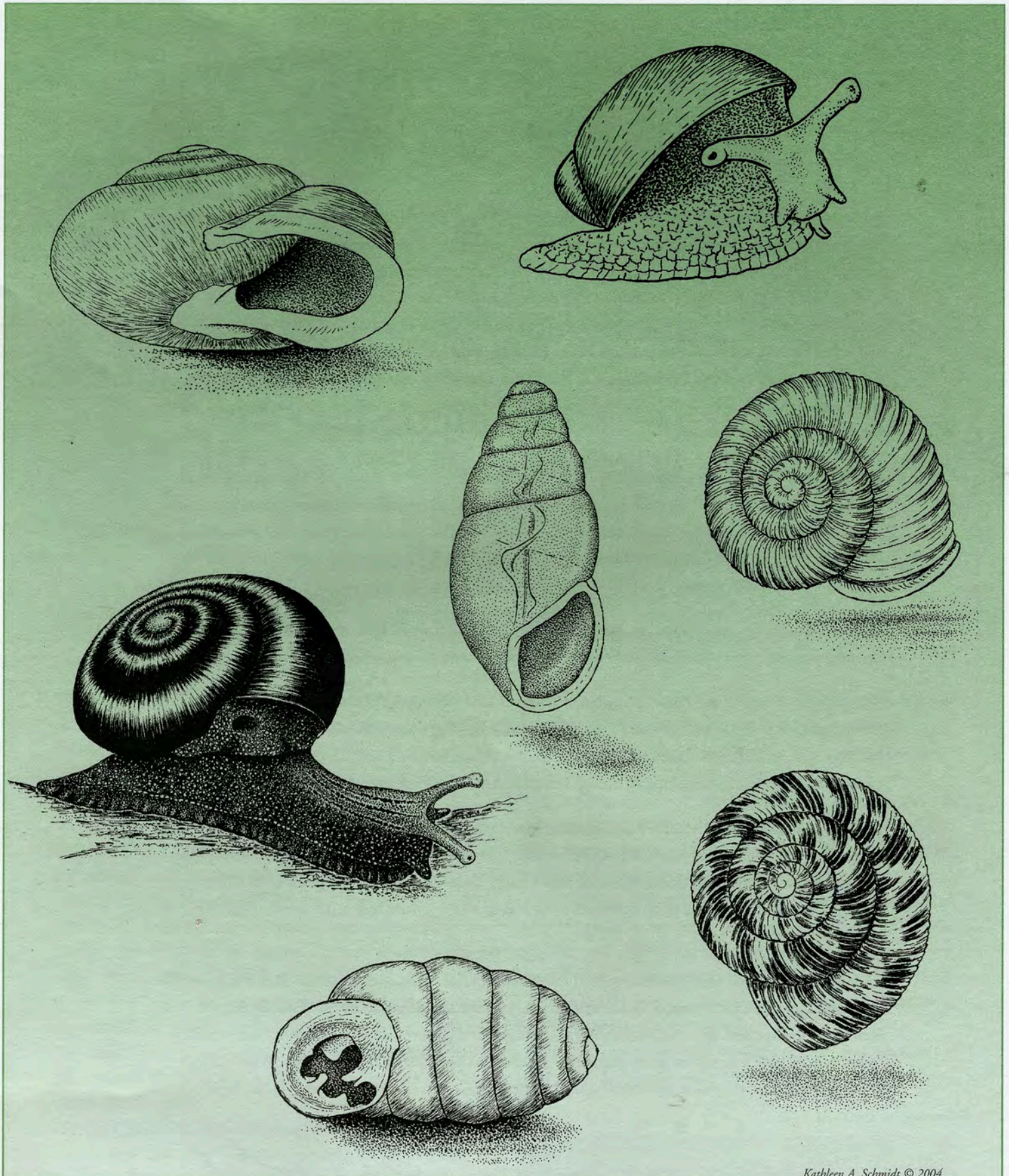

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News from Hudsonia

Volume 19, Number 2 Fall 2004

INSIDE HUDSONIA

Dear Friends & Colleagues,

As the days turn crisp and Hudson Valley wildlife prepare for the long, cold season ahead, Hudsonia scientists hasten to complete their pre-winter field work. With us now are two new biologists, Catherine Dickert and Don McClelland. Catherine, a native of Saratoga with degrees from Bard College and the University of Vermont, most recently studied the endangered giant garter snake in California's San Joaquin Valley. She is now working on our Town of Stanford habitat mapping project, and other biological assessment projects in the Hudson Valley. Don, a West Virginia native and a recent graduate of Simon's Rock College of Bard with a specialty in botany, has been working on our Blanding's turtle research, herbarium curation, habitat mapping, and a variety of other projects. We feel lucky to have them both.

In July, Dan Madonia, a graduate of Bard and formerly on the staff of Bard's Henderson Computer Resources Center, became our new Administrative Assistant. Dan's office management, technical support, and logistical supervision have greatly relieved the administrative burdens on other Hudsonia staff. This brings to five (including Tanessa Hartwig and Erik Kiviat) the number of Hudsonia staff members with Bard degrees.

In early summer we said farewell to Development Director Laurie Rubin; we wish her great success in her new position with Jacob's Pillow Dance Festival in Becket, Massachusetts.

We extend our thanks to David Sampson, just retired from the Board of Directors, for his 3 years of service, and we welcome to the board Peter Groffman, Allan Page, and Felicia Keesing. Peter is a microbial ecologist with the Institute of Ecosystem Studies. Allan, formerly with Central Hudson, is now a consultant specializing in renewable energy. Felicia is Associate Professor of Biology at Bard College.

Our 5th annual summer benefit, held in July at Innisfree Garden in Millbrook, was a great success thanks to the leadership of Bindy Kaye, Pat Stensrud, Jim Gundell, and Beth Ledy, and the capable stewardship of consultant Alison Allred of Blue Flower Event Design. We are grateful to all of Hudsonia's board members, staff, and volunteers, and to all the guests and other donors for their contributions to the event.

In August Hudsonia's satellite office moved from Rhinebeck to a renovated barn in Red Hook, where we have more space for Hudsonia's administration, for staff and activities of the Biodiversity Resources Center, and for storage of equipment, books, and archives. We are delighted with the new quarters, and look forward to many years here. Hudsonia's main office remains at the Bard College Ecology Field Station where we have access to laboratories, the herbarium, and the Tivoli Bays.

Erik Kiviat
Executive Director

Michael Trimble
Chair, Board of Directors

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Environmental Research and Education
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News from Hudsonia

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Volume 19, Number 2 Fall 2004

THE SNAGGLETOOTH AND THE SLUG: HIDDEN LIVES IN THE HUDSON VALLEY

By Kathleen A. Schmidt*

Ask the snail beneath the stone,
ask the stone beneath the wall,
are there any stars at all?

From "Waltz of the New Moon" by Robin Williamson; The Incredible String Band

What's the largest group of land animals you've probably never noticed? Most people are almost unaware of their existence, yet, incredibly, they are the most diverse terrestrial invertebrates after the insects and spiders.

They're the land snails!

Land snails and their shell-less relatives, the slugs, inhabit nearly every continent and terrestrial habitat on earth with the exception of the polar regions. A few hardy species even live in deserts.

Part of the phylum Mollusca, land snails number about 30,000–40,000 kinds, most of which are tropical. There are roughly 1000 native species in the continental US, and about 85 taxa here in the Hudson Valley. We also have a handful of introduced species in the region.

As a child, I was a passionate seashell collector, and since then I have considered myself to be fairly aware of the natural world. So how could I, and apparently many others, have been so oblivious to the presence of land snails? Sure, like many people, I had come across the occasional half-dollar sized white-lipped forest snail (*Neohelix albolabris*). But it wasn't until I had a chance encounter with Tucker Abbott's book *Compendium of Landshells*[1] that I began to wonder if there might be more species around here. To my great surprise, once I discovered how to "see" them, I found five different kinds right around my own back yard. They were hard to find at first because most of them are cryptically colored and often nocturnal or active only on rainy days. They live in or around leaf litter, in the soil, or under bark, rocks, logs, or piles of junk. Also, many species of land snails are very small—2 mm (0.08 in) or less.

Finding land snails is far more difficult than collecting shells on the beach. The snail hunter must flip over dozens of logs and rocks and spend a great deal of time lying on the ground finger-sifting through leaf litter and soil. Professional snail hunters do visual searches or trap snails under pieces of cardboard. (Damp cardboard makes an attractive temporary refuge for snails.) In addition, biologists may take bags of leaf litter back to their labs, sieve the litter, and then look for small snails under the microscope. Species identification sometimes requires use of a microscope and dissection of the preserved soft parts of the body.

Terrestrial species of snails and slugs fall into two subclasses of gastropods, the prosobranchs (gill bearers), and the pulmonates

Continued on page 2

* Entomologist Kathy Schmidt is Hudsonia's scientific illustrator, and the principal of Natural History Illustration and Design, Hillsdale, New York.

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Snails continued from page 1

(lung bearers). The prosobranchs comprise most of the ocean snail fauna, and only a few thousand of the prosobranch species have become land dwellers, mostly in the tropics. They respire using gills, have opercula (retractable horny plates at the opening of the shells), and their male and female sexes are in separate individuals. In our region, nearly all of the land snails and slugs are pulmonates. They have lungs and lack opercula. The pulmonates are hermaphroditic; each individual has both male and female sex organs. They rarely self-fertilize, however; instead, two snails mate, engage in a mutual exchange of sperm, and then each lays eggs.

HABITATS

Land snails live in many habitats in the Hudson Valley but they are most numerous in areas with high soil calcium, which they need for building their shells. They are least likely to occur in acidic pine woods, though some, such as the tree zonite snail (*Zonitoides arboreus*), the white-lipped forest snail, and the slippery teardrop snail (*Cochlicopa lubrica*), can be found in the woods almost anywhere. Other species specialize in moist places; for example, the black gloss zonite snail (*Z. nitidus*) is usually found in forested river valleys, and the oval amber snail (*Succinea ovalis*) is found in low muddy places, often on plants such as skunk cabbage and jewelweed. Some non-limestone talus rock slopes, such as those at Stissing Mountain (Dutchess County), usually have a high diversity of species as long as the soil calcium is adequate. There, the forest cover and boulders help sustain the soil and air moisture and provide the deep crevices that the snails need in drier times.

By far my favorite habitats for collecting snails are limestone ledges and the loose rocks below. When I collect along road cuts in Catskill (Greene County), I often find 20 or more species at a time. This bounty usually includes several species of the family Pupillidae, small pupa-shaped shells, 1.7–5.0 mm (0.07–0.20 in), with exquisitely beautiful sculpturing visible under the microscope. Among these is the armed snaggletooth (*Gastrocopta armifera*) which I call the "tuba with teeth" because of its bell-shaped opening choked with teeth. Pupillids have been sparsely collected in the region and their local distribution is poorly understood. I also love the striking zig-zag pattern of the larger (20 mm) striped forest snail (*Anguispira alternata*) which can be found by the hundreds in areas of Greenport (Columbia County) where for decades limestone dust has drifted eastward from the cement plants nearby. There is also the beautiful little ribbed vallonia (*Vallonia costata*), which manages to thrive in the hot sun on top of limestone ledges by hiding around the bases of plants. Even though I collect mostly empty shells of these species, I occasionally preserve live specimens to send to a museum so that their identifications and localities can be documented.

LAND SNAIL LIFE

In the wild, land snails eat vegetation and roots, soil microorganisms, algae, fungi, and detritus. I have tried to keep many species alive on romaine lettuce, fish food, or chicken mash. A few taxa can survive on this diet alone, but most seem to need a natural diet of organic detritus to thrive in the long term, and of course supplemental calcium. Jacobson and Emerson in their 1961 book, *Shells of the New York City Area,*[3] speculate that the common white-lipped snail *Mesodon thyroidus* and perhaps others need a high quality diet, including organic detritus, to attain some of their adult features, e.g., the reflected (turned back) lips and "teeth."

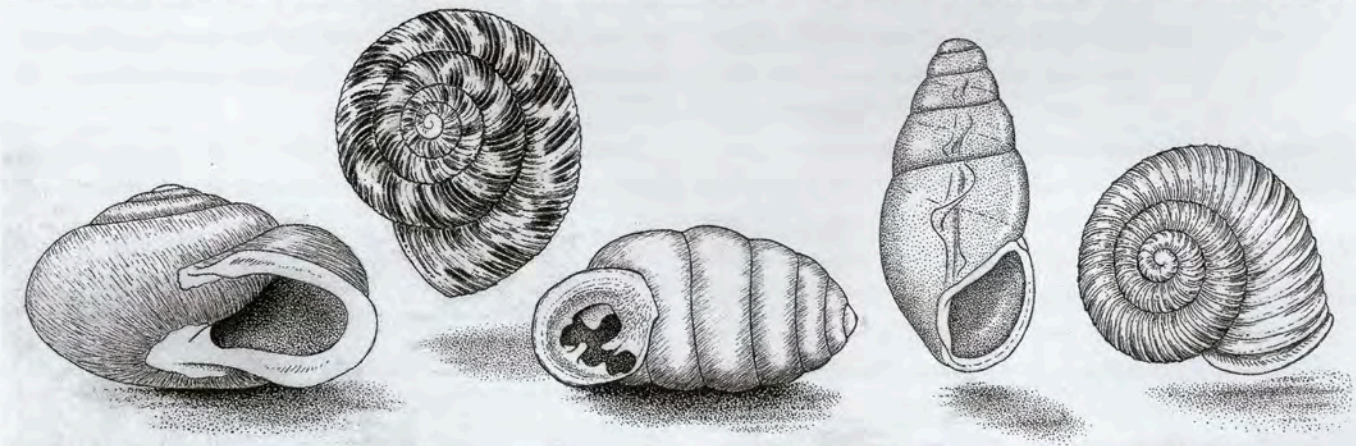
Some snails prey upon other snails, including one local species, the cannibal snail (*Haplotrema concavum*). It has a predator's typical long slender body that allows it to easily slip into the aperture of another snail and devour it.

Land snails and slugs form part of the diet of many amphibians, reptiles, birds, and small mammals. Nonetheless, snails are protected to some degree by their shells. Their cryptic coloration often prevents them from being seen in the first place. The apertures of many kinds of shells have tooth-like bumps of calcium, called denticles, extending well into the openings. Snail bodies can maneuver out between the teeth, but small predators such as ants and beetles cannot get in.

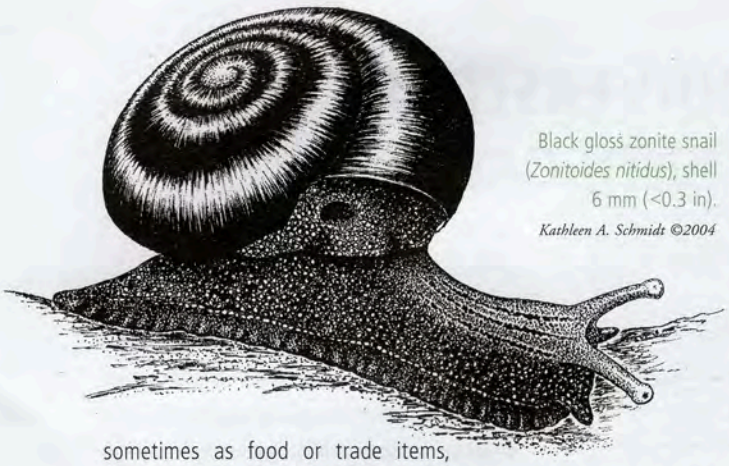
The biggest advantage the shell provides is protection against dessication, the perennial problem of land dwellers. In hot dry spells pulmonate snails retreat into their shells and produce a moisture-proof mucous barrier, called an epiphragm. Some snails have been reported to survive for several years in this state.

ECOLOGY

Since the time humans began moving around the globe land snails have moved with us,



Left to right: White-lipped forest snail (*Neohelix albolabris*), 30 mm (1.2 in). Striped forest snail (*Anguispira alternata*), 20 mm (0.8 in). Armed snaggletooth (*Gastrocopta armifera*), 4.5 mm (<0.2 in). Slippery teardrop snail (*Cochlicopa lubrica*), 6 mm (<0.3 in). Ribbed vallonia (*Vallonia costata*), 2.5 mm (0.1 in). *Kathleen A. Schmidt ©2004*



Black gloss zonite snail (*Zonitoides nitidus*), shell 6 mm (<0.3 in). *Kathleen A. Schmidt ©2004*

sometimes as food or trade items, other times as unsuspected passengers. Relatively few species have become pests in their new homes, but those few can cause a disproportionate amount of trouble. As with most introduced pests, invasive snails tend to be adaptable, hardy, and prolific. Over the centuries they have wreaked havoc with crops, transmitted diseases of humans and livestock, and forever changed the species diversity of local faunas. As an example, the giant East African snail (*Achatina fulica*) has been introduced repeatedly into many tropical areas around the world. It is large (about 18 cm [7 in]) and voracious and can quickly denude vast areas of crops. In Hawaii, two carnivorous snails (*Gonaxis* and *Euglandina*) were introduced to control the *Achatina* scourge. But these new snails refused to eat their intended prey and ended up causing the near extinction of Hawaii's strikingly beautiful endemic agate snails (genera *Achatinella* and *Partulina*).While some countries prohibit importation of East African snails, others permit their propagation and do not restrict their export. Some websites actually encourage people to grow and sell this *Achatina* and other snail species dangerous to the environment!

In the Hudson Valley we have generally been protected from the worst gastropod scourges because many of the problem species are tropical and cannot survive our cold winters. Our most frequent infestations occur in greenhouses, gardens, and croplands, often involving European species of snails and slugs. I have found several populations of cellar snails (*Oxychilus* spp.) and banded grove snails (*Cepaea nemoralis*) near greenhouses and old factories and on cement walls and sidewalks, sometimes in huge numbers. Non-native slugs seem to cause more problems locally, especially for gardeners. As a general rule, you can distinguish them from native species by looking at the mantle, the smooth patch on top. If the mantle is small and confined to the front half of the slug, you probably have an introduced species. If the mantle covers most of the top of the slug, it is a native species of the family Philomycidae. The slugs *Milax gagates* and *Deroceras reticulatum* and those of the genera *Limax* and *Arion* are frequent pests and are mostly non-native species.

A few land snails act as vectors of disease. The most important disease carried by land snails in the Northeast is brainworm, which limits moose populations in some places. The ubiquitous slippery teardrop snail is a vector of lancet liver flukes in woodchucks, sheep, deer, and cattle. Amber snails are intermediate hosts of the *Leucochloridium* parasite of songbirds. Banded grove snails (introduced) may carry a cestode parasite fatal to chickens, and the striped forest snail is a vector of lungworm disease in sheep.

Ecologists are beginning to take another look at land snails as useful indicators of environmental quality. Unlike many other animals, snails are unable to migrate or move very far and are generally not very adaptable. These are perfect attributes for indicator species. Snails survive in a relatively narrow range of temperatures and humidity and are intolerant of change. Such human impacts as forest stand conversion, overgrazing by deer, or heat island expansion around cities are suspected of causing extinction of native snail populations due to removal or change of vegetation cover. There is also evidence that certain pesticides can be very damaging to non-target land snail populations. Spraying of the biological agent Bt (*Bacillus thuringiensis*) to control insects needs to be studied more; some preliminary data from Egypt[2] suggest that it may affect land snails more than was previously suspected.

Continued on page 6

CONSERVING BIODIVERSITY IN FRAGMENTED LANDSCAPES

By Jennifer E. Tollefson*

At the end of a long day of habitat mapping in the Hudson Valley, I sloshed through a red maple swamp to investigate a small clearing that had caught my eye on an aerial photograph. When I reached the clearing, I knew right away that I had found something special. Rivulets of seepage water flowed into a shallow depression where low-growing vegetation was interspersed with patches of exposed gravel and deep organic sediments. Shrubby cinquefoil (*Potentilla fruticosa*), fringed gentian (*Gentianopsis crinita*), and grass-of-Parnassus (*Parnassia glauca*) were in full bloom, providing accents of color within a carpet of sedges and rushes. This was a fen—an unusual type of open wetland associated with areas of limestone or marble bedrock and calcareous groundwater discharge. Not only are fens themselves rare in the Hudson Valley, but they also harbor an array of rare plants, invertebrates, breeding birds, and reptiles.

CONSERVATION AT MULTIPLE SCALES

This fen and the species it supports are pieces of a vastly larger network of species, populations, and habitats that comprises our native biodiversity in the Hudson Valley. Increasingly, scientists and conservation practitioners recognize that in order to protect the full suite of native biodiversity in a region we must focus conservation efforts at multiple geographic scales. While some species and habitats may be adequately protected at a relatively small scale, wide-ranging species with large spatial requirements compel us to think about conserving large, interconnected blocks of unbroken habitat. Thinking bigger still, conservation efforts that target migratory birds, fishes, and some insects and large mammals must take place at scales encompassing millions of hectares (or acres) and multiple states and countries. Species at all scales are maintained in the long-term via metapopulation dynamics, which require that habitats containing source populations are adequately close to one another to allow dispersers to replenish populations when local extinctions occur.

THE FRAGMENTED LANDSCAPE

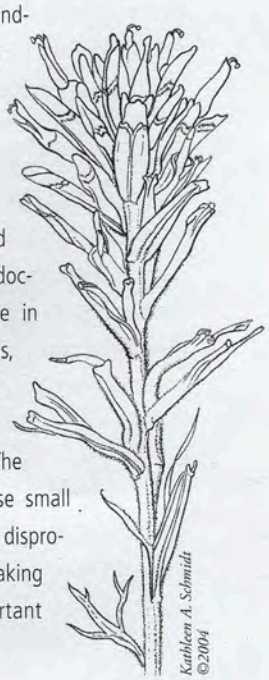
Undertaking biodiversity conservation at the full range of geographic scales poses serious challenges even in remote, undeveloped landscapes. The challenge is even greater in the landscapes where we live and work. The Hudson Valley, for example, harbors both rich biological diversity and a long history of human habitation. Here, like many places in the United States, rural landscapes are undergoing rapid change as farms and forest are converted to residential and commercial uses. In the most developed parts of the Hudson Valley, the habitats that remain consist of small, often isolated fragments.

In these landscapes where we no longer have the opportunity to protect vast areas of contiguous habitat, the chances for comprehensive biodiversity conservation are slim. As a landscape becomes fragmented, those species with large requirements for space become increasingly vulnerable. Small habitat patches, which have more exposed edge relative to interior area, are subject to a range of disturbances including invasion by non-native plants and predation by human-adapted and human-subsidized animals such as raccoon, striped skunk, and domestic cat. Roads between habitat patches can increase mortality for insects, reptiles, amphibians, birds, and mammals as they attempt to move from one area to another. Habitat patches surrounded by human development function as islands, and species unable to move between patches are vulnerable to genetic isolation and possible extinction over the long term.

PUTTING THE PIECES TOGETHER

Despite this discouraging prognosis, there are compelling reasons to pursue biodiversity conservation in fragmented landscapes. Through Hudsonia's habitat mapping work, we have found that even in highly developed areas of the Hudson Valley there are patches of ecologically significant habitat worthy of immediate conservation attention. In East Fishkill, for example, we found that some sizable patches of unfragmented habitat still exist within an extensively developed landscape. Although many of the species that depend on very large areas of unfragmented habitat are no longer present in East Fishkill, the patches that remain likely provide significant biodiversity value for a host of other species, particularly if corridors of undeveloped land allow movement between habitat patches.

Good things can also come in small patches. Small, isolated forest patches may provide important stopover habitat for migrating birds in a heavily fragmented landscape. Some habitats that are rare or support rare species occur naturally at a small scale as a result of local physical and chemical factors and ecological processes. We documented several of these in East Fishkill including fens, kettle shrub pools, an acidic bog lake, and a circumneutral bog lake. The biodiversity value of these small habitat patches is often disproportionate to their size, making them particularly important targets for conservation.



Painted cup (*Castilleja coccinea*), 2–6 dm (8–24 in) tall, is a rare plant of fens and other calcareous environments.

* Jenny Tollefson is Hudsonia's Biodiversity Mapping Coordinator.

Fens, for example, often occur in patches of just a few acres or less and are maintained by site-specific geologic, hydrologic, and soil conditions. It is always preferable to protect fens and other small habitats within a larger mosaic of intact habitat to accommodate the needs of mobile species. The bog turtle, for example, an endangered species in New York State, uses fens as its primary habitat east of the Hudson River. The ability to move between fens is important, we believe, for maintaining genetic diversity within bog turtle populations and for ensuring that turtles can disperse to new habitat if a particular fen is degraded or becomes otherwise unsuitable. Although a bog turtle population might persist for decades in a fen that had become isolated from other fens by encroaching development, its long-term viability in a fragmented landscape would be compromised. Some important biodiversity values, however, may be retained even in small isolated patches. Localized populations of rare plants, rare insects, or rare breeding birds, for example, might persist in an isolated fen, particularly if it is adequately protected from excessive nutrient runoff, hydrologic alteration, and other human disturbances.

Protecting species, habitats, and the ecological processes that sustain them is the ambitious goal of biodiversity conservation. While we have lost many opportunities for large-scale conservation in the highly fragmented landscapes of the Hudson Valley, important opportunities still exist for protecting remaining patches of viable habitat. A strategy for pursuing biodiversity conservation in fragmented landscapes should include identifying and protecting the largest remaining patches of undeveloped habitat, the small patches of high quality habitat, and the corridors between habitat patches. In the Hudson Valley, private landowners can be effective agents for conservation by learning what important biological resources exist on their own land and by coordinating with neighbors and local decision makers to ensure that biodiversity values are protected. ■

We thank Kristi MacDonald, Hudsonia Research Associate and Ph.D. candidate at Rutgers University, for reviewing this article.

AN *AMBYSTOMA*'S AUTUMN ARRIVAL

Each March, many Hudson Valley naturalists brave the cold, dark, rain, and fog of early spring nights to witness a spectacular natural phenomenon: the annual mass migrations of salamanders to seasonal pools. Intermittent woodland pools, which typically hold water during winter and spring, are critical breeding sites for our native mole salamanders (*Ambystoma* spp.). In our region, spring-breeding mole salamanders include the spotted, Jefferson, and blue-spotted salamanders.

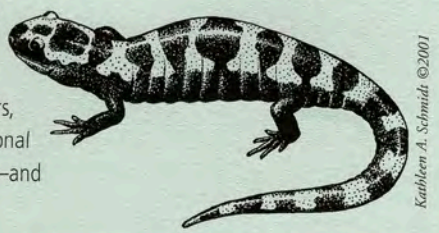
Our fourth native, the marbled salamander (*Ambystoma opacum*) is on a completely different breeding schedule, however, and has only recently embarked on its own annual journey. Like the other ambystomids, the marbled salamander lives in deciduous forest and travels overland, once a year, to congregate at intermittent woodland pools for breeding. But unlike the other species, the marbled migrates to the "pools" in early fall, when they are just dry depressions on the forest floor.

Males arrive at the pools first, in late August or early September, followed by females a few days or weeks later. After mating, females construct shallow nests under moss, leaves, logs, or rocks in the dry pool bottom. They deposit a clutch of approximately 50–200 small, transparent eggs, which are quickly stained dark by the surrounding leaves and soil.[1] The females guard the eggs for a couple of months until autumn rains refill the pools and flood the nests, and the eggs begin to hatch.

Throughout the winter, under the icy surface of the pool, the aquatic marbled larvae have little competition for the zooplankton they feed on. Then, in March and April when larvae of spring-breeding mole salamanders are just hatching, the marbled larvae are already nearing metamorphosis and exploiting a very different food resource than the smaller *Ambystoma* larvae.[2] In fact, the larger marbled larvae may even prey upon the newly hatched larvae of other mole salamander species, in addition to fairy shrimp and wood frog larvae.

While the competitive advantage afforded by early development appears to secure a promising future for the young marbled salamanders, several variables may hinder their survival, particularly nest-site selection. For example, if eggs are laid in a deep part of the pool bed, they might be flooded with a light rain, hatch, and then die if the water evaporates. Or, eggs situated too high may not flood at all, and would need to remain dormant until the arrival of heavier spring rains, all the while enduring harsh winter conditions and predation.[1,3]

As always, there are also human influences on survival. Urbanization in the Hudson Valley has eliminated marbled salamander from parts of its New York range,[2] and the species is currently listed as a New York State Species of Special Concern. Salamanders may be faithful to ancestral breeding pools[4]; if so, what happens when those pools are destroyed or the surrounding forest habitat is altered? As you head out this autumn to admire the marbled salamanders, consider them as ambassadors of these seasonal habitats—a wellspring of so much diversity—and of the rich landscape we call home. ■



Kathleen A. Schmidt ©2001

Ambystoma opacum, 7.7–12.7 cm (3–5 in), is a stout salamander with striking patterns of white and gray on a black or purplish-black body.

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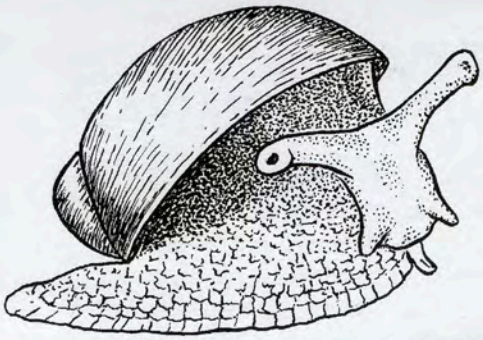
—Laura T. Heady, Biodiversity Educator



Newly hatched oval amber snail (*Succinea ovalis*), shell <1 mm (<0.04 in). *Kathleen A. Schmidt ©2004*

Snails continued from page 3

Next time you are walking in the woods or eating lunch at a roadside pull-off, take a few minutes to look for snails. Flip over a few logs and look under some stones. (Don't forget to replace them when you're done!) Scrape through the detritus on a limestone ledge. Look closely. You may see snails living their lives. The other day I was lucky enough to watch one deftly twist its mouth around and clean off the edge of its opening—the molluscan version of a cat washing its back. I was also treated to the hatching of hundreds of baby oval amber snails, each with a transparent shell, a tiny round body, and fat antennae with black eye dots leading it out into the world. Witnessing these events made me feel as though I had peeked out from under my own metaphorical stone, however temporarily. Like me, you may feel privileged to spend a few minutes in a world that most people never even suspect is there. ■

We thank Kenneth Hottop of Appalachian Conservation Biology for reviewing this article.

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THANKING JAIME

Jaime Hazard swung her hand-held antenna west to east, trying to pinpoint the direction of the strongest signal. The beep was fairly strong, indicating that the animal was nearby. Scanning the surrounding forest and wetland, she caught a glimpse of a bright yellow neck 30 meters away. The animal was at the edge of a dirt road, studying her carefully. Aware that it had been spotted, it darted towards the safety of the swamp on the other side of the road. Jaime dropped her radiotelemetry receiver (gently, because it is an expensive piece of equipment!) and sprinted, knowing that she had only a few seconds before the animal disappeared into the muck. She caught the Blanding's turtle, a New York State Threatened species, just a few centimeters from the water's edge, where the turtle would have continued her dangerous journey across busy Route 55 to lay her eggs in an upland meadow or on roadside gravel.

Jaime was Hudsonia's "turtle wrangler" from January through June this year at our long-term Blanding's turtle study site in La Grange. Jaime has a degree in Natural Resources from Cornell University, and has studied reptiles and amphibians in Florida and Texas. She spent most of last winter organizing and entering Blanding's turtle data from past years. In May, as reptiles and amphibians throughout the Hudson Valley were shaking off the last of winter's cold, Jaime helped trap 20 Blanding's turtles at the research site: 7 males, 9 females, and 4 juveniles. Each turtle was fitted with a radio transmitter that enables us to track the turtle's location through the rest of the year. Jaime then tracked the females closely during the June nesting season, often staying up till the wee hours of the morning to keep them from crossing roads or other dangerous areas during their nesting migrations, and to install a predator guard on each completed nest. With Jaime's help and with the help of our dedicated volunteers (listed in this issue), Hudsonia protected and monitored 8 nests this year and released 97 hatchlings into nearby wetlands. Since 1996 when we started monitoring this population, we have released a total of 810 hatchlings from protected nests at the research site.

Jaime is now back in Valois, New York (near Ithaca), working at an animal sanctuary. We are indebted to Jaime for her diligence and care in carrying forward the Blanding's turtle research for another season. But perhaps most of all we miss her wisecracking humor that kept us smiling in the face of equipment malfunctions, trying field conditions, and the other customary woes of biological field research. We are grateful to the Youth Resource Development Corporation in Poughkeepsie for providing us the opportunity to host Jaime as an AmeriCorps member. ■

Photo by Shannon Torrence

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Jessica Leinwand
Al Sargeant
Shoni Spears
Jason Tesauro
Zachary Wallace
Amie Worley

BIODIVERSITY ASSESSMENT TRAINING

We are now accepting applications from municipal agencies, watershed councils, land trusts, and similar organizations for our 10-month Biodiversity Assessment Training. Selected groups attend monthly workshops and receive a $1000 grant from the New York State Department of Environmental Conservation's Hudson River Estuary Program to learn biodiversity assessment techniques and conduct an assessment in their community. Contact Laura Heady, Biodiversity Educator, at (845) 758-0600 or heady@bard.edu.

WISH LIST

Binding machine
Digital camera
Digital projector
Laminator
Library shelving
Natural history literature (esp. NY & NJ)
Van or pickup in good working order

SPECIAL THANKS

to Audubon New York, the Dutchess County Environmental Management Council, and the Institute of Ecosystem Studies for hosting Hudsonia's Biodiversity Assessment Short Course, and to Danniela Ciatto for hosting our Phragmites Management Workshop.

Hudsonia is also grateful to **small packages, inc.** (**www.smallpackages.com**) for hosting our website free of charge and for providing other technical assistance.

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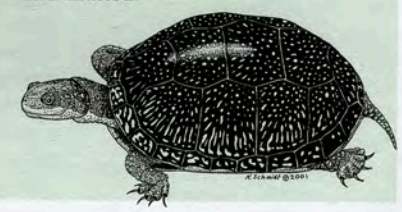
BECOME A BLANDING'S TURTLE HABITAT GUARDIAN

Hudsonia receives many inquiries from people wanting to help with our efforts to understand the habitat needs of rare and endangered species. Monthly giving provides essential support for Hudsonia's award-winning Blanding's turtle habitat restoration project. Your monthly contribution of $5 or more is charged to your credit card for 1 year, renewable annually.

Habitat Guardians receive:

- Special recognition in *News from Hudsonia*.
- Invitation to Hudsonia's members-only Biodiversity Education Seminar Series.
- A large color photograph by Hudsonia co-founder Erik Kiviat or by natural history photographer Esther Kiviat. For annual Guardian gifts of $15 or more per month, the photograph will be autographed and matted.



ANNOUNCING UPCOMING SEMINAR

Hudsonia invites all members to attend the 2nd of our

2004 Biodiversity Education Seminars

New Tools for Protecting Biological Resources in the Hudson Valley

2–4 PM, 6 November 2004

Attendees will be instructed in using maps of ecologically significant habitats to guide protection of plants, animals, and natural systems. Hands-on workshop and discussion of land use strategies will be led by Gretchen Stevens and Laura Heady.

The seminar will be held at our Red Hook office, and is free of charge to all members. To register, contact Daniel Madonia at (845) 758-7053 or madonia@bard.edu.

HUDSONIA MEMBERS, 2004

Hudsonia gratefully acknowledges the individuals, businesses, and foundations that have, through their gifts, expressed a commitment to the advancement of environmental science, education, and conservation.

2004 BLANDING'S TURTLE HABITAT GUARDIANS

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Peter & Diana Bethke *in honor of Amos Cariati & Hannah Cariati*
Sally Daly
Connie Kustas
Connie E Mayer
Brenda Sramek
Janeth L Thoron

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