Sunday, 10 a.m.-5 p.m.



Optics Fair at The Audubon Shop

Drumlin Farm, Lincoln

781-259-2214

Saturday, September 11—10 am-3:30 pm

15% Discount for members!

Meet the manufacturers' reps and see current products:

Pentax, Bushnell, Swift, Nikon,
Swarovski, Zeiss, Manfrotto (tripods)



Patterns in the Wild: Woodcuts by Andrea Rich

Through September 19

Mass Audubon Visual Arts Center

963 Washington Street, Canton

781-821-8853

www.massaudubon.org/visualarts

Canoe and Kayaking

BERKSHIRE SANCTUARIES

Lenox, 413-637-0320

Canoe Trips on the Housatonic

July 25—8:30 a.m.-12:30 p.m.

September 4—8:30 a.m.-12:30 p.m.

Canoe Trip on Goose Ponds

September 5—8 a.m.-noon

Canoe Trip on Buckley

Dunton Lake

September 15—9 a.m.-noon

BROAD MEADOW BROOK

Worcester, 508-753-6087

Neighborhood Nature on the Water

Every Friday in July and

August—2-5 p.m.

BROADMOOR

South Natick, 508-655-2296

Canoe and Breakfast on the Charles

August 7—7-11:30 a.m.

Preregistration required

CONNECTICUT RIVER VALLEY

Easthampton, 413-584-3009

Evening Paddle and Birdwatch

August 27—6-8 p.m.

FELIX NECK

Edgartown, 508-627-4850

Guided Kayak Tours

Every Tuesday and Thursday from

July 20 through September 2—

9:30-11:30 a.m.

Every Saturday from July 24

through September 25—

9:30-11:30 a.m.

Moonrise Kayak Tours

July 24, 25, 26, and 27—7-9 p.m.

August 21, 22, 23, 24, 25,

September 24, 25—6-8 p.m.

October 22, 23—5-7 p.m.

IPSWICH RIVER

Topsfield, 978-887-9264

Family Dusk Paddles

Owls on the Ipswich River:

July 30—6-8:30 p.m.

Discovering Wetlands:

August 6—6-8:30 p.m.

Paddle to Thatcher Island

Kayak Trip

August 7—10 a.m.-4 p.m.

WACHUSETT MEADOW

Princeton, 978-464-2712

Canoeing on Eagle Lake

August 8—1-4 p.m.

WELLFLEET BAY

South Wellfleet, 508-349-2615

Coastal Ecology by Kayak

Field School

August 23-26

Twilight Canoe Trips

Weekly tours in July, August, and September

Call the individual sanctuaries for more information, fees, and to register. For a full listing of Mass Audubon programs and events, visit our online catalog at www.massaudubon.org/programs.

SUMMER AND FALL CELEBRATIONS

BOSTON NATURE CENTER

Mattapan, 617-983-8500

Rappin' with Raptors Festival

September 25—1-4 p.m.

BROAD MEADOW BROOK

Worcester, 508-753-6087

Barbara J. Walker Butterfly Festival

August 14—10 a.m.-4 p.m.

Boo Meadow Brook

October 15, 16, 6:30-8:30 p.m.

DRUMLIN FARM

Lincoln, 781-259-2206

Tales of the Night

October 28, 29—6:30-9 p.m.

October Harvest Weekends

October 2, 3, 9, 10, 11, 16, 17, 23, 24—9 a.m.-5 p.m.

MOOSE HILL

Sharon, 781-784-5691

Halloween Prowl

October 22, 23, 24—various evening times

Preregistration required

SOUTH SHORE

Marshfield, 781-837-9400

Farm Day at Daniel Webster Wildlife Sanctuary

September 25—10 a.m.-4 p.m.

WACHUSETT MEADOW

Princeton, 978-464-2712

Hey Day

October 2—11 a.m.-4 p.m.

Halloween Night Hike and Hay Ride

October 24—6-8 p.m.

WELLFLEET BAY

South Wellfleet, 508-349-2615

Haunted Forest

October 29

Call the individual sanctuaries for more information, fees, and to register. For a full listing of Mass Audubon programs and events, visit our online catalog at www.massaudubon.org/programs.

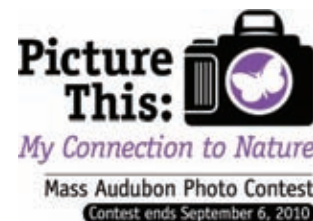
Discovery Days

A series of fun, free events at select Mass Audubon wildlife sanctuaries. There will be guided nature walks, demonstrations, and activities for visitors of all ages throughout the day. Discovery Days will run from 10 a.m.-3 p.m. at the following sites:

- ♦ **Wachusett Meadow:** Saturday, August 7
- ♦ **Ipswich River Wildlife Sanctuary:**
Saturday, September 11
- ♦ **Oak Knoll-Attleboro Springs:** Saturday, October 2
- ♦ **Arcadia Wildlife Sanctuary:** Saturday, October 16
- ♦ **Blue Hills Trailside Museum:** Saturday, October 23

Calling all shutterbugs!

Mass Audubon announces its first-ever *Picture This: My Connection to Nature* photo contest, open to all participants. Enter striking images that highlight the beauty and diversity of Massachusetts wildlife, habitats, and people in nature. For details visit: www.massaudubon.org/picturethis.



Curious Naturalist

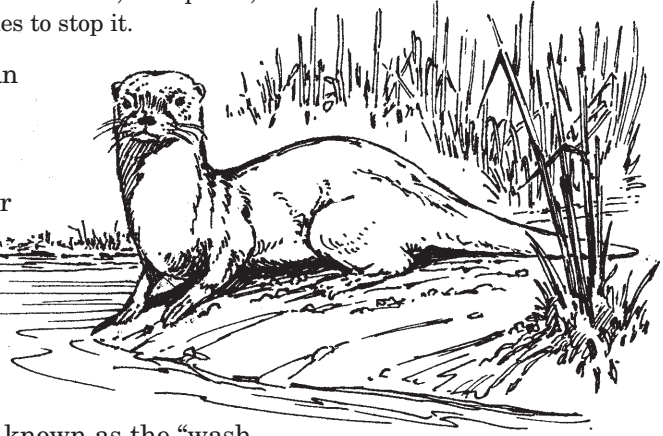
Streamside Mammals

Illustrated by Gordon Morrison

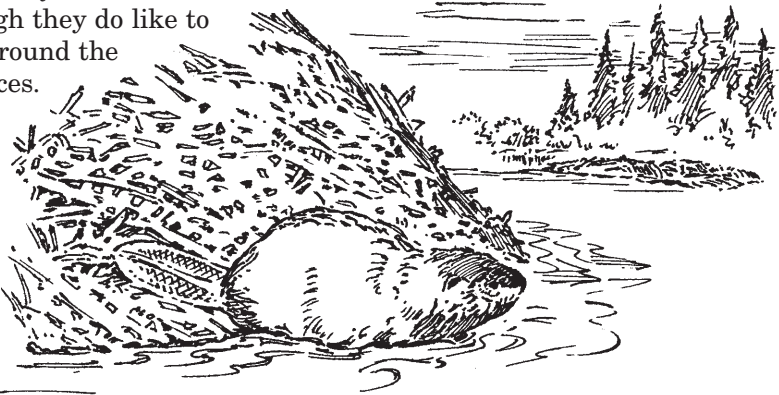
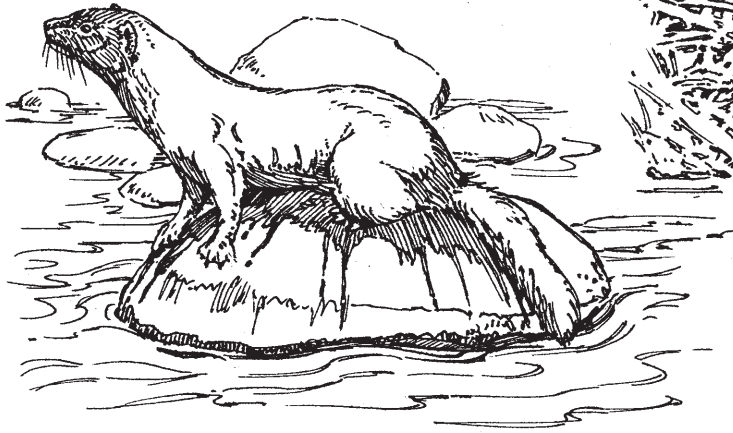
There are a variety of mammals that seem to favor running water. Some, such as muskrats and otters, live in water, and some, such as minks and raccoons, simply favor stream banks. However, one species, the beaver, actually dislikes running water—and instinctively tries to stop it.



Otter: Otters favor clean waters and are sleek active swimmers. They feed mainly on fish but also seek out frogs, water snakes, and even large aquatic insects.



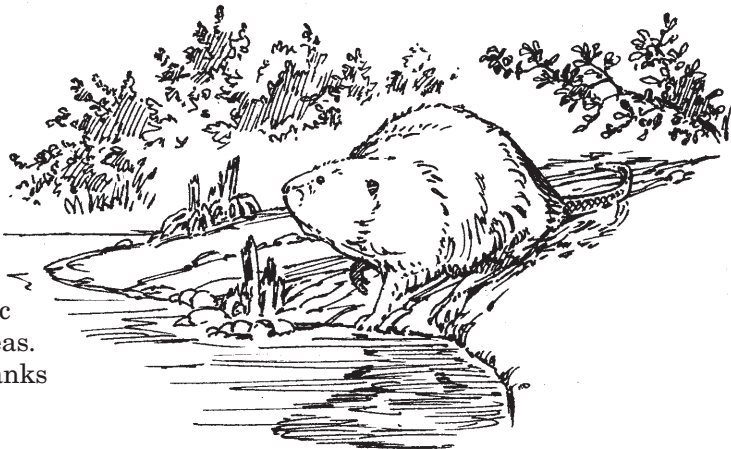
Raccoon: In Sweden and other Scandinavian countries, raccoons are known as the “wash bears,” theoretically because they clean their food in streams. Actually, although they do like to soak their food, often they are feeling around the bottom for crayfish and other food sources. Raccoons are also upland creatures, as many suburbanites know.



Beaver: Colonies may begin along slow-running streams, but, whenever they can, beavers will dam up the running water to create ponds where they will build their lodges. They feed on the bark, twigs, and branches of trees—mainly aspen, willow, maple, birch, and poplar.

Mink: One of the smaller members of the weasel family, the mink is associated with ponds and stream banks. Individuals feed mostly on upland vertebrates such as mice and voles, but they also eat frogs, fish, and freshwater clams.

Muskrat: Among the most common aquatic mammals, they are found even in urban areas. In spring, they build lodges along stream banks of mud and vegetation.





Outdoor Almanac ▲ Summer 2010



July 2010

July 20 Seventeen-year cicadas may be whining in the trees on hot days by this time.

July 25 Shorebirds begin migrating. Watch for the flocks along the coast.

July 26 Full moon. The Hay Moon.

July 27 Look for Indian pipes and beechdrops in forested areas.



August 2010

August 5 Yellow warblers and northern waterthrushes begin moving south.

August 9 Black fruits appear on the curving stems of Solomon's seal.

August 10 New moon.

August 12 Goldfinches are nesting at this time. Watch for them in gardens and field edges.

August 14 Sweet pepperbush blooms near lakes and ponds about this time; sniff the air for its spicy odor.

August 17 The woodland asters begin blooming.

August 23 Cardinal flower blooms along clean freshwater streams.

August 24 Full moon. Fishing tribes are given credit for naming this the Sturgeon Moon.

August 26 Watch for migrating nighthawks overhead at dusk.

August 29 Fall webworms begin to appear; look for their nests at the tips of tree branches.



September 22 Autumnal equinox; days and nights are of equal length.

September 23 Full moon. The Corn Moon.

September 26 Look for ripening wild grapes along old stone walls. Wild cherries, elderberries, and dogwood berries are ripe. Watch the thickets for feeding migratory birds.

October 2010

October 2 Green darner dragonflies migrate about this time. See them over sunny meadows.

October 5 First juncos arrive from the north.

October 6 Phoebe are still around.

October 7 New moon.

October 9 Watch for squirrel middens on stumps and rocks.

October 12 Look inside goldenrod flowers for yellow crab spiders.

October 14 Watch for daddy longlegs in meadows.

October 17 Watch for dropping hazelnuts.

October 21 Yellow-rumped warblers migrate. Watch for them in small trees and shrubs and listen for the check call.

October 23 Full Moon. The Harvest Moon.

October 26 Once the leaves are off the trees, look for oriole nests at the ends of willow and elm branches.

October 29 Watch for large congregations of migrating blackbirds around this time.

September 2010

September 6 This is the peak of the fall warbler migration; watch for them in backyard shrubbery and treetops.

September 8 New moon.

September 10-15 Broad-winged and sharp-shinned hawks migrate about this time of year. Watch the ridges on clear days with a northwest wind.

November 2010

November 4 Mushrooms are still coming up: look for the bright caps of yellow pholiota growing on logs and vase-shaped clusters of oyster mushrooms on tree trunks.

November 6 New moon.

November 11 Peak migration date for snow buntings.