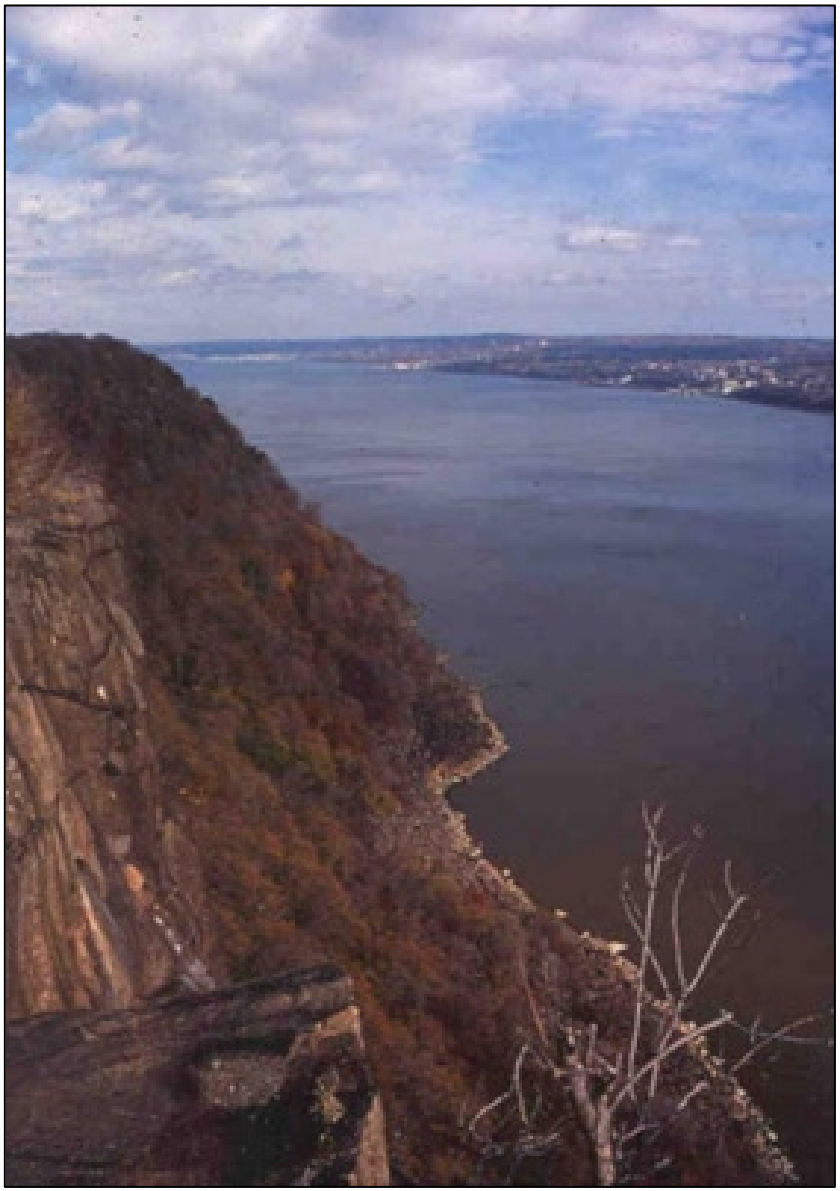


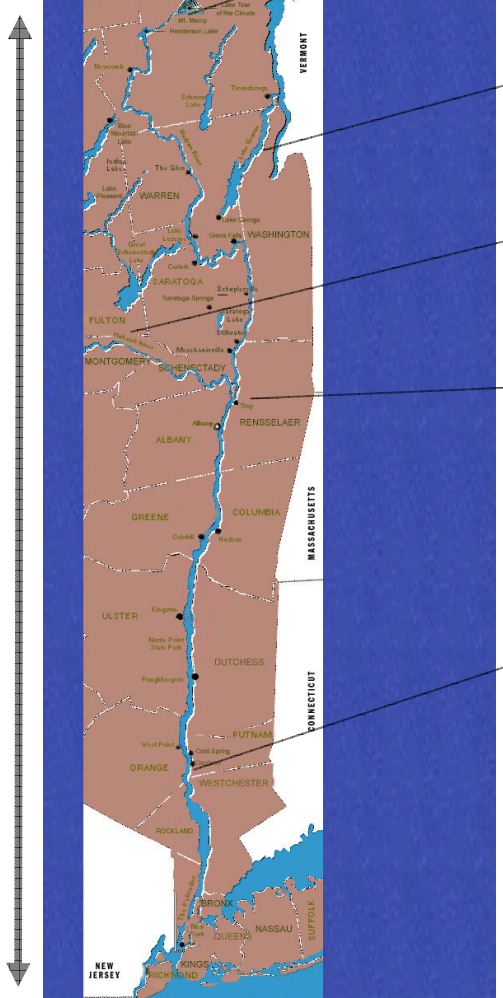
Flora & Fauna of the

Hudson Valley Estuary

Ian Giddy

The Hudson River

- What is the Hudson River?
  - A fast-moving mountain river?
  - A slow-moving canal?
  - A tidal estuary?
  - A fjord?



Lake Tear-of-the-Clouds

The Champlain Canal

The Erie Canal

The locks at Troy

The saltwater transition

Lake Tear-of-the-Clouds

- "Far above the chilly waters of Lake Avalanche, at an elevation of 4,293 feet, is Summit Water, a minute, unpretending tear of the clouds, as it were - a lovely pool shivering in the breezes of the mountains, and sending its limpid surplus through Felspar Brook and to the Opalescent River, the wellspring of the Hudson."

- Colvin Verplank; his report to the State Legislature, 1872.

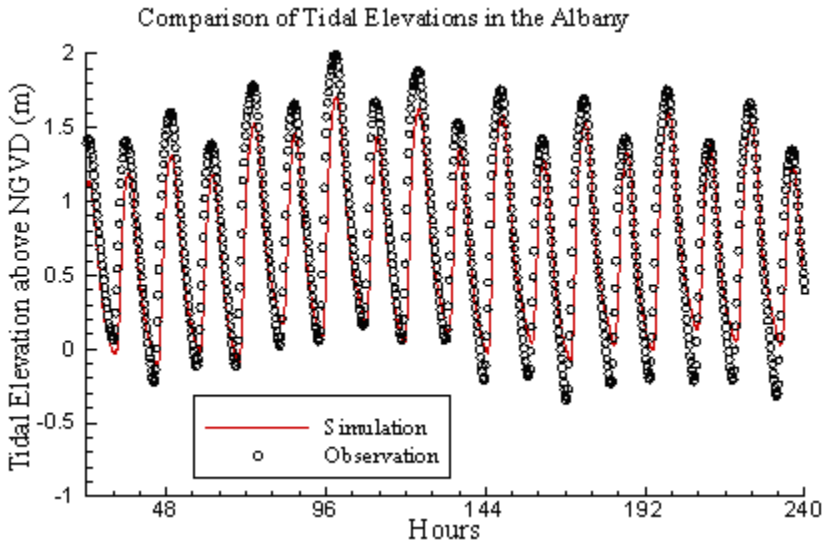
A fjord?

The Hudson Highlands

- Fjords are defined as valleys eroded well below sea level by glaciers, and then filled by the sea after the glaciers melt. They are deepest upstream of their mouths, where the erosive power of the glacier was greatest.
- By this definition, the Hudson qualifies as a fjord: it is deepest here in the Highlands - up to 175 feet deep at West Point.

Muhheakantuck
"River-Which-Flows-Two-Ways"

- The Hudson is tidal for over half its length, for 150 miles up to Troy. During the last Ice Age, glaciers thousands of feet thick gouged the River's bed to below sea level. *At that time, so much of the world's water was bound up in ice that the Hudson flowed an additional 120 miles beyond Manhattan to reach the sea.*
- As the glaciers retreated about 18,000 years ago, the ocean's waters rose and poured in behind them, mingling with fresh water from the river's newly thawed tributaries to form the river we see today.



An estuary

- The Hudson is an **estuary**, where tides push salt water from the ocean upriver to meet fresh water draining from the surrounding land.
- Tides push salt water from the ocean upriver to meet fresh water draining from the surrounding land.

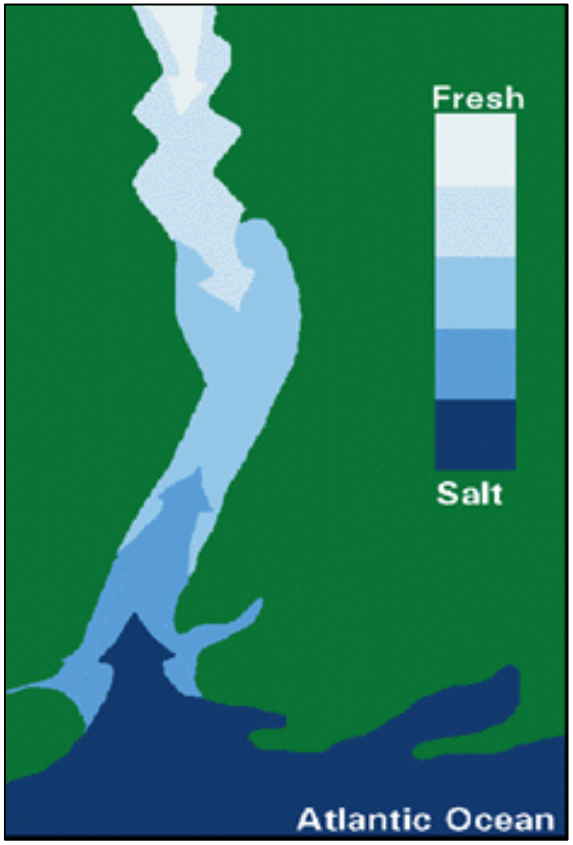
The dam at Troy

An estuary

- A fascinating feature of the Hudson's marshes is that the upper ones are freshwater while the lower ones, from Foundry Cove and southerly, are salty or brackish, becoming salty in the Tappan Zee area (12-18 ppt at Piermont compared to about 35 ppt in the Atlantic). Because the lower Hudson is almost all at sea level, salty seawater penetrates many miles of the Hudson upstream.
- The vegetation varies with salinity, and also in accordance with the local tides. The back-and-forth tidal turbulence traps life-giving nutrients, such as nitrogen, in the water.
- The estuary may in turn by divided into three aquatic zones: a subtidal zone that is inundated permanently, an intertidal zone that is flooded every day at high tide; and an irregularly flooded zone that is under water only during high spring or storm tides.
- These zones each have their characteristic ecological communities of plants found in different Hudson River marshes.

The "Salt Front"

- The leading edge of dilute seawater coming up the river is called the *salt front*. In years with normal patterns and amounts of precipitation, the salt front reaches Newburgh Bay in late summer.
- During drought years, the front can go as far upriver as Poughkeepsie. Spring runoff or large rainstorms can push the salt front as far south as the Tappan Zee or even Manhattan.



The marshes

- Small and large reed-filled marshlands that border the Hudson. Many of these are behind railroad causeways and invisible to those traveling the main river. Not only the railroads but also (ironically) the Army Corp of Engineers, with their notoriously roughshod treatment of the natural environment, have created the conditions for some of the most productive marshes.

The marsh at Piermont

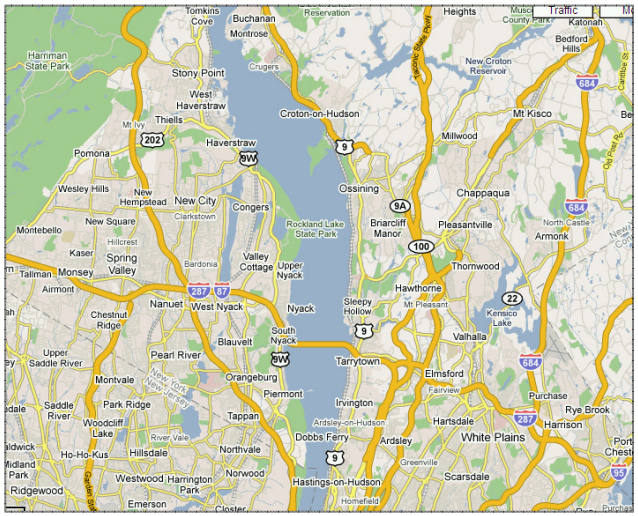
- By dumping dredge matter alongside the concrete abutments that border the Hudson below Albany, the Corps produced swampy flatlands unsuited to farming. The "dredge islands" and peninsulas in the regions of Stockport and Catskill harbor a wealth of biological diversity. The marshes typically have channels between the reeds, channels that can be explored only by small craft.

The marshes

Papscanee Island marsh	4 miles
Schodack Island marsh	3.5 miles
Bronck Island	4 miles
Vosburg Swamp	.3 mile
Stockport Island marshes	3 miles
North Bay Marsh, Hudson	1 mile
Hellenbeck Creek	.7 mile
Ramshorn Marshes	2 miles
Dewitt Point Marsh	.5 mile
Roeliff Jansen Kill	.3 mile
Saugerties Marsh	.3 mile
North Tivoli Bay	1.5 miles
South Tivoli Bay	1.5 mile
Mandara Marshes	.5 mile
Mills Point Marsh	.4 mile
Astor Cover	.6 mile
Kingston Point Nature Park	.2 mile
Rondout Creek	.4 mile
Sleighsburg Spit	.1 mile
Suckley Cove	.3mile
Vanderburgh Cove	1.2 miles
Quassic Creek	.5 mile
Fishkill River	.2 mile
Moodna Creek Marsh	.5 mile
Storm King48.2	.3 mile
Foundry Cove	1 mile
Con Hook marsh	.3 mile
Iona Island Marsh	1 mile
Camp Smith Marsh	.5 mile
Georges Island Marsh	.5 mile
Minisceongo Creek Marsh	.3 mile
Croton River	.2 mile
Piermont Marsh	1.2 miles

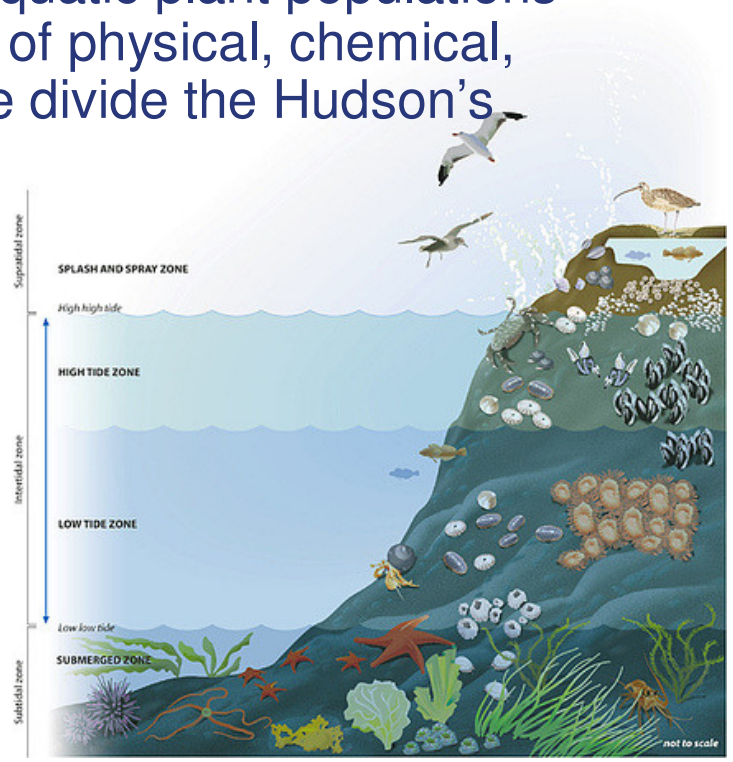
The fertile shallows of spring

- South of the Highlands, the Hudson River spreads out at Haverstraw Bay and the Tappan Zee. Three and a half miles across, Haverstraw Bay is the widest spot on the estuary. Its expanses of shallow water capture lots of sunlight, energizing the growth of tiny drifting organisms called plankton. Those capable of photosynthesis - algae, for example - are called phytoplankton.
- The lengthening days and warming waters of spring allow phytoplankton populations to grow rapidly, providing food for tiny drifting animals called **zooplankton**. The abundance of zooplankton in the shallows makes these areas ideal nurseries for hungry newborn fish.



Plants of the Hudson and the Tidal Zones

- The presence of aquatic plants in river environments can be summarized in a single statement:
- *If light reaches the bottom, plants will grow.*
- Of course, it is not as simple as that. Aquatic plant populations are governed by a complex interaction of physical, chemical, and biological factors. For simplicity we divide the Hudson's plants into three groups:
  - Underwater and floating plants
  - Plants in the intertidal zone
  - Plants mostly at the high tide zone



Underwater and floating plants

- Water Celery (*Vallisneria americana*). Fresh water. Underwater.
  - Long stringy leaves that like to drape themselves on paddles.
- Water Milfoil (*Myriophyllum exalbescens*). Fresh water. Underwater.
  - Long round stems supporting a thousand feather-like leaves.
- Water Chestnut (*Trapa natans*). Fresh water. Floating.
  - Six-inch doilies of one-inch, triangular leaves float at the end of long narrow stems. Below the leaves one usually finds a cluster of seeds. Introduced from Asia over a century ago, this miniature lily-like weed is the bane of a watergoer's life. Worse are its seeds: inch-wide "devil's horns" with sharp spikes that adorn beaches and sits waiting to penetrate the unwary foot. *Trapa natans* has effectively taken over areas such as Tivoli South Bay, blocking sunlight and displacing native species.

Plants in the intertidal zone

Spatterdock

- Yellow Pondlily or Spatterdock *(Nuphar luteum)*. Fresh water marshes.
  - These are found in deeper sheltered water, up to 6 feet at high tide. The heart-shaped leaves with rounded ends may be submerged or floating but are usually above water. The cup-shaped yellow flowers bloom May to August. They grow rampantly and contribute a great deal to marsh wildlife: ducks eat the seeds, muskrats the sweet rootstocks and deer graze on the greens. Indians used to eat the rootstocks like potatoes or pound them into flour.
- Pickerelweed (*Pontederia cordata*). Fresh water marshes.
  - 1-4 feet tall, found in shallower sheltered water. Smaller, heart-to lance-shaped leaves; long purplish flower blooms June-November.
- Arrow Arum Lily (*Peltandra virginica*). Fresh water marshes.
  - 1.3 feet tall, with large, wrinkled arrow-shaped leaves with a prolonged tip. The yellow flower is enclosed within a tall, narrow, partially-opened pouch. Blooms April-June.
- Broad-Leaved Arrowhead (*Sagittaria latifolia*). Fresh water marshes.
  - Found on the water's edge in marshes, the Broad-leaved Arrowhead or "Wapato" has a flower with 3 roundish white petals that appear in groups of 3 on the stem, which bloom July-September. The starchy tubers were an Indian staple; Lewis and Clark learned the name Wapato from the Chinooks of the Pacific Northwest. The smooth arrow-shaped leaves are easily confused with the Arrow Arum when neither is in flower. The clue lies in the veins: Arrowhead veins run parallel to the midrib, while those of the Arrow Arum run diagonally outward from the midrib.
- Wild Rice (*Zizania aquatica*). Fresh water marshes.
  - Tall stems topped by whisk-broom tuft and 1/2-inch spikelets, the edible grain dangles from little branches below. Ribbonlike leaves staggered along the stem. In the past, every autumn Indians of the northern lake regions traveled to "ricing camps" where they collected the grain from stands of wild rice by threshing the tops of living plants across their canoe gunwales. This inefficient technique left behind enough seed to guarantee a crop the following year. Found in the Stockport area (
- Great Bulrush (*Scirpus validus*). Fresh water marshes.
  - Erect, tubular, leafless stems 2-10 feet tall with drooping clusters of brown flowerheads, 1/4-1/2" long. The seeds and stems are food for ducks and geese.
- Marsh Marigold *(Caltha palustris)*. Fresh water marshes.
  - May be hidden behind other plants. Clusters of inch-wide roundish leaves that float lily-fashion on the water, small bright yellow flowers that bloom April to August. The leaves may be cooked and eaten, but are poisonous if eaten raw.
- Big Cordgrass (*Spartina cynosuroides*). Brackish water marshes.
  - Single long stalk with cluster of furry stems at the top.

Arrow arum lily (*Peltandra virginica*)

Found in fresh water marshes.

- 1.3 feet tall, with large, wrinkled arrow-shaped leaves with a prolonged tip.
- The yellow flower is enclosed within a tall, narrow, partially-opened pouch.
- Blooms April-June.

Yellow Flag Iris

Plants mostly at the high tide zone

- Yellow Flag Iris (Iris psuedocorus). Fresh water marshes.
  - Tall, swordlike leaves at base of a stalk. Yellow "bearded" flowers with small upright standards. Not as prolific as some of the others, but a delight to see in flower April through August on rocky riverbanks.
- Narrowleaf Cattail (Typha angustifolia). Fresh and brackish water marshes.
  - Tall stems (2-10 feet) and long vertical leaves surrounding the two-part spike: a handle supporting the straight brown (female) or yellow (male) "cat's tail." Blooms May-July. Much of the cattail is edible: for example, in spring and early summer the young shoots can be eaten raw or cooked, and in fall the rhizomes can be peeled and cooked like potatoes. "Broadleaf" leaves are 1 inch wide, "Narrowleaf", 1/2 inch.
- Common Reed (Phragmites australis). Fresh and brackish water marshes.
  - Bushy purplish top to long stout stem which has sparse, stiff, narrow leaves. Blooms July-September. Four to fifteen feet tall and standing above the crowd, reed grasses form dense stands in the Hudson's marshes and rivulets such as Tivoli North Bay. The silky-haired spikelets are attractive but unproductive: the plants seldom produce seed but spread by means of rootstocks that may be 30 feet long. An invasive species, the common reed has taken over large parts of the high ground of Hudson River marshes.
- Purple Spiked Loosestrife (Lythrum salicaria). Fresh and brackish water marshes.
  - Vertical stem with paired horizontal leaves and narrow, tall bushy top of rose to deep magenta. Blooming July-September, often most spectacular in August in the Hudson valley. Found in wet meadows, ditches and ponds as well as in marshes. This is an imported European species, regarded by some as a bane because of its tenacious spreading.
- Saltmeadow Cordgrass (Spartina patens). Salt water marshes.
  - Long narrow spiky grass with wheat-like things at the top.

Narrowleaf Cattail (*Typha angustifolia*).

- Fresh and brackish water marshes.
  - Tall stems (2-10 feet) and long vertical leaves surrounding the two-part spike
  - A handle supporting the straight brown (female) or yellow (male) "cat's tail."

The food web

- Alive and green or dead and decaying, plants in the Hudson's shallow areas provide food and shelter for small fish, crabs, and macroinvertebrates, including insect larvae and tiny crustaceans.
- These creatures are in turn eaten by larger fish, birds, and other predators. *All are vital links in the Hudson's food web.*

Male fiddler crabs are easily identifiable - they have one large claw and one smaller claw.

Fish of the river

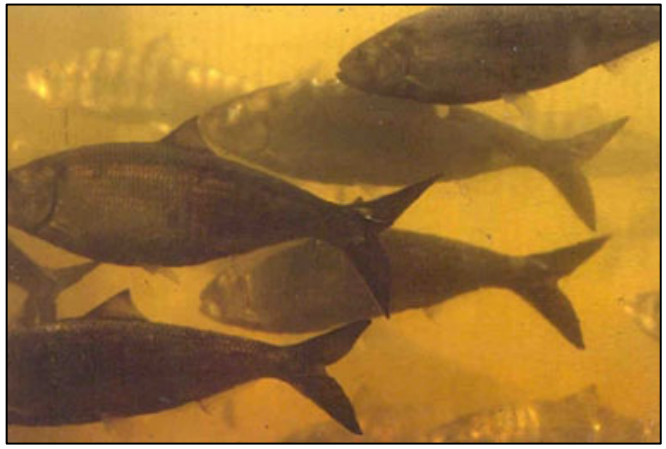
Striped Bass

- *Befitting its dual character, the Hudson is home to both fresh water and ocean fish.*
- **Anadromous fish** are those which mate and lay eggs (spawn) in freshwater but grow in the sea. These include Hudson denizens such as striped bass, shad, alewife and Atlantic sturgeon.
- Each spring, the American shad starts its annual migration upriver to shallow areas between Croton and Castleton, where they spawn. The river is also a major spawning ground for striped bass. As spawning fields for ocean fish of the Atlantic, the Hudson estuary is rivaled only by Chesapeake Bay, which has suffered severe declines in some of its fish populations, in recent years .If you see big fish jumping in open water, they're probably "stripers"; in shallow marshes, carp.
- Fishermen also catch yellow and white perch (in feeder streams), flounder (in the lower parts of the river), sturgeon, bullheads, catfish in mid-summer, crappies and, in the spring, shad. Bluefish follow and stay with the salt line in the river, where the salinity drops off.
- It's safe to eat migrating fish such as shad, but beware of contamination in general.

Anadromous species

Those that are born in fresh water but spend most of their lives in the ocean.

- The American shad is a key anadromous species in the Hudson River. Every year around the end of March, this large herring enters the river to spawn.
- Shad is the only Hudson River fish still caught and sold for the dinner table; because shad do not eat while in the river, they avoid much of the PCB contamination that has closed other fisheries.



Birds of the river

- There are large numbers of resident and breeding bird species in the Hudson Valley. A birder's list could include the Eastern bluebird, pileated woodpeckers, yellow warblers, and hundreds of other species.
- There are birds of prey throughout the valley. *Even in New York City, Central Park bird-watchers can enjoy spying on red-tailed hawks and other raptors.*

Birds of the river

- Far too many birds frequent the Hudson's water and banks to mention here. I'll list only the more prominent ones. Many paddlers carry "Birds of North America" or the like.
- **Gulls.** Lots of them, particularly on jetties. The most common is the Ring-billed Gull (*Larus delawarensis*), a grey-mantled gull with greenish-yellow legs and wide wings (22-26 ins.). Wingtips are black with white spots. The complete black ring on the bill distinguishes it from the Herring Gull which has a ketchup-like drop of red on the lower mandible (bill). Herring Gulls (Larus arentatus) play a useful part in cleaning up the Hudson's shorelines. In addition to scavenging, they eat crabs and clams, sometimes dropping the latter on stone jetties to break them open. Also look for the Great Black-Backed Gull (*Larus marinus*), the world's largest gull, with black mantle and yellow bill with reddish spot at tip. In a mixed gathering of gulls this bird often occupies a dominant perch and may rob others of their food.
- **Geese.** Hear musical honking above? Look for the Canada Goose (*Branta canadensis*) flying in V-formation. In the water, particularly in sheltered bays or marshes, note the light brown body and long, black-stockinged neck with a white chin-strap. Canada Geese usually nest near the water's edge on a moderately elevated platform, such as a small island or muskrat house.
- **Cormorants.** The Double-Crested Cormorant (*Phalacrocorax auritus*) is a large, blackish, fish-eating bird that stands erect on light structure or rocks holding its neck in an S. It may have its wings spread out to dry.
- **Swans.** Groups of the elegant Mute Swan (*Cygnus olor*) may be seen gliding along at several points, especially marshlands, on the Hudson. These were once ornamental birds brought from Europe, but they're now well established in the wild. They swim with an S-curve in the neck and take off with a great effort and commotion. They are not really mute: the cygnets peep, and the adults sometimes hiss or grunt.
- **Great Blue Herons** (*Ardea herodias*). It's a pleasure to spot this large, lean bluish-grey bird with its long legs and neck and dagger-like bill. Herons are wading birds that need open, shallow water to feed on small fishes. They winter in the southern U.S. and Latin America, returning to the Hudson in spring to breed. Great blue herons nest in large swamp forest trees, sometimes far from their feeding grounds. Herons fly with their necks pulled in, and are usually seen singly near marshes or lily patches. Other herons seen on the Hudson include the green-back heron, the black-crowned night heron, the secretive least bittern and the great egret, a picture of stately white elegance.
- **Ducks**. Ducks are migratory waterfowl. About 15 species of duck frequent the Hudson, including mallards, black ducks, wood ducks, ringnecks, canvasbacks and mergansers. Ducks use the Hudson River Valley as a major migratory corridor as they travel between northern breeding grounds and southern overwintering areas. Most duck species found on the Hudson are present only during the fall and spring migrations: they breed in central or northern Canada. Those that may be seen during summer months are likely to be mallards, black ducks, wood ducks, blue-winged teals and hooded mergansers. Wood ducks breed alongside the river, in tidal wetlands. The most common is the Mallard Duck (*Anas platyrhynchos*), striking with its Abercrombie & Fitch colorings: glossy-green head, white neck ring, reddish-brown chest, white body and black-and-white tail. The fine head feathers refract light, looking bluish or greenish depending on the angle at which light strikes them. A strikingly resilient bird, it breeds in a wide variety of water bodies. The blue rear wing stripe may be seen when the bird's in flight. Mallards are often seen with just the ends of their tails sticking out of shallow water as they feed on the plants and small animals found at the bottom, like other marsh ducks.
- **Grebes**. The grebe is a duck-like diving bird with almost no tail. You may see the Pie-Billed Grebe, brownish with a black throat patch and a ring around its bill in summer.
- **Red-Winged Blackbird** (*Agelaius phonoeceus*). About 8" long, often seen around marshes. You may catch a glimpse of the orange epaulets that are displayed briefly as the bird flits around the reeds.
- The **Tree Swallow** (*Iridoprocne bicolor*) is another bird to look out for in marshes. Steely blue-black above with a clear white underbody. Despite its name it roosts in reeds: I have seen dozens clustered, each at the feathery top of a tall marsh reedgrass stem, twittering together.

The Return of the Bald Eagle

- The bald eagle has returned to the Hudson River as both a winter resident and as a spring breeder. Indeed, for the first time in over 100 years, a bald eagle was born alongside the Hudson in 1997. Some 40 eagles regularly spend the winter fishing along the Hudson. Until 1997, none had successfully bred.
- The U.S. Fish and Wildlife service has been studying the eagles which failed to breed in previous years in the Hudson Valley, in search of pollution or other causes. The reproductive problems have been linked to high levels of PCBs and pesticides.
- Now there is evidence that breeding has resumed.

Bald eagles are back

- In 1997, for the first time in more than a century, a young eagle was fledged from a nest along the river.
- By 2007, there were eighteen bald eagle nests along the estuary.

Restoration ecology is complex

- Cormorant populations have increased markedly across New York in recent years, likely a result of a cleaner environment and fewer pesticides.
- Large nesting colonies are a sight to behold, but high densities of nesting cormorants are not without problems. In Lake Champlain, destruction of vegetation on nesting islands in Vermont by cormorants threatens populations of common terns, a threatened species

Invasives

- As bird and fish species recover in a cleaner setting, less desirable new residents are also finding the Hudson to their liking.
- When transplanted to the fertile environment of the Hudson, exotic and invasive species from other lands often have few predators and spread rapidly.
- These invading species, which include the purple loosestrife (pictured here), water chestnut and zebra mussel, have had major negative impacts on the ecology of the estuary.

Purple loosestrife – pretty bad

The Hudson River – Flora & Fauna

- The lower Hudson is an estuary. Tides move the water northwards twice a day, and southwards twice a day.
- The river's salinity gradient, as well as the rise and fall of the water, means that many plants and fauna have adapted to the different degrees of salinity and to the intertidal zone.
- The Hudson's continued fertility is amazing, considering the effect of industrial pollution, habitation, sewerage, barge traffic, introduction of invasives and other anthropogenic effects.
- The Hudson has come a long way in the past thirty years. *We must protect these gains and strive to continue this progress.*

Further exploration

giddy.net/hudsonestuary

- *Limburg, K., Moran, M.A., and McDowell, W., The Hudson River Ecosystem (New York, 1985).Technical.*
- *Boyce Thompson Institute, An Atlas of the Biological Resources of the Hudson Estuary(Yonkers, 1977). Graphic but technical.*
- *New York State Department of State and The Nature Conservancy, Hudson River Significant Tidal Habitats (Albany: March 1990). A surprisingly readable and comprehensive guide to the river's natural history.*
- *New York State Breeding Bird Atlas - Documenting the distribution of 250 breeding birds in New York State.*

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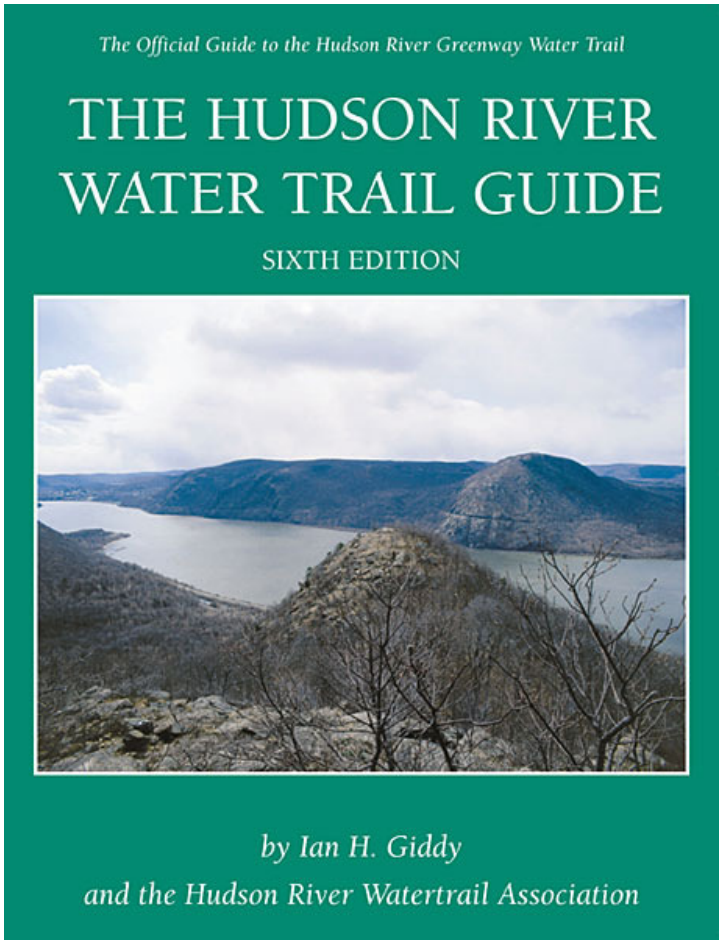

Available at New York Kayak Company
http://shop.nykayak.com/Hudson-River-Water-Trail-Guide_p_28-46.html
Or through Watertrail membership at hrwa.org