ISSN 1072–8244

Environmental Research and Education
Science for Conservation

News from Hudsonia

Bard College #217
PO Box 5000
Annandale, NY 12504-5000
Telephone: (914) 758-7053
Facsimile: (914) 758-7033

Volume 13, Number 3 Fall 1998

Where are the Reptiles and Amphibians of the Hudson River? Part 2

by Erik Kiviat *

Northeastern frogs, salamanders, snakes, lizards, and turtles provide few commercially useful products and are rarely sought for sport. Thus they are not generally of much economic or regulatory concern.

The life histories, behavior, and movements of "herps" nonetheless make them highly vulnerable to land development, alterations of water bodies and wetlands, pollution, highway mortality, pet keeping, and predation by overabundant mammals and birds. And many herps are missing from, or rare in, the Hudson River fauna.

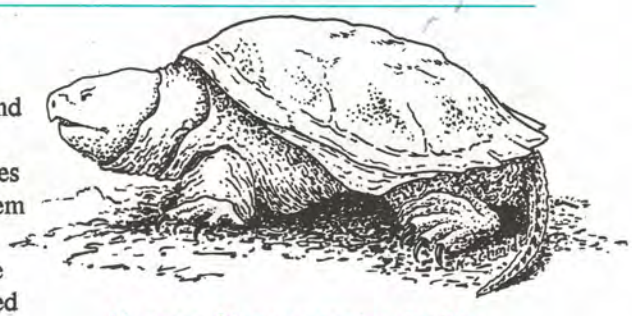
Part 1 of this article[1] contained an annotated list of species and discussed influences of factors such as tidal fluctuation, predation, harvest, and pollution on the Hudson River herpetofauna (amphibians and reptiles).

Part 2 contains a revised checklist (Table 1) with new data from readers and Hudsonia personnel, a discussion of selected species, and questions for amateur and professional biologists.

Snapping Turtle

This is the only reptile or amphibian that is common in the tidal Hudson. At low tide on a warm, sunny day in May, snappers may seem truly abundant on intertidal mudflats and in shallow pools in some tidal marshes. Although snapping turtles occur in Piermont Marsh, they seem less common there, probably because they are unable to tolerate the salinity in summer for extended periods.

Many herps are missing from, or rare in, the Hudson River fauna.



Hudson River snapping turtles sampled in 1977 were heavily loaded with PCBs and other contaminants. (The turtle in the illustration is a juvenile.)

Hudson River snapping turtles eat fish, invertebrates, and plants. Snappers in Tivoli North Bay forage intensively for killifish. Tom Lake reported snapping turtles feeding on alewife, white sucker, and golden shiner in gillnets set for research at the mouth of Moodna Creek. Broadleaf arrowhead plants (*Sagittaria latifolia*) often show snapping turtle beak-shaped pieces of tissue missing from leaves, and ripening spatterdock fruits are commonly eaten in North Bay.

Hudson River snapping turtles emerge from the larger wetland complexes, such as Constitution Marsh and Tivoli North Bay, in mass nesting migrations each spring. Nesting begins about 9 June, when the cattails start to release pollen. A warm, drenching rain a few days later can bring an impressive number of females onto the North Bay railroad embankment to lay their eggs.

Juvenile snapping turtles of carapace (shell) length ca. 90-150 mm live in shallower, smaller tidal creeks, and perhaps in dense vegetation, where adults (over 200 mm) are less often found. In spring 1995, Bard College graduate student Christine Rozycki saw several hatchlings of the previous year in tidal creeks close to the railroad. I presume these very small (ca. 30 mm) turtles are vulnerable to predators and spend much of their time concealed in live or dead plant material.

* *Hudsonia*

Hudson River snapping turtles sampled in 1977 were heavily loaded with PCBs and other contaminants.[29] One turtle had approximately 8,000 parts-per-million, or almost 1%, PCBs in subcutaneous fat! In Lake Ontario, which, like the Hudson, is contaminated with PCBs, these chemicals injure the developing turtle embryos.[2] A preliminary laboratory study of eggs from Tivoli North Bay suggested lower than normal hatching rates.[5]

Although there are lots of snapping turtles in the Hudson, and they seem to go about their business as usual, we do not know to what extent contamination has altered their behavior or population dynamics.

Many snapping turtles were harvested from the Hudson for food before the discovery of high PCB residues in turtles. Today there is a State Department of Health Advisory against eating snapping turtles from the Hudson; it is unclear if harvesting continues.

Painted Turtle

One of the most common and adaptable turtles in ponds and lakes of the Hudson Valley, the painted turtle is rare in the Hudson River. The Tivoli North Bay population is sparse, and the turtles apparently weigh less for their length than they did in the 1970s.[25] There are local pockets of greater abundance in sheltered pools or sluggish channels that hold water at low tide and have more submerged vegetation or water-chestnut (*Trapa natans*).

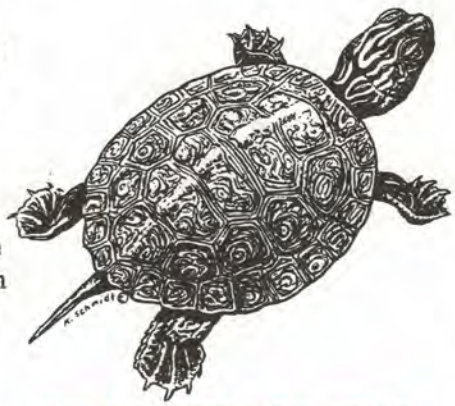
The painted turtle population may be under stress from predators (e.g., raccoons; many individuals have mammal teethmarks on their shells), a scarcity of submerged and floating-leaved vegetation, low abundances of certain types of prey (e.g., larger aquatic insects), too much tidal fluctuation, former harvesting for the pet trade,[23] and contaminants such as PCBs. Disentangling this mystery will require comparison of populations in different Hudson River habitats and in nearby nontidal habitats, with measurement of

One of the most adaptable turtles, painted turtles are rarely found in the Hudson River, yet they abound in nearby ponds.

contaminant burdens and physiological indicators such as hormone levels.

Map Turtle

The Hudson River has the only known estuarine population of the map turtle. Except for a single report from the upstream side of the dam at Eddyville on Rondout Creek, the map turtle is not found away from tidal waters in the Hudson Valley, and elsewhere in New York it is known only from the Susquehanna River, lakes Erie and Ontario, and Lake Champlain.



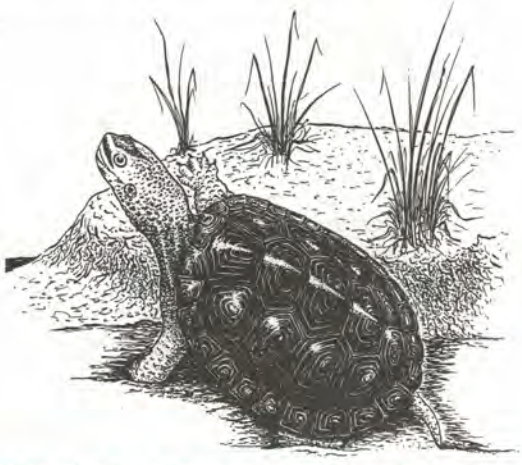
Map turtles occur in estuarine waters of the Hudson but may have migrated in from Lake Champlain or the Susquehanna River through canals built in the 1800s. The map turtle illustrated above is a juvenile, about 50 mm long.

Throughout the North American range, the map turtle is associated with large bodies of open water. Map turtles live in the open shallows of the Hudson River where logs, rocks, timber, and concrete are available as basking perches away from the shore. Elsewhere in their range, map turtles eat mollusks and crayfish, and their diet in the Hudson presumably is similar (and is likely to include zebra mussels). The turtles also move into tidal marshes, and females emerge to nest on the railroad embankments and on islands.

The University of Michigan Museum of Zoology has a specimen collected at Kingston during the 1936 Biological Survey, and prehistoric remains have been reported from archaeological sites near the river in Greene and Columbia counties.[8]

A small map turtle population was found in the river in the towns of Hyde Park and Rhinebeck in the 1970s.[9,14] Sparse populations are now well known in Columbia, Rensselaer, Greene and Dutchess counties. There are unverified reports from Poughkeepsie to Piermont; these may have been map turtles or diamondback terrapins. More documentation is needed from brackish waters.

The species could be native in the Hudson River, or the archaeological materials could have arrived in trade and map turtles could have entered the Hudson River through the Hudson-Champlain canal[14] or the Erie Canal, both built in the early 1800s. A population in the nontidal Delaware River on the New Jersey - Pennsylvania line[1] could have moved there via the Delaware and Hudson Canal. Until there is clear evidence that the species is



Historically, diamondback terrapins were depleted because they were a popular source of food for humans. Today's terrapins are vulnerable to drowning in crab traps and predation by raccoons. (An adult may be from 100 to 240 mm in carapace, or shell, length.)

either native or introduced in the Hudson, we should regard the map turtle as native for conservation purposes.

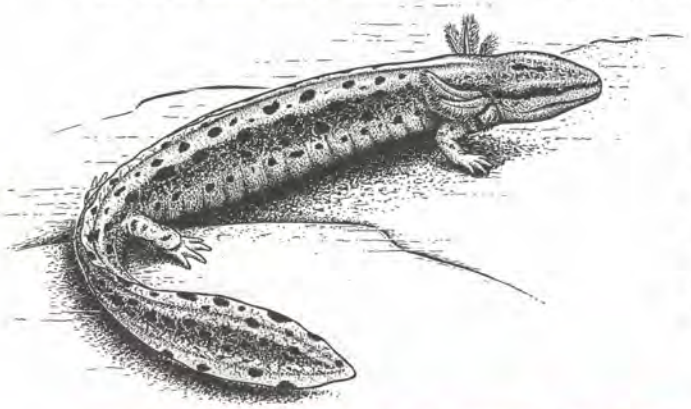
Diamondback Terrapin

The diamondback terrapin is unusual in its adaptations to life in temperate zone saline and brackish tidal marshes. The first Hudson River record for this species dates from the 1960s.[6] In the 1970s, turtles were found at Indian Point and Bear Mountain.[24] More recently a population has been documented at Piermont Marsh.[18,27,28]

Like the map turtle, the terrapin feeds on mollusks and crustaceans, and presumably eats the red-jointed fiddler crabs (*Uca minax*), blue crabs (*Callinectes sapidus*), and other large invertebrates that abound in Piermont Marsh.

Turtles in general are slow to mature and generally suffer high mortality in the egg and juvenile stages. Populations are vulnerable to loss of adults and therefore cannot sustain much harvest. Historically, terrapin populations were depleted by harvest for human food, and now they are vulnerable to drowning in crab traps[3] and predation by raccoons.[26] Dense phragmites stands may have degraded nesting habitat at Piermont.[18]

The presence of terrapins, harbor seals, and lots of people at the Piermont Pier creates an underexploited opportunity for education about wildlife.



Hudson River anglers caught animals that were probably mudpuppies (adults are ca. 250 mm in length) during the mid 1900s, but no mudpuppies have been found recently.

Water Snake

The northern water snake is common around ponds, lakes, and streams in the Hudson Valley but is rare in the estuary. Along the Hudson, water snakes are often seen on roads, on railroad causeways and on rocky shores, but are also found on soft sediments, occasionally well away from shore in marshes such as Tivoli North Bay. Observations seem less frequent now at Tivoli Bays than in the 1970s.

The water snake is common in the freshwater tidal marshes of the Patuxent River in Maryland, indicating that tidal fluctuation per se is not a problem for this species.

Water snakes are fish eaters, and their food in the Hudson presumably comprises small fish up to perhaps 10-15 cm total length. I once observed a water snake trying to catch fish at a small tidal culvert beneath the railroad near Barrytown.

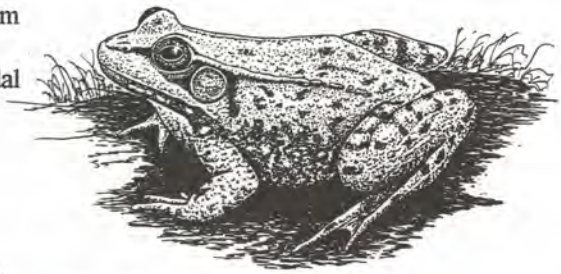
Mudpuppy

The mudpuppy is a large, fully aquatic salamander of large lakes and rivers. Mudpuppies were reportedly common in the Hudson River near Albany in the late 1800s,[22] and there are published records from the vicinity of Kingston and Poughkeepsie;[4] it is unclear whether these reports refer to tidal or nontidal waters. I have spoken to people who caught animals that were probably mudpuppies, on hook-and-line in the Hudson, reportedly in the 1930s-1960s. Ichthyologist Allen Beebe saw a mudpuppy caught by an angler on Rondout Creek just above the Eddyville dam (i.e., just above tidewater) about 1970.

The mudpuppy may have entered the Hudson via the Erie Canal.[22] I suspect a population became established in the tidal river and survived until post-World War II PCB contamination or other pollution became too severe. Mudpuppies may have entered the Rondout Creek via the Hudson or the Delaware and Hudson Canal, and survived in the Eddyville Pool where they were not subject to PCB contamination. The Hudson may have had the only estuarine mudpuppy population within the range of the species. Clarification of this odd tale will await further discovery of specimens, photographs, or written documentation.

Green Frog

Along with the painted turtle and water snake, the green frog should be much more common than it is in Hudson River tidal wetlands.



Tidal fluctuation, predation of eggs, tadpoles or adults, and contaminants may be reasons for the low number of green frogs in Hudson River tidal wetlands. (Adults may be ca. 100 mm in head-body length.)

On a late spring or summer evening one can almost always hear a few green frogs calling in quiet pools of a freshwater tidal marsh, but I doubt that there is one adult frog per hectare (2.5 acres) in Tivoli North Bay, a ridiculously low density for this species. What controls the population -- tidal fluctuation, contamination, or predation of eggs, tadpoles, or adults? The DEC is initiating a program to monitor contaminant levels in Hudson River green frogs.

Northern Leopard Frog

In the 1980s I found a small population of northern leopard frogs in wetlands

Table 1. Amphibians and reptiles of the tidal Hudson River, excluding recently introduced species and omitting New York City - New Jersey shores.

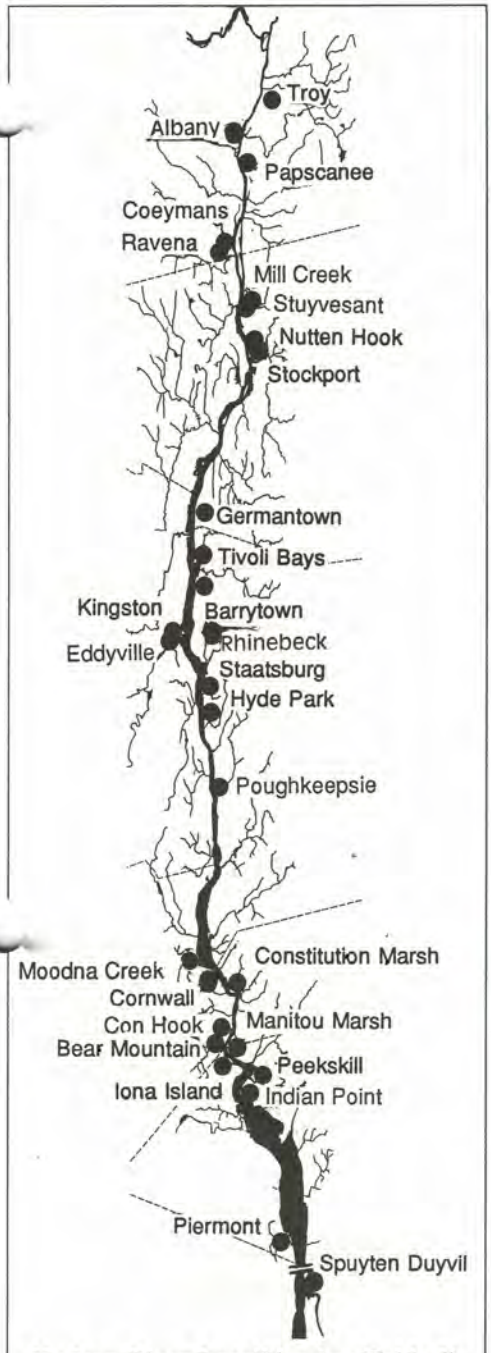
For localities, see map; for Sources, see References Cited (numbers) and Acknowledgements (letters).

Key to tide-affected habitats in the Hudson River: D = Tidal deltas or tidal channels of tributaries; E = Edge (upland shoreline near Mean High Water); I = Island with elevations above the highest tides; M = Tidal marsh including creeks therein; P = Supratidal pools; R = Road causeways; RR = Railroad causeways; Sh = Subtidal shallows; Sw = Intertidal or supratidal swamp (woody vegetation) including creeks; U = unknown.

Species	Distribution	Habitat	Abundance*	Source
Snapping turtle, *Chelydra serpentina*	Troy - Piermont Marsh	RR P? Sw M Sh	Common	10, 29
Musk turtle (stinkpot), *Sternotherus odoratus*	Germantown to Peekskill (isolated locations)	D Sh M?	Rare	data unavailable
Spotted turtle, *Clemmys guttata*	Mill Creek to Manitou Marsh	I RR U M/Sw	Rare	18, c, 9, Aa
Wood turtle, *Clemmys insculpta*	Stockport to Constitution Marsh	D Sw	Rare	13, d, k, m, r
Eastern box turtle, *Terrapene carolina*	Constitution Island	I	Rare	c
Diamondback terrapin, *Malaclemys terrapin*	Bear Mountain to Piermont	M? Sh?	Uncommon to rare	6, 24, 18, 27, p, z, Dd
Map turtle, *Graptemys geographica*	Papscanee Creek to Hyde Park (Poughkeepsie, Cornwall Bay, Iona Island, Piermont?)	RR Sh	Uncommon	14, 16, 20, c, g, h, i, j, n, q, s, Bb
Painted turtle, *Chrysemys picta*	Papscanee Creek to Iona Island (Piermont**)	I RR P D Sw M Sh	Uncommon to rare	25, c, h, 9, u
Atlantic ridley, *Lepidochelys kempii*	Spuyten Duyvil	Deep water ?	1 record	k, 9, w
Five-lined skink, *Eumeces fasciatus*	Con Hook, Iona Island?	I	Rare	c, 9
Water snake, *Nerodia sipedon*	Nutten Hook to Manitou Marsh	I E R RR Sw M S	Rare	many observers
Brown snake, *Storeria dekayi*	Little Nutten Hook, Tivoli Bays	E?, Sw	Rare?	h, 9, s
Garter snake, *Thamnophis sirtalis*	Tivoli Bays, Constitution Marsh	E I R RR Sw M	Rare	a, c,9, n, t
Ringneck snake, *Diadophis punctatus*	Nutten Hook, Constitution Island?	I	Rare	12, c
Black racer, *Coluber constrictor*	Tivoli Bays, Constitution Isl., Manitou Marsh	I R RR	Rare	c, e, 9, x
Smooth green snake, *Opheodrys vernalis*	Little Nutten Hook	Sw	1 unverified record	h
Black rat snake, *Elaphe obsoleta*	Iona Island Marsh, Piermont Marsh	M	2 records	r
Milk snake, *Lampropeltis triangulum*	Tivoli Bays; Constitution Island?	I E	Rare	c, 9, Cc
Copperhead, *Agkistrodon mokasen*	Cornwall Bay?, Constitution Marsh	E Sw	Rare	t
Spotted salamander, *Ambystoma maculatum*	Nutten Hook to Constitution Island	I P Sw	Very local	c, 9, s, v
Blue-spotted - Jefferson salamander complex, *Ambystoma laterale, A. jeffersonianum* & hybrids	Nutten Hook area	P	Very local	12, h, s, u
Red-spotted newt, *Notophthalmus viridescens*	Nutten Hook to Constitution Island	I S	Rare	12, c, 9
Northern dusky salamander, *Desmognathus fuscus*	Tivoli Bays	D	Very rare	9
Redback salamander, *Plethodon cinereus*	Nutten Hook to Constitution Island	I	Locally common	c, h, 9, s, v
Four-toed salamander, *Hemidactylium scutatum*	Tivoli Bays?	Sw?	Unverified report	l
Mudpuppy, *Necturus maculatus*	Albany to Kingston?	Sh?	Now rare or extirpated	22, 4, b, f
American toad, *Bufo americanus*	Papscanee to Iona Island	I E? P Sw? M	Uncommon, local	12, 15, c, 9, s, y
Gray treefrog, *Hyla versicolor*	Stuyvesant to Constitution Marsh	P Sw	Rare to uncommon	9, s, t, v
Spring peeper, *Pseudacris (Hyla) crucifer*	Mill Creek to Manitou Marsh	I P Sw M?	Locally common	12, 18, c, 9, s, t
Bullfrog, *Rana catesbeiana*	Papscanee to Constitution Marsh	I P M	Rare	c, 9, t
Green frog, *Rana clamitans*	Papscanee to Iona (Piermont**)	I D P Sw M	Uncommon	many observers
Wood frog, *Rana sylvatica*	Stuyvesant to Constitution Marsh	I P Sw M?	Rare, locally common	12, c, s, t
Northern leopard frog, *Rana pipiens*	Mill Creek to Barrytown	P Sw M	Rare	12, 17, 9, o, r, s
Pickerel frog, *Rana palustris*	Tivoli Bays, Staatsburg, Constitution Marsh	E D Sw M	Rare to locally common?	9, t, y

* Relative to other species in the tidal Hudson River.

** Reported from the "lagoon" at the Piermont Pier [21]; this habitat was presumably supratidal and less brackish than the river, or the animals were found in spring or after heavy rains.



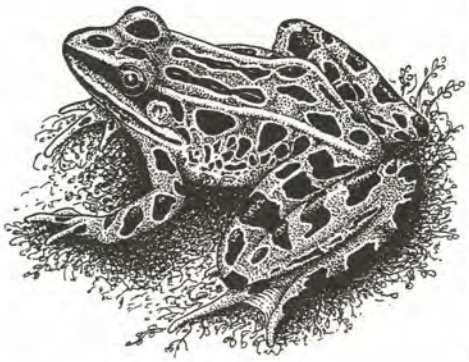
Hudson River Localities (see Table 1).

near Barrytown and one individual near Stockport;[17] in 1997 I confirmed a small population at Nutten Hook[12] first reported by Chuck Nieder; and in 1998 Hudsonia biologists found leopard frogs widespread but sparse from Stuyvesant to Little Nutten Hook.

Because the leopard frog is more common north of the Capital District, it is likely there are other populations

Supratidal pools, swamps, and marshes along the Hudson, even on dredge spoil deposits, appear to be important habitats for herps, according to two 1998 field studies.

along the Hudson between Stuyvesant and Albany. In the Hudson and Housatonic valleys, the northern leopard frog is associated principally with the floodplains of large tidal and nontidal rivers and nearby areas.[17] Southern leopard frog, a closely related species, could occur along the west shore of the Hudson in Orange or Rockland counties.



Northern leopard frog, ca.130 mm in head-body length

Current Studies

The first step in understanding the herpetofauna of the Hudson is to sample and document the reptile and amphibian communities of different habitats.

Two local studies were conducted in 1998 on state-owned shore lands. Hudsonia Research Associate Stephen Nyman sampled herps from Mill Creek to Gays Point north of Stockport in Columbia County, and Polgar Fellow Michael Rubbo sampled at Stockport Flats and Tivoli Bays. These studies used quantitative and semi-quantitative sampling techniques (frog call counts, dipnetting and minnow trapping for amphibian larvae, hoop net trapping for turtles, searching under logs and rocks for snakes and amphibians). Tidal marshes, tidal swamps, supratidal pools, shorelines at Mean High Water elevation, and uplands were surveyed. (Supratidal refers to areas within about one meter vertical elevation above Mean High Water, i.e., irregularly flooded by the tides.) Steve's study is supported by the New York State Department of Environmental Conservation as part of biological and cultural resource surveys for management planning. Mike's study is sponsored by the Hudson River Foundation and Hudson River National Estuarine Research Reserve.

Preliminary results support two hypotheses. First, the herpetofauna is indeed impoverished, i.e., diversity is low and few species are common. Second, there is a gradient of species richness (the number of species) from open intertidal marshes that are highly influenced by the estuary, to sheltered supratidal pools that are irregularly or occasionally flooded by unusually high tides. Up to five species of frogs breed in supratidal pools, whereas only the green frog is known to breed (or at least call) in intertidal marshes.

In the Hudson, supratidal habitats (pools, swamps, and marshes) on dredge spoil and natural substrates appear to be important habitats for herps, and warrant conservation and restoration. There is much concern among managers about tidal wetlands in which tidal circulation is artificially restricted by culverts and other structures, or where sediments are building up and woody vegetation is invading. Although these wetlands may be less suitable for many fish species, they may be better for most herps than open tidal marshes. We are planning further studies of the herp communities in the Hudson and other northeastern estuaries.

Information Needed

There are obviously gaping holes in our knowledge of the herpetofauna of northeastern estuaries. The Hudson River seems peculiar in supporting unusually

low densities of many herp species, yet has the only known estuarine populations of the wood turtle[13] and map turtle (and possibly mudpuppy).

We don't know whether herps are slipping into oblivion in front of our eyes, as contamination, overabundant predators like raccoons, and collecting or killing by humans compound the natural stresses of estuarine life, or whether the Hudson River herpetofauna has always been sparse in species and individuals. The reptile and amphibian communities of the Hudson await detailed study by meticulous naturalists and biologists who are willing to cope with the tides, soft mud, and dense vegetation.

At the least, every Hudson River naturalist should own a copy of the Conant and Collins (1991)[7] field guide and a good camera with a close-up lens to document identifications and observations.

Watch for the species that occur near the Hudson River but have not been reported at the estuary, e.g., two-lined salamander, slimy salamander, Fowler's toad, ribbon snake, worm snake. Herps in tide-affected habitats of the Hudson River may be reported to the Hudson River Almanac (Tom Lake, New York State Department of Environmental Conservation, New Paltz, NY 12561), the New York Amphibian and Reptile Atlas Project (Wildlife Resources Center, Delmar, NY 12054), or to Hudsonia (see masthead or e-mail kiviat@bard.edu).

Here are some specific suggestions:

- Where do frogs and salamanders breed? Frog or salamander larvae encountered in regularly or irregularly tide-flooded waters should be collected (2 or more good specimens of each species) and submitted to an amphibian expert for accurate identification. (Amphibian larvae should be preserved in 10% buffered formalin.) Advanced students of amphibians might try collecting eggs of, e.g., American toad or spotted salamander, from tide-affected and non-tidal habitats, and rearing them under similar conditions.

- What kills herps? Animals found dead in good condition should be put on ice or refrigerated (sealed in double, clean plastic bags) as soon as possible and reported to the DEC Wildlife Pathology Unit (tel. 800-356-0560) which may want them for examination and analysis for residues of toxic substances. Dead sea turtles, identified by flippers instead of feet, should be collected or tied up. If collected, put the carcass on ice or refrigerate it, and immediately call the sea turtle and marine mammal stranding center at Riverhead Foundation for Marine Research and Preservation (tel. 516-369-9829). Practice good hygiene when handling dead (and living) animals; pathogenic bacteria such as *Salmonella* and *Aeromonas* may be acquired from herps.

- What are the distributions of the less-common species? Report locations and habitats of all herps except snapping turtles and painted turtles (painted turtles from Iona Island south should be reported). The most mysterious species in the Hudson are musk turtle, spotted turtle, brown snake, green snake, black racer, black rat snake, copperhead, gray treefrog, pickerel frog, and all salamanders. Make identifications carefully; for example, leopard frog vs. pickerel frog is troublesome. Take photographs. Frogs can often be identified from audiotapes.

- Can we recover "lost" documentation? Can you locate photos, published or unpublished written records, or (best of all) preserved specimens of Hudson River herps for which at least approximate locality, date, and habitat are known? Valuable recent and historical photographs of marine mammals in the Hudson have come to light, and there must be evidence for herps as well. Old photos, field notes, or specimens may be fragile and should be handled with care until examined by experts.

- The softshell turtle mystery. In the 1800s, softshell turtles were reported in the Hudson where they may have arrived via the Hudson-Champlain or the Erie canal. Spiny softshell is a turtle of large rivers and lakes; its distribution (like that of the map turtle) follows the Great Lakes to Lake Champlain. In 1994, an unidentified softshell turtle was videotaped in the mouth of the Saw Mill River,[18] and an unidentified softshell was caught and released at Piermont Marsh in 1997.[27] Were these turtles spiny softshells from the lakes, or were they spiny softshells or another softshell species that escaped from the pet trade or ethnic food markets? If you find a softshell (or a mudpuppy) in the Hudson, keep it - alive or frozen, and call a herpetologist.

A scientific collector's license may be required for the capture of live animals. Ask the DEC Special Licenses Unit (50 Wolf Road, Albany, NY 12233, tel. 518-457-0689) and be prepared to explain your plans in detail.

We don't know whether herps are disappearing in front of our eyes, or whether the Hudson River herpetofauna has always been sparse in species and individuals.

Acknowledgments

The story of Hudson River herps has gradually been revealed through 28 years of observations and comments by scientists, students, and the public. (The superscripts refer to Table 1.) This list includes: Anita Barbour, Spider Barbour,[a] Bob Bard, Juliana Barrett, Nels Barrett, Allen Beebe,[b] Erika Beecher, Jim Beemer,[c] Debby Berry,[d] Betsy Blair, John Bleiler, Bob Boyle, Al Breisch, Don Buso,[e] Todd Castoe, Robert Chapman,[f] Jeff Clock, Elaine Colandrea, Jeff Connor, Paul Connors,[g] Joe Crittenden, A.F. Czajka, Roz Davis, Jason Demarest,[h] Stewart Fefer, Fred Ford, Maria Gara, Hank Gruner, Bob Gunther, Ken Hanaburgh, Kathy Hattala,[i] Sven Hoeger, Jesse Jaycox, Bob Kakerbeck, Richard Kirgan,[j]

Esther Kiviat, Michael Klemens, Vincent Kobos, Frank Koschir, Tom Lake,[k] Lori Leonardi,[l] Eric Lind,[m] Wayne MacCallum, Bill Maple,[n] Roberta Marsh, John McKim, Gail Mihocko,[o] Dennis Mildner, Bill More, Tom Morrison,[p] Christiane Mulvihill, Everett Nack,[q] Steve Nack, Chuck Nieder,[r] Steve Nyman,[s] Dianne Outlaw, Jerry Platt, Ed Reilly, Stephen Ringler, Michael Rivlin, Bill Robinson, Jim Rod,[t] Jasz Rodziewicz, Barbara Rogolsky, Daphne Ross,[u] Chris Rozycki, Mike Rubbo,[v] Carolyn Rutgers, Andy Sabin, Sam Sadove,[w] Allen Salzberg,[x] Bob Schmidt,[y] Kathy Anne Schmidt, Dave Seymour, Devi Sharp, Andy Singer, Nancy Slowik,[z] Norm Soule, Jim Stapleton, Gretchen Stevens, Bryan Swift,[Aa] Tom Turner,[Bb] Roberto Ungaro, Will Waeys, Kate Wallen, Peter Warny, Kristin Westad,[Cc] Michael Wilkins, George Zoebelein,[Dd] Doug Zwick. (I apologize if I have forgotten anyone.)

Hudsonia observations were made during many projects; we are especially grateful for funding from New York State Department of Environmental Conservation, Hudson River National Estuarine Research Reserve, National Oceanic and Atmospheric Administration, Hudson River Foundation, Scenic Hudson, Museum of the Hudson Highlands, and Nature Conservancy.

References Cited

1. **Arndt**, R.G. & W.A. Potter. 1973. A population of the map turtle, *Graptemys geographica*, in the Delaware River, Pennsylvania. Journal of Herpetology 7(4) :375-377.
2. **Bishop**, C.A., R.J. Brooks, J.H. Carey, P. Ng, R.J. Norstrom & D.R.S. Lean. 1991. The case for a cause-effect linkage between environmental contamination and development in eggs of the common snapping turtle (*Chelydra s. serpentina*) from Ontario, Canada. Journal of Toxicology and Environmental Health 33:521-547.
3. **Bishop**, J.M. 1983. Incidental capture of diamondback terrapins by crab traps. Estuaries 6:426-430.
4. **Bishop**, S.C. 1941. The salamanders of New York. New York State Museum Bulletin 324, 363 p.
5. **Bleiler**, J. Unpublished data.
6. **Boyle**, R.H. 1969. The Hudson River; A natural and unnatural history. W.W. Norton, New York. 304 p.
7. **Conant**, R. and J.T. Collins. 1991. A field guide to reptiles and amphibians; Eastern and central North America. Houghton Mifflin Co., Boston. 450 p.
8. **Funk**, R.E. 1976. Recent contributions to Hudson Valley prehistory. New York State Museum Memoir 22, 325 p.
9. **Kiviat**, E. Unpublished data.
10. **Kiviat**, E. 1980. A Hudson River tidemarsh snapping turtle population. Transactions of the Northeast Section, The Wildlilfe Society 37:158-168.
11. **Kiviat**, E.1997. Where are the reptiles and amphibians of the Hudson River? Part 1. News from Hudsonia 12(2-3):1, 3-5.
12. **Kiviat**, E. 1997. Spring bird, reptile, and amphibian surveys at Nutten Hook Reserve, Town of Stuyvesant, Columbia County, New York. Report to the New York State Department of Environmental Conservation, Hudson River National Estuarine Research Reserve and the Greenway Conservancy for the Hudson River Valley, Inc. 31 p. + 1 p. corrigenda.
13. **Kiviat**, E. & J.G. Barbour. 1996. Wood turtles in fresh-tidal habitats of the Hudson River. Canadian Field-Naturalist 110(2):341-343.
14. **Kiviat**, E. & D.C. Buso. 1977. Geographic distribution: *Graptemys geographica* (map turtle). Herpetological Review 8 (3):84.
15. **Kiviat**, E. & J. Stapleton. 1983. *Bufo americanus* (American toad): Estuarine habitat. Herpetological Review 14(2):46.
16. **Klemens**, M.W., R.P. Cook & D.J. Hayes. 1992. Herpetofauna of Roosevelt-Vanderbilt National Historic Sites Hyde Park, New York, with emphasis on Blanding's turtle (*Emydoidea blandingii*). U.S. National Park Service Technical Report NPS/NAROSS/NRTR-92-08. 34 p.
17. **Klemens**, M.W., E. Kiviat & R.E. Schmidt. 1987. Distribution of the northern leopard frog, *Rana pipiens*, in the lower Hudson and Housatonic river valleys. Northeastern Environmental Science 6(2):99-101.
18. **Lake**, T., ed. 1995. The Hudson River almanac 1994-95. Vol. 1. New York State Department of Environmental Conservation, New Paltz, NY. 100 p.
19. **Lake**, T., ed. 1996. The Hudson River almanac 1995-96. Vol. 2. Purple Mountain Press, Fleischmanns, NY, 128 p.
20. **Lake**, T., ed. 1997. The Hudson River almanac 1996-97. Vol. 3. Purple Mountain Press, Fleischmanns, NY. 119 p.
21. **Lawler**, Matusky & Skelly Engineers. 1987. Piermont Landing; Draft Environmental Impact Statement. Vol. 1. Lawler, Matusky & Skelly Engineers, Pearl River, NY.
22. **Marshall**, W.B. 1892. *Necturus maculatus* in the Hudson River. American Naturalist 26(309):779-780.
23. **Nack**, E. Personal communications.
24. **Platt**, J.L. 1978. Geographic distribution: *Malaclemys terrapin terrapin* (northern diamondback terrapin). Herpetological Review 9(3):107.
25. **Rozycki**, C. & E. Kiviat. 1996. A low density, tidal marsh, painted turtle population. P. V-1 to V-35 in E.A. Blair & J.R. Waldman, eds. Final Reports of the Tibor T. Polgar Fellowship Program 1995. Hudson River Foundation and New York State Department of Environmental Conservation - Hudson River National Estuarine Research Reserve.
26. **Siegel**, R.A. 1980. Predation by raccoons on diamondback terrapins, *Malaclemys terrapin tequesta*. Journal of Herpetology 14:87-89.
27. **Simoes**, J.C. & R.M. Chambers. 1998. A population study of diamondback terrapins of Piermont Marsh, Hudson River, NY. P. I-1 to I-31 in J.R. Waldman & W.C. Nieder, eds. Reports of the Tibor T. Polgar Fellowship Program, 1997. Hudson River Foundation and New York State Department of Environmental Conservation.
28. **Slowik**, N. Personal communications.
29. **Stone**, W.B., E. Kiviat & S.A. Butkas. 1980. Toxicants in snapping turtles. New York Fish and Game Journal 27(1):39-50. ❑

Inside Hudsonia

Board of Directors: We welcome two new members to Hudsonia's Board of Directors. Allison Lee is president of Kingston-Newburgh Enterprise Corporation and lives in Ulster County. Michael Trimble chairs the Town of Rhinebeck Conservation Advisory Council and serves on the boards of the Winnakee Land Trust and Cornell Cooperative Extension Dutchess County.

They join board members Lawrence H. Weintraub (Chair), Deborah Meyer DeWan, Drayton Grant, Karen L. Jacobs (on leave), Michael W. Klemens, Thomas R. Lake, William T. Maple, and Jack Wertheim.

We are seeking new directors to help with fundraising, publicity, and other activities.

We are grateful to have had the services of the following people: **student assistants:** Nadja Carneol, Dwane Decker, Boriana Handjiyska, Dareth McKenna, Kate Mini, Amy Toth; **technicians:** Todd Castoe, Jason Demarest, Stephanie Matteson, Christiane Mulvilhill, Kate Wallen; **Bard Graduate School of Environmental Studies student** Stacey Thew; and **AmeriCorps member** John Sullivan.

News from Hudsonia credits; illustrations, © Kathleen A. Schmidt; design and production, Victoria Balcomb; editing, Gretchen Stevens.

We welcome suggestions for articles, and offers of underwriting for future issues.

Dear Friends,

We proudly celebrate Hudsonia's 17th birthday this October! Over the years we've earned a reputation for authoritative, impartial reports on environmental issues that influence the lives of people in the Hudson Valley and beyond.

We could not have done this without you. Please help us continue our work in the months and years ahead by giving us a birthday gift. Thank you.

Larry Weintraub
Chair, Board of Directors

THANK YOU, ONE AND ALL

Friends and Supporters

Anonymous
William R. Coleman
Gordon Douglas
Sol J. Heiligman
Bill & Mary Lunt
Marilyn Marinaccio
Richard L. Menchel
Gail & Thomas Rockwell
Marian H. Rose
Scott & Annie Appleby Charitable Trust
Eric P. Sheinberg
Margaret S. Stevens
Neil C. Stevens
Doris Walker
Jack Wertheim

Sponsors

Drayton Grant & Wayne Baden
Joe Bridges
Citizens for Responsible Growth
Walter & Ursula Cliff
Elaine Colandrea
Nancy Ann Cook
Deborah Meyer Dewan
Douglas Fraser
Hudson & Pacific Designs, Inc.
IBM International Foundation
Karen L. Jacobs
Bruce & Ruth Lisman
Eugene & Sue Mercy, Jr.
Norcross Wildlife Foundation
Andrew Sabin
Edward Spiegel
Mark A. Stevens
B.J. Dockweiler & Frank Stiefel
Anton F. Wilson
The Woodstock Chimes Fund

Donors

Carla Abrams
Adrian Andersen
Edgar A. Anderson
Helen M. Andrews
Dr. Matthew A. Asbornsen
Victoria Balcomb
Berkshire Wetland Services
Ana & George Berry
Hans G. Boehm
Robinson O. Brown
Alice & Fred Bunnell
Eleanor Buthmann
Barbara Butler
Jack & Beverly Campisi
Ray Cannata
Robert & Audrey Cole
John Connor Jr.
Frances Davis
Gerald A. Davison
Linda & Roy Deitchman
Joe Deschenes
William Diebold
John Dobkin
Wesley C. Natzle & Frances F. Dunwell
Lucie D. Eastman
Cece Fabbro
Uta Gore
Joan Dye Gussow
Edward Hoagland
John Holsapple
Sandra & George Hutton
Chip Jenkins
Mida Kaelin
Jean L. Klaiss
Evelyn Krueger
Sarah E. Kuhn
Mr. & Mrs. Edgar Lehman
Debbie Marks
Katherine Gould-Martin & Robert L. Martin
Maeve Maurer
Hamilton & Helen Meserve
Renee E. Miller
Richard Miller
Mrs. B. Moreau
Harry J. & Bettyann B. Newton, Jr.
Marta E. Nottebohm
Frederick Osborn III
Kenneth Pearsall
Ian H. Porter, M.D.
Hector Prudhomme
Mr. & Mrs. Barry Rosen
John H. Schock
John Serrao
Bill Sheridan
Peter N. Skinner
Summer Moon
Tamarack Preserve
John Taras
Janeth Lloyd Thoron
Stephen Tilly
Town of North Salem
Michael Tronolone
Mario & Donna Verna
Alvin D. Wanzer
Jay Wenk
Gail Whistance
Mary-Alice White
Jay E. Wilmarth
Elma L. Williamson
Winter Sun

THANKS, TOO, FOR THE GIFTS OF TIME, SERVICES, AND SUPPLIES

Volunteers

Field Work
Carla Abrams
Gale Belinky
Colleen Brandes
Lin Fagan
Greg Giacci
Caroline Hermans
Naja Kraus
Meg Maisch
Stephanie Matteson
Amy Toth
Kate Wallen
Travis White

Professional Services
Deborah Meyer DeWan
Drayton Grant
Peter Groffman
Russ Immarigeon
Rachael Jones
Paul Keller
Michael Klemens
Allison Lee
Barbara Maple
William T. Maple
Chuck Nieder
Larry Weintraub
Jack Wertheim
Dave Woods

Herbarium
Beth Coakley
Lin Fagan
Heather Gaston

Equipment, supplies, and books

Carol Brener
Joe Bridges
Lin Fagan
Florida Marine Research Institute
Steve Gomez
Katherine Gould-Martin
Harbor Branch Oceanographic Institute
Smithsonian Institution Program for Scientific Translations
University of Maryland Horn Point Library
Beth Waterman
Dave Yozzo

Acquiring, analyzing, and sharing accurate, up-to-date, regional and site-specific scientific information, Hudsonia is a non-advocacy, non-profit, tax exempt, 501(c)(3) organization.