

Changing Channels in the Hudson River Estuary:

Understanding Navigation Channel Construction and Consequences for Habitat and Restoration

Daniel Miller- Hudson River Estuary Program



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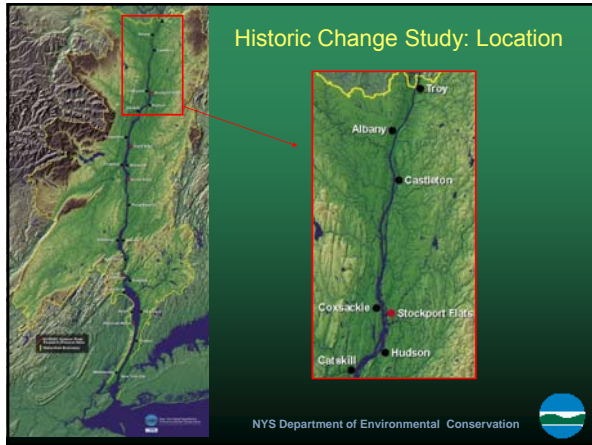


The Hudson River Estuary

- 152 miles from NYC to Albany
- 13,000 mi² watershed
- Rock-framed estuary
- Supports numerous resident and migratory species

•Only sea-level crossing of Appalachians
= Critical Transportation Route for 400 years

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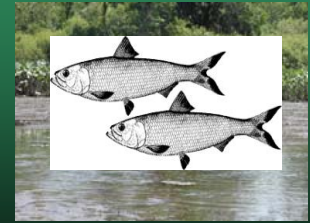


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Vegetated Shallows: Critical Habitats

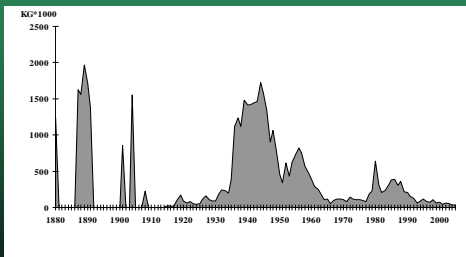
- Biodiversity
- Nutrient cycles
- Sediment budgets
- Critical spawning and refuge habitat
- Important to recovery of declining fishery resources



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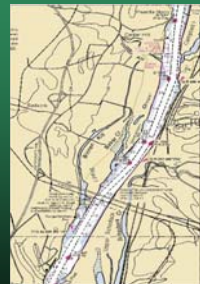
Historic Commercial Fishery Landings of American Shad in the Hudson River Estuary, 1880-2005.



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Today's Upper Hudson River Estuary



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Identifying Historic Conditions

- Maps
- Written Descriptions
- Photographs
- Technical Reports



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United States Army Corps Reports

"In 1819 the available channel between New Baltimore and Albany was 4 feet at mean low water; in 1867 it was 7 ½ feet; in 1878 and 1879 it was 8 ½ feet"



From the Annual Report of the Chief of Engineers, United States Army, To The Secretary of War For The Year 1888

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"Too Many Channels!"

"... this upper section of the river, so far as its history is known to us, has always been obstructed by bars and shoals due to the existence of numerous islands and sloughs, and the consequent diversion of the river water through too many channels"



Randel 1820

USACOE 1888

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Historic Descriptions

"The alluvial "flats" in this neighborhood are wide, and low islands, partly wooded and partly cultivated, divide the river in channels. They stretch parallel with the shores, a considerable distance, and the immense passenger steamers sometimes find it difficult to traverse the sinuous main channel. These, and the tall-masted sloops, have the appearance, from the Castleton shore, of passing through vast meadows, the water that bears them not being visible."



Lossing, Benson J. The Hudson from the wilderness to the sea. (1866)

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19th Century Hudson River Channel Improvement- Flow



"The general system of improvement has been the same throughout, viz, the contraction of the channels by the construction of jetties and dikes intended to deepen them by means of the scour so produced...."

ACOE 1888

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Hudson River Channel "Improvements"

19th Century Flow Modification

- Prior to 1831 NYS Construction of spur dikes and dredging: little improvement
- After 1835-1838- NYS and Federal Government Construct Longitudinal Dikes
- 1863-1867- 6 Additional Longitudinal Dikes Constructed (reliable depth 7 ½ feet)

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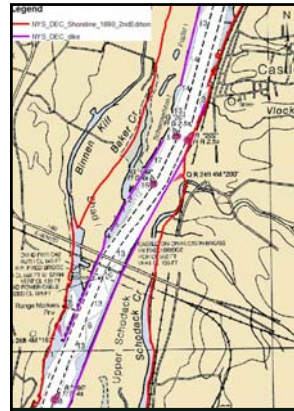


More Hudson River Channel "Improvements"

20th Century Dredging

- 1910- 12-foot deep channel maintenance is extended south approximately 22 miles to Hudson. Additional dredging becomes necessary and more disposal sites are developed.
- 1925-Congress authorizes deepening the original 12 foot channel to 27 feet.
- 1954- Channel is deepened from 27 feet to 32 feet.

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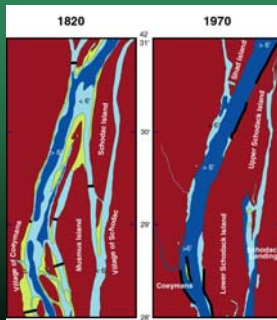
Hudson River Improvement:

- Historic Condition: 1890 ACOE Improvement Charts
- Historic Condition: 1890 Shoreline and Islands
- 19th Century Construction of Longitudinal Dikes
- 20th Century Dredging and Filling
- Modern Hudson River

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Mission Accomplished! The Cost?



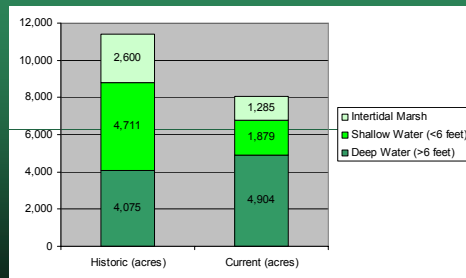
Ladd and Nieder 1996

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- Loss of about 3,000 acres of surface water area
- Loss of 4,000 acres shallow and intertidal habitat
- 71 miles of shoreline eliminated
- Transformation of shallow dominated system to deep dominated system

Habitat Loss and Change in the Upper Hudson River Estuary (RM 110-115)



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Planform Analysis

(Collins and Miller)



- Main channel
- Secondary channel
- Contiguous backwater
- Isolated backwater
- Island



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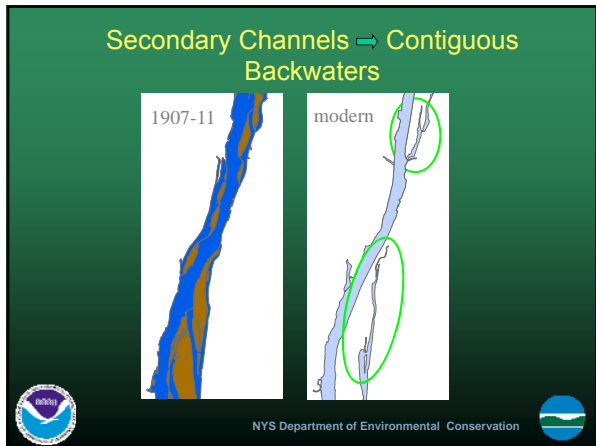
Results –Water Areas (acres)

	Main Channel	Secondary Channels		Tributary Channels	Contiguous Backwaters		Isolated Backwaters		Total Water Area	
	no.	no.	area	no.	no.	area	no.	area	no.	area
1907-11	8,593	14	1,889	59	24	69	1	1.5	40	10,612
modern	6,184	6	527	114	23	802	0	0	30	7,628
change	-2,409	-8	-1,362	55	-1	733	-1	-1.5	-10	-2,984
	-28%	-57%	-72%	93%	-4%	1064%	-100%	-100%	-25%	-28%



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- ### Change Analysis Results
- Many shallow water habitats lost over 20th century in the Athens to Troy reach (≈ 4,000 acres)
 - Loss is in main channel border areas and secondary channels
 - Many secondary channels were converted to lower velocity contiguous backwaters
 - Velocity in main channel was increased
 - Filled secondary channels provide opportunities to restore moderate velocity, shallow water and shoreline habitats
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- ### Secondary Channel Restoration: Advantages
1. Restoration of critical habitats and function
 2. Restoration of structural element that has been eliminated (fringe remains)
 3. Flow regimes can be manipulated (unlike main channel)
 4. Protection of site during recovery (years)
 5. Undeveloped sites
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- Roger's Island/Hallenbeck Creek
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- ### Acknowledgments
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- NYS Department of Environmental Conservation

Thank You

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