Have the "Impediments" to Passage for Migratory Fish on Lower Hudson River Tributaries Changed Over a 15 Year Period?

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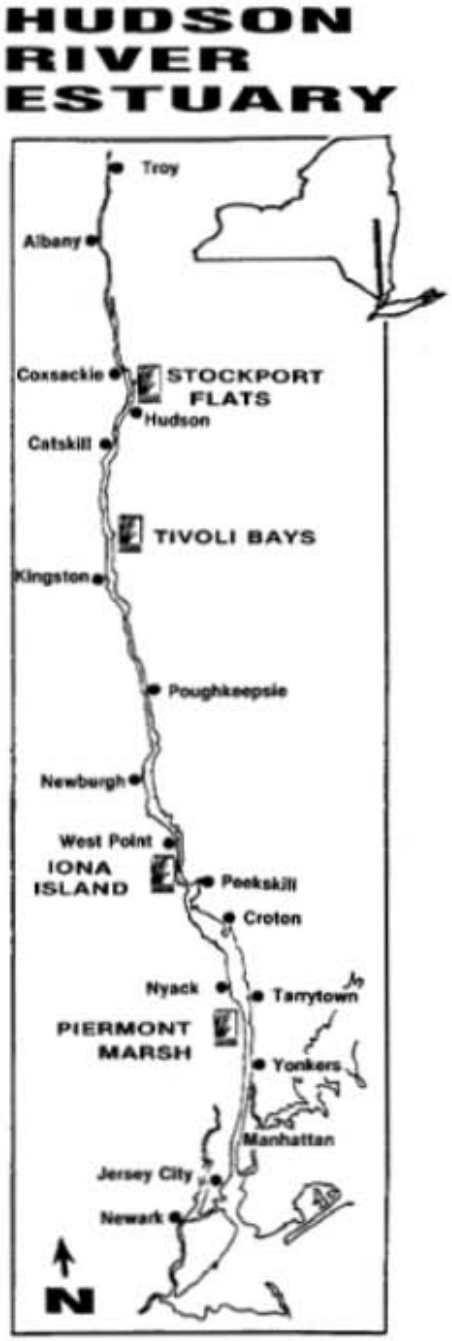
Approach to Hudson River Restoration Planning

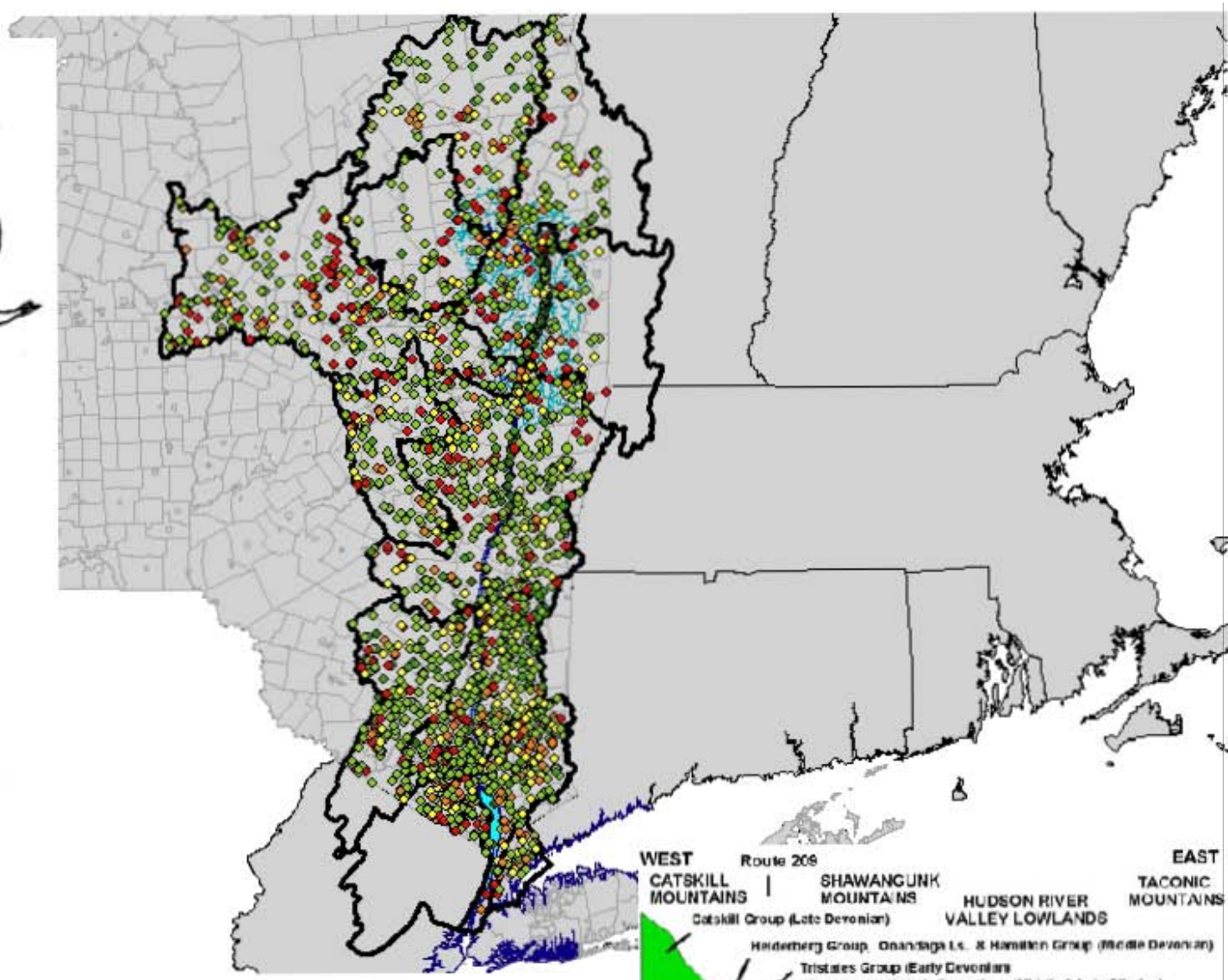
- Past Efforts in the Estuary
- Species of Interest
- NOAA Current Efforts to Categorize Fish Passage Impediments
  - Scope of Effort
  - Tools
  - Proposed Action
- Consideration of Climate Change Predictions

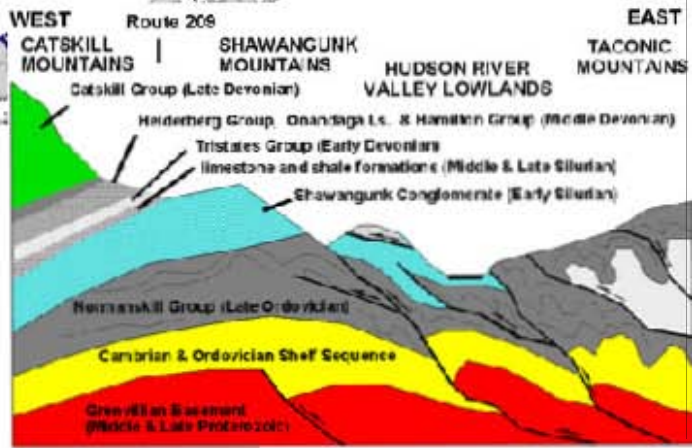
- Objectives
  - Investigate Changes to Fish Passage Impediments and create an Inventory of Barriers for use as a Decision Making Tool.

- Scope of Effort
  - 37 Tributaries
  - Not Limited to First Two Barriers
  - Desktop Tools
    - Google Earth, Bing, Digital USGS 7.5 Series Topographic
    - Digital NYS Dam Inventory
  - Groundtruthing
    - GPS, Video, Photography, Notes

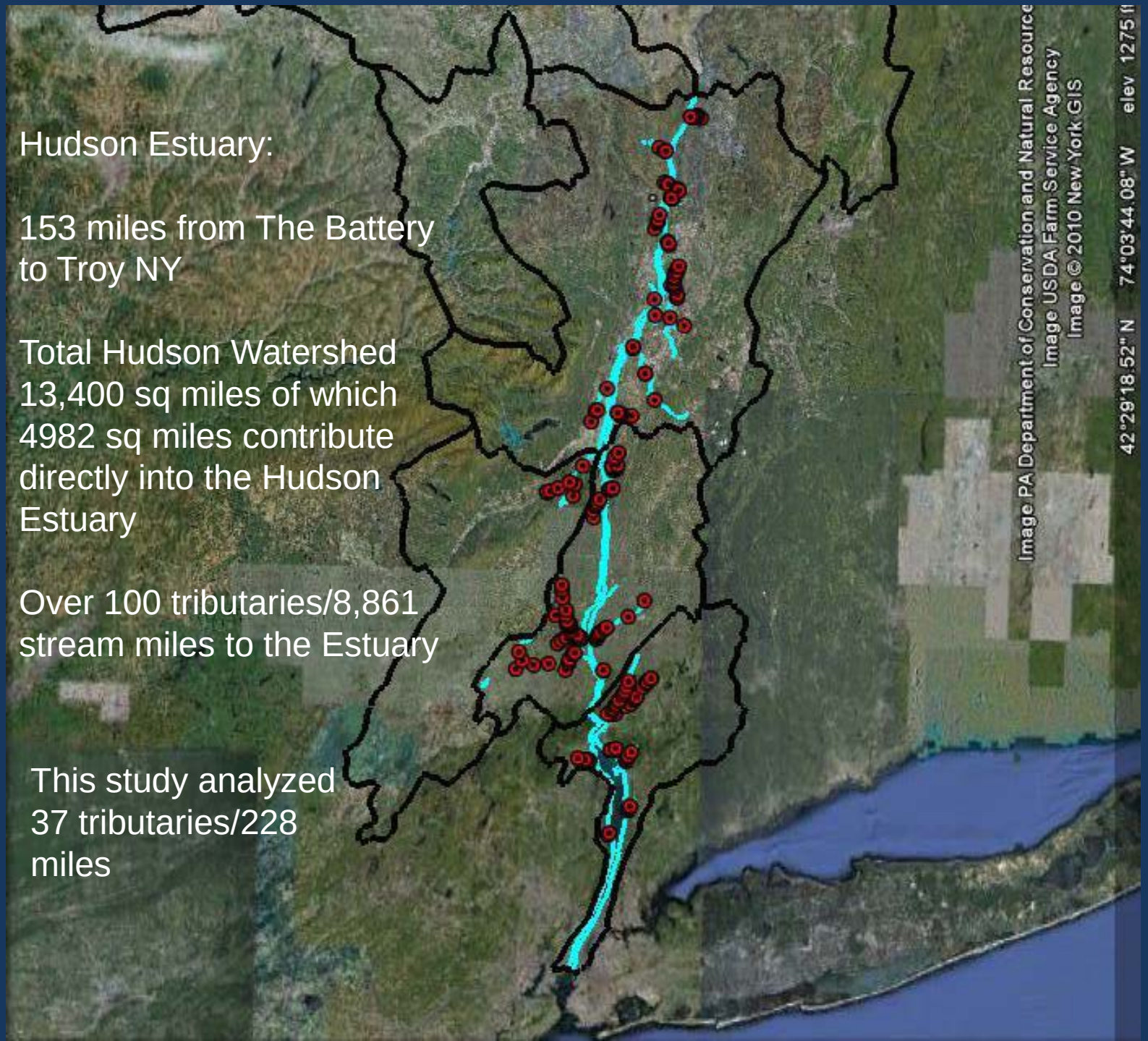
- Proposed Action
  - Dam Removal and Culvert Upgrades Preferred
  - Eelways, Fish Ladders, Rock Ramps





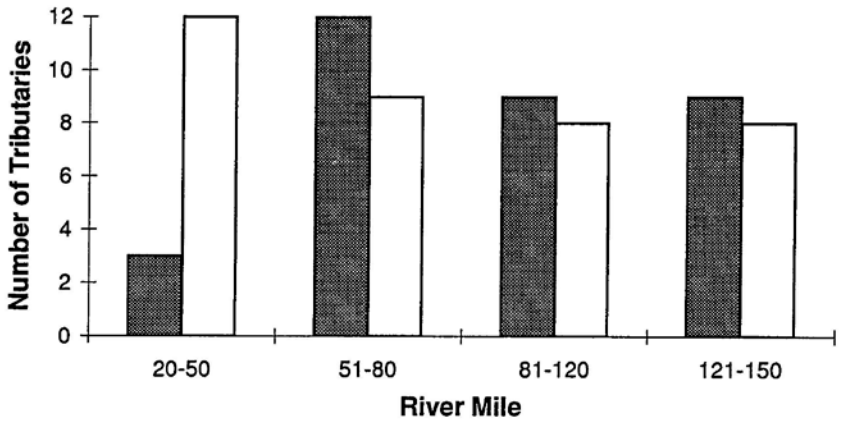


http://www.nysgis.state.ny.us/gisdata/inventories/details.cfm?DSID=1130
http://3dparks.wr.usgs.gov/nyc/valleyandridge/hudsonvalley.htm


Hudson Estuary:
153 miles from The Battery to Troy NY
Total Hudson Watershed 13,400 sq miles of which 4982 sq miles contribute directly into the Hudson Estuary
Over 100 tributaries/8,861 stream miles to the Estuary
This study analyzed 37 tributaries/228 miles
Image PA Department of Conservation and Natural Resource
Image USDA Farm Service Agency
Image © 2010 New York GIS
42°29'18.52" N 74°03'44.08" W elev 1275 ft

Schmidt and Cooper 1996

- Objectives
  - Documented presence, location, magnitude obstructions anadromous fish
  - Primary focus- river herring
- Scope of Effort
  - 68 Tributaries
  - First and Second Barriers
- Proposed Action
  - Top 10 Tribs Id for Enhancement
  - Denil Fish Ladders Man-Made and Natural Barriers



Summary Figure 1. Numbers of tributaries with natural (shaded bars) and artificial (unshaded bars) barriers as the first barrier to upstream migration. The tributaries we visited are grouped into four areas of the Hudson River estuary indicated by the range of river miles.

Summary Figure 2. Hudson River tributaries grouped by priority of enhancement for migratory fishes. A "2" is high priority for enhancement and a "10" is low.

Halavik and Orvis 1998

- Objectives
  - o Investigate impediments to fish spawning
- Scope of Effort
  - o 11 streams
- Proposed Action
  - o Install passage or remove dam

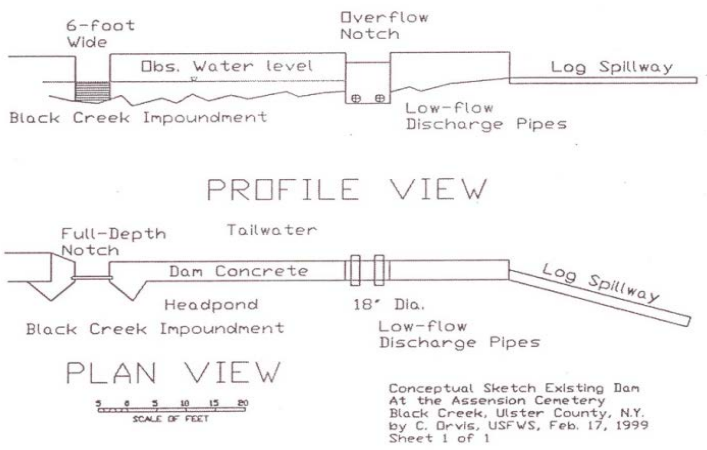
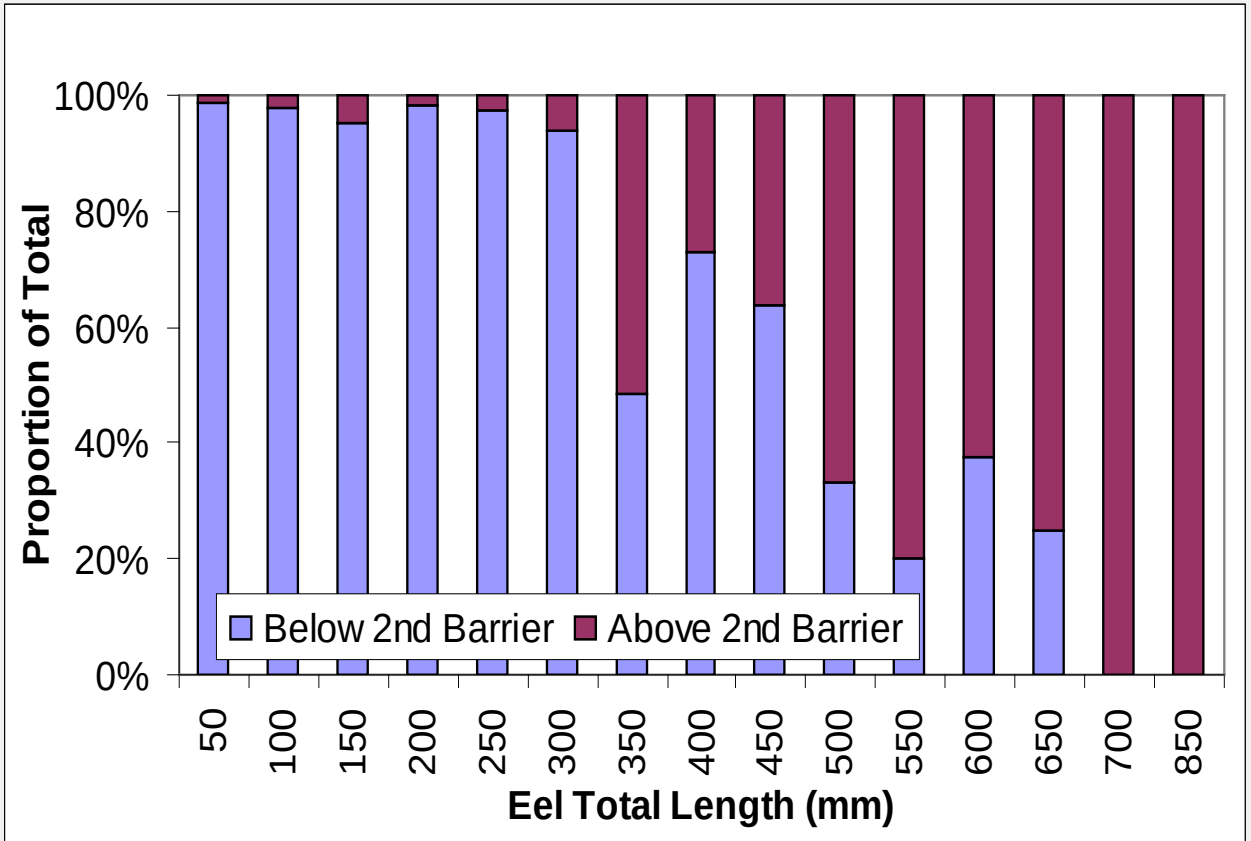


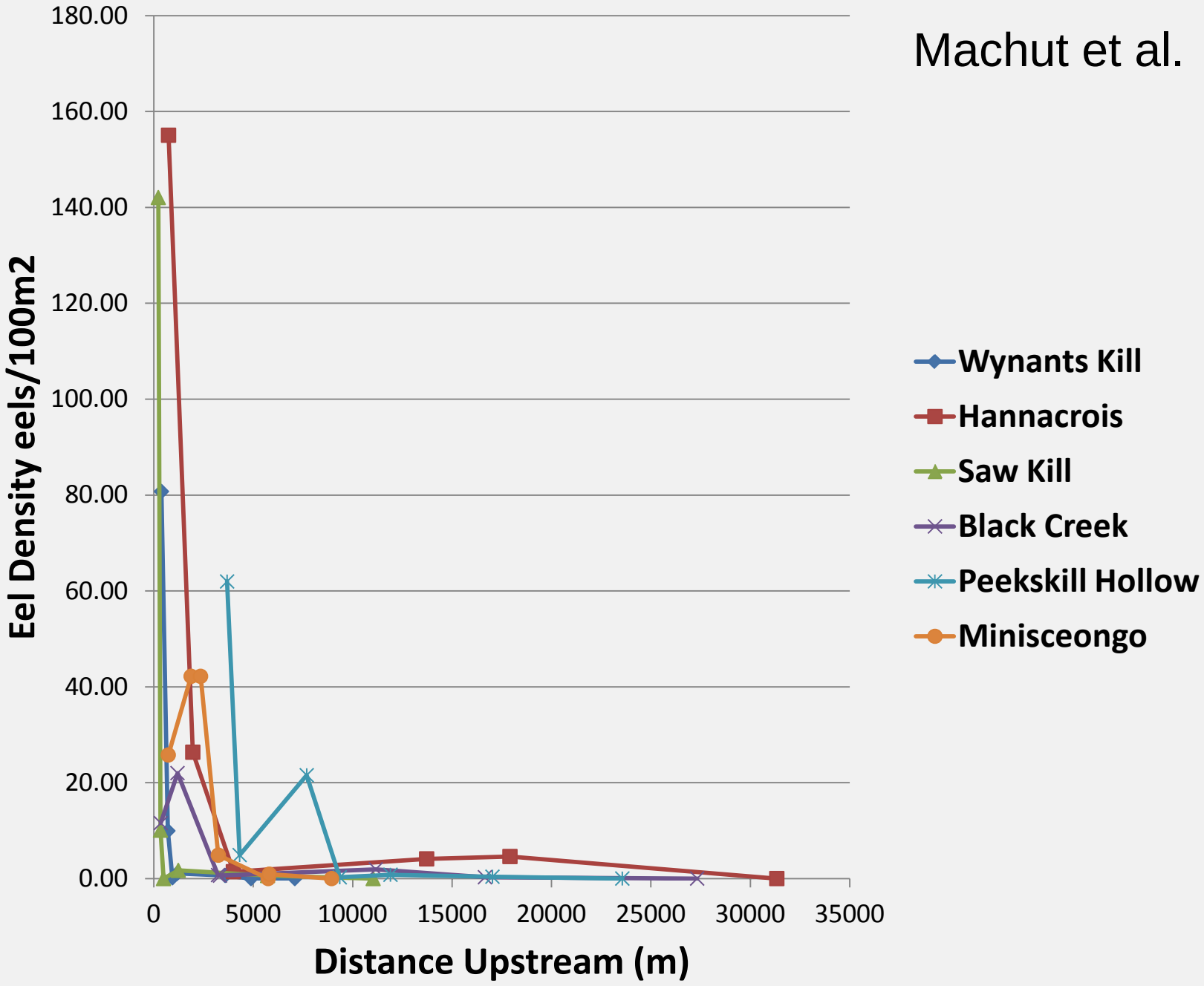
Figure 4 Existing Dam at Black Creek Ulster County, New York

Machut et al. 2007

- Objectives
  - Investigate eel distribution
- Scope of Effort
  - 6 Tributaries < 5 m high
- Findings
  - Tributaries are important nursery area
  - Decreasing density due to barriers



Source: www.fws.gov/northeast/ameel/machutetal.ppt


Machut et al. 2007
180.00
160.00
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
Eel Density eels/100m2
0
5000
10000
15000
20000
25000
30000
35000
Distance Upstream (m)
Wynants Kill
Hannacrois
Saw Kill
Black Creek
Peekskill Hollow
Minisceongo

Anadromous/Catadromous Fish Using Tributaries for Spawning

Anadromous

- American Shad
- Hickory Shad
- Blueback Herring
- Alewife
- Striped Bass
- Rainbow Smelt

Catadromous

- *American Eel*

http://www.dec.ny.gov/animals/52634.html; Levinton and Waldman 2006

Potamodromous Fish Using Tributaries for Spawning

- White sucker

- Smallmouth bass

- White perch

- Yellow perch

- Spottail shiner

- Golden shiner

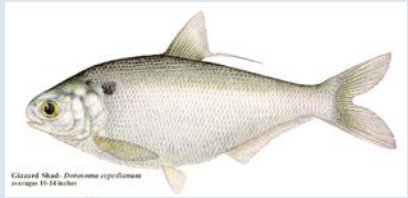
- Carp

- Northern pike

- Walleye

- Shorthead redhorse

- Gizzard Shad



Source: Levinton and Waldman 2006

What are the points to consider in a regional pre-assessment of multiple stream corridors w/multiple stream barriers?

- Even the high tech tools are blunt instruments
- Given limitations, pre-assessment means that only a small subset of data that will eventually be required for feasibility study can be readily obtained.
- Consider the limitations of available data within five areas of Feasibility (Site Control, Political, Regulatory, Cost and Technical)

Technical Evaluation of Barriers

- Were migratory fish present historically?
- What are the current impediments to passage? Can all of the potential barriers to fish passage be identified?
- What is the nature of the barriers? Man-made? Natural Falls? Rock Ledges? Steep slopes and rapids?
- Can fish/eel pass now? Would removal result in passing fish/eel beyond current limitations.
- Can a barrier be moved? Does removal pass fish/eel only seasonally or year-round?
- Does removal benefit protected species/species of concern and how great is the benefit?

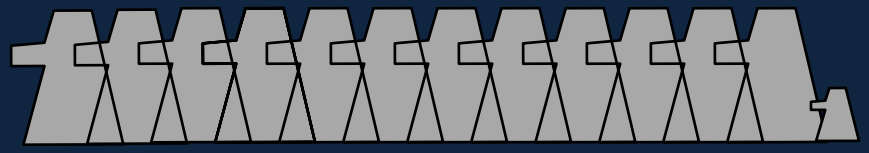
Deliverables of the Study

Database

GIS IDENTIFYING
LOCATION ATTRIBUTES
RESTORATION ATTRIBUTES
HABITAT ATTRIBUTES
SPECIES ATTRIBUTES
OBSTRUCTION ATTRIBUTES
ACRE BENEFITS
CONTACT ATTRIBUTES
COMMENTS AND CONCERNS
PHOTO LINKS

Mapping Product
Video Library
Photo Library
Animations
Development of Prioritization Tool

NOAA STUDY RESULTS



121 Man-made Dams were Identified

107 are intact and un-breached

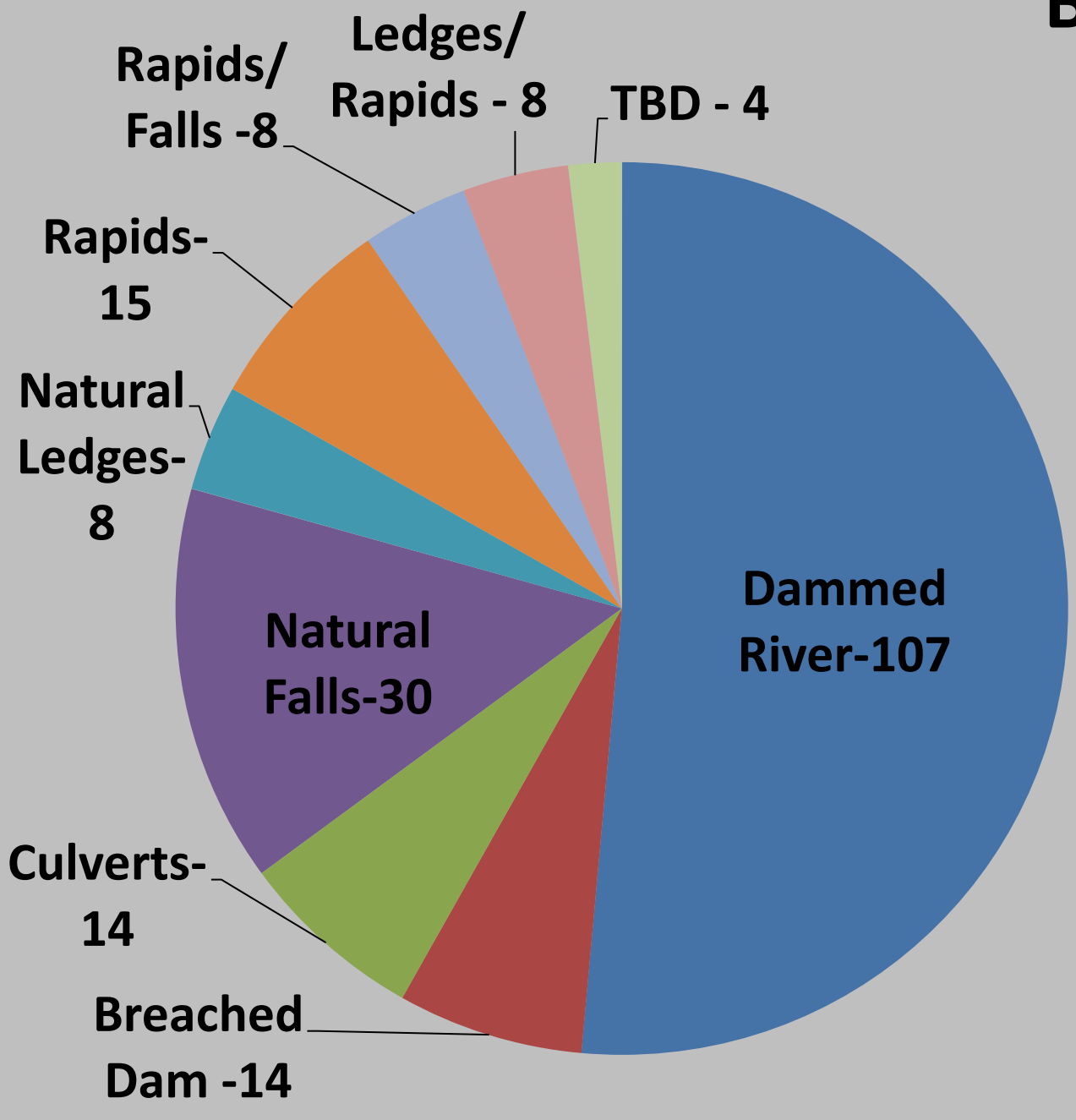
Of the 107, NYSDSD has a record of 55 intact

Of 14 breached dams 6 were recorded in NYSDSD

3 dams breached since Schmidt survey: Furnace Brook, Moodna and Quassaic. At least 1 new culvert and 1 dam constructed since 1995

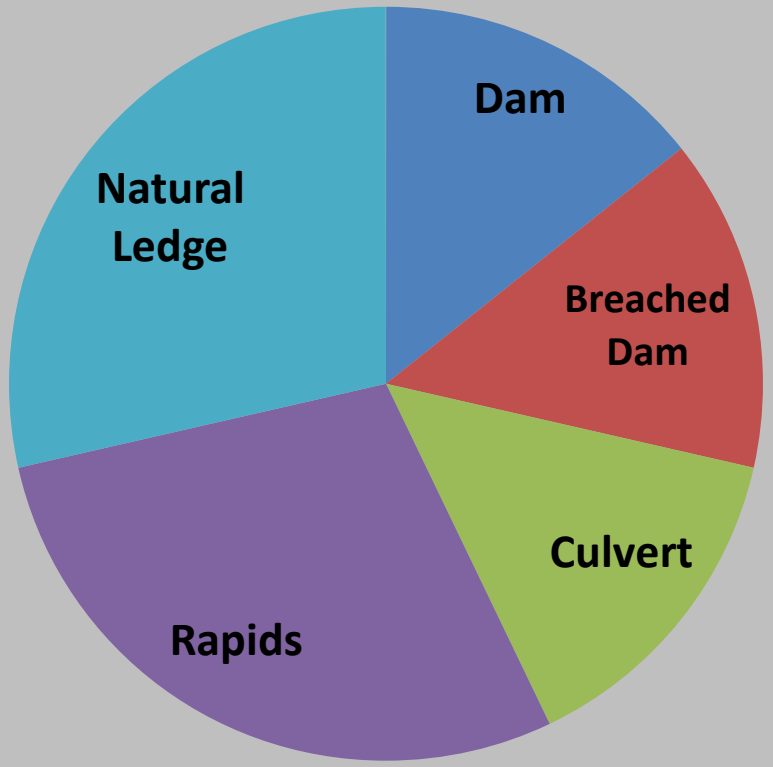
At least 47 dams are confirmed unrecorded by NYSDSD

BARRIER TYPES

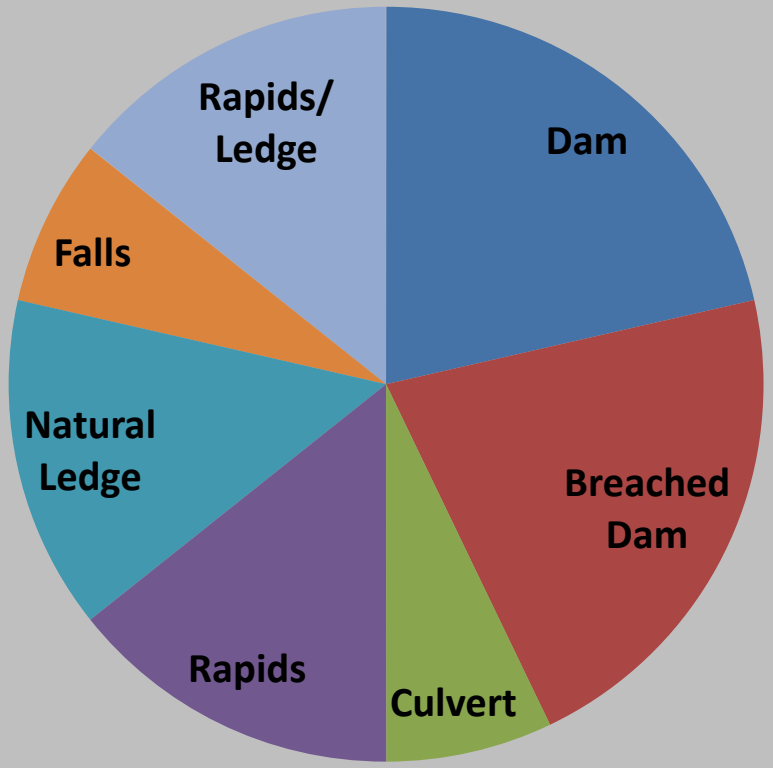


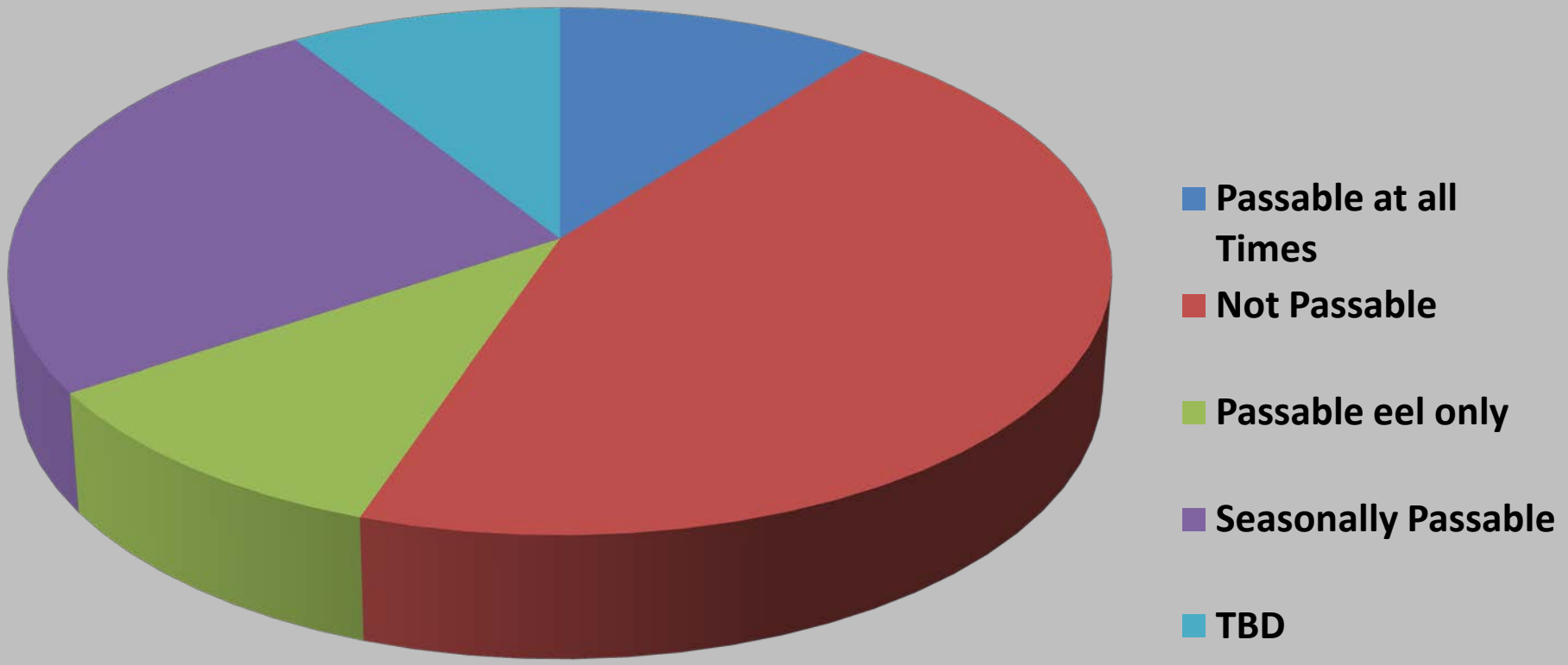
- 37 Tributaries
- 208 Barriers
- 135 Man-made, 69 Natural, 4 TBD
- Dams constructed 1800-1999
- Dam height ranges up to 141 feet
- Spillway width ranges up to 850 feet
- Includes stream segments where slopes exceed 1:20

First Barrier Missed
n=7

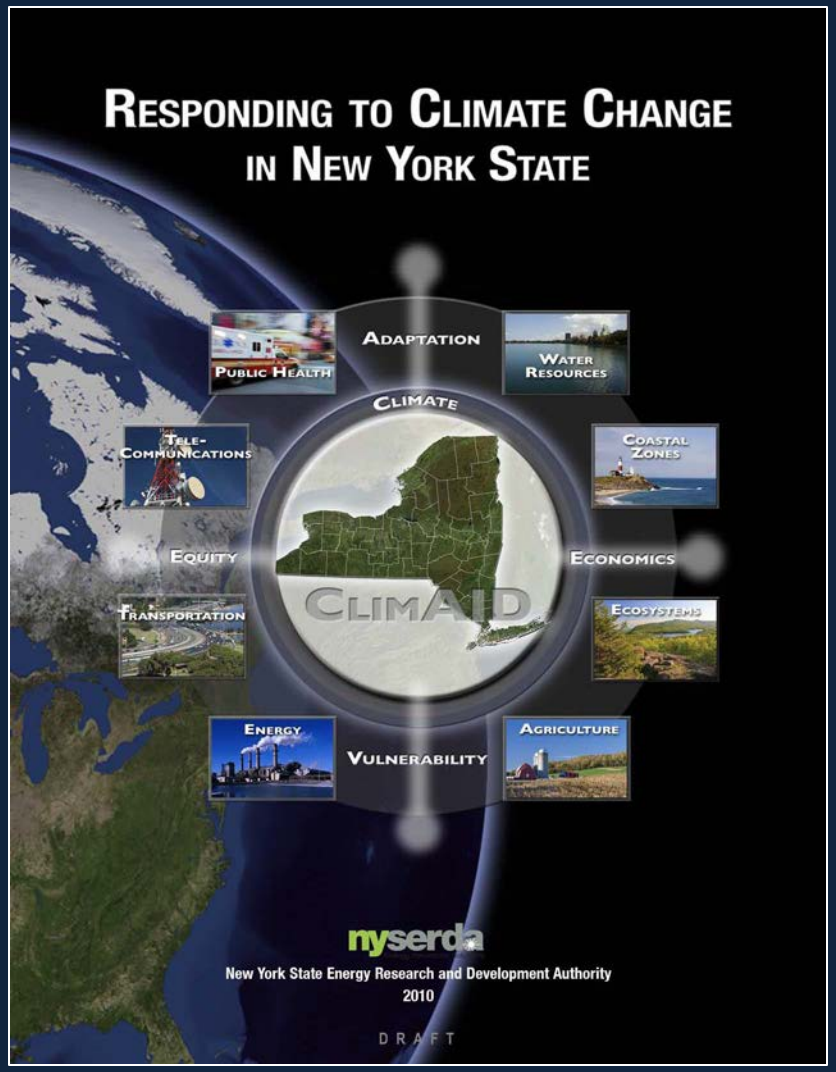


Second Missed Barrier
n=14





Status of First and Second Natural and Man-made Barriers n=68



DRAFT

New York State Sea Level Rise Task Force

Report to the Legislature

Draft for Public Comment

November 2010

Cornell U./NYS Climate Modeling

HEC-RAS modeling

- tributary flow level, sea level rise, storm surge
- Analyzed 0, 2 and 4 ft SLR scenarios at Battery

Findings

- Existing 5 ft tidal range in estuary may increase up to 0.5 feet for 4 ft of SLR in the mid to upper estuary
- For every 1 ft elevation gain at Battery there is a comparable 1 ft rise at Albany (bathtub effect)
- Deeper estuary due to sea level rise
- Storm surge is often slow relative to dynamics of estuary so a 1 ft storm surge results in an approximately 1 ft rise throughout estuary.

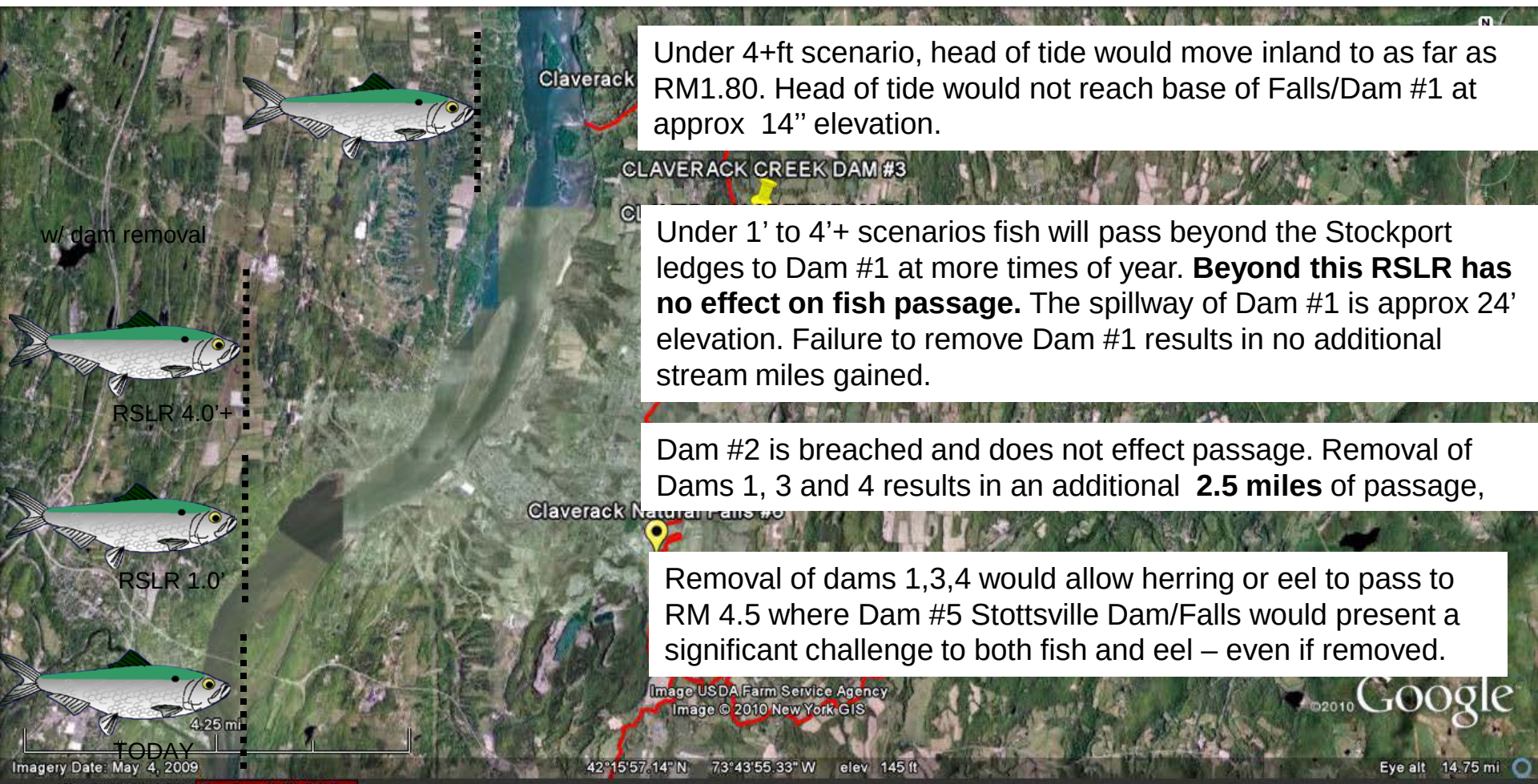
Source: Stedinger, Yi and Marcell 2010;
http://ciceet.unh.edu/progressreports/2010/3_2010/blair08/index.html

Assumptions for our Change Analysis

- Increased Incursion of Head of Tide in Tributaries due to Sea Level Rise
- Selected 1 ft and 4 ft scenarios for examination of SLR effects on tributaries between 2050-2080.
- Increased Flows in Tributaries due to Increased Precipitation and Intensity – requires modeling (not within scope)

Claverack Creek

4 intact dams
2 breached dams

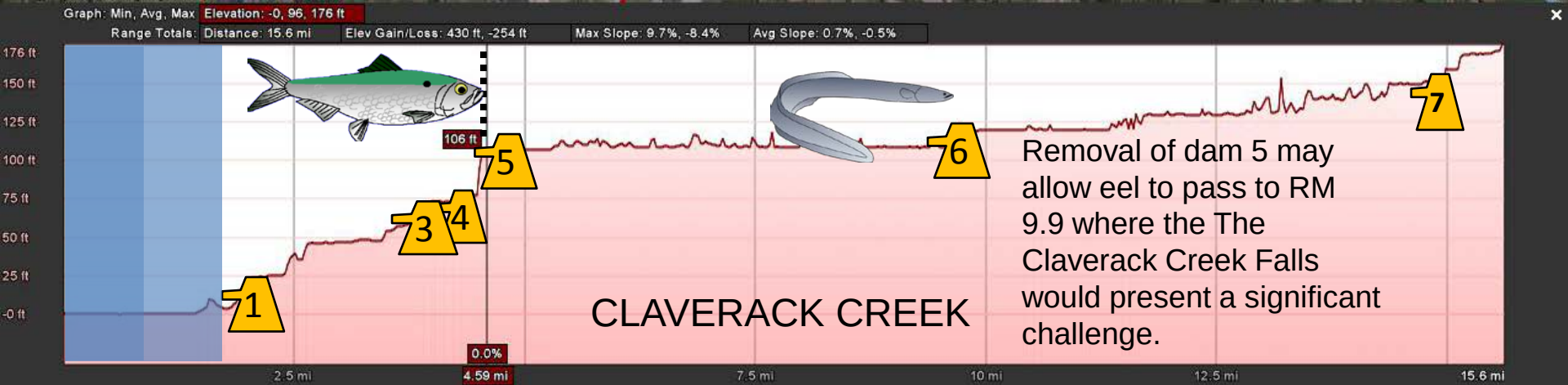


Under 4+ft scenario, head of tide would move inland to as far as RM1.80. Head of tide would not reach base of Falls/Dam #1 at approx 14'' elevation.

Under 1' to 4'+ scenarios fish will pass beyond the Stockport ledges to Dam #1 at more times of year. **Beyond this RSLR has no effect on fish passage.** The spillway of Dam #1 is approx 24' elevation. Failure to remove Dam #1 results in no additional stream miles gained.

Dam #2 is breached and does not effect passage. Removal of Dams 1, 3 and 4 results in an additional **2.5 miles** of passage,

Removal of dams 1,3,4 would allow herring or eel to pass to RM 4.5 where Dam #5 Stottsville Dam/Falls would present a significant challenge to both fish and eel – even if removed.



Removal of dam 5 may allow eel to pass to RM 9.9 where the The Claverack Creek Falls would present a significant challenge.

Sprout Brook

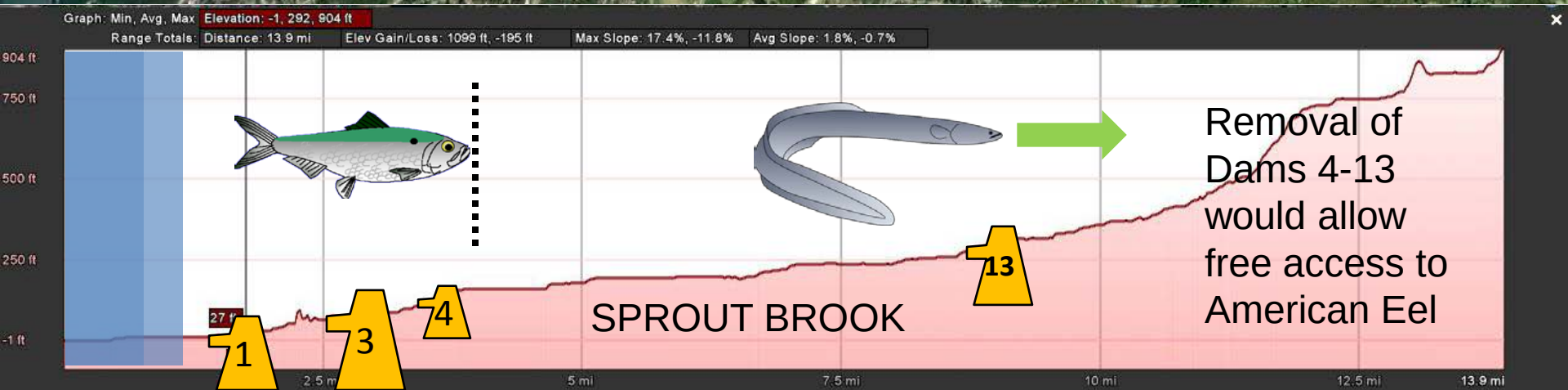
Total 13 dams, including 2 on top of natural ledges

Under the high RSLR prediction Head of Tide would move inland (distance uncertain (0.10-0.25 miles). Dam #1 is 3' high and the base of Dam #1 at El 24'. **The Dam and Fish passage beyond the Dam would be unaffected by RSLR.**

Failure to remove the 1st dam results in no additional stream miles gained.

Assuming that the Cortland Lake Dam(#3) 15' in height remains in place, removal of Dams 1 & 2 results in no more than an additional **1.22 miles** of passage.

The removal of Dam 3 & 4 would allow river herring movement to a location approx RM 3.75 where a series of natural ledges at a gradient >5% would conservatively preclude their movement further.



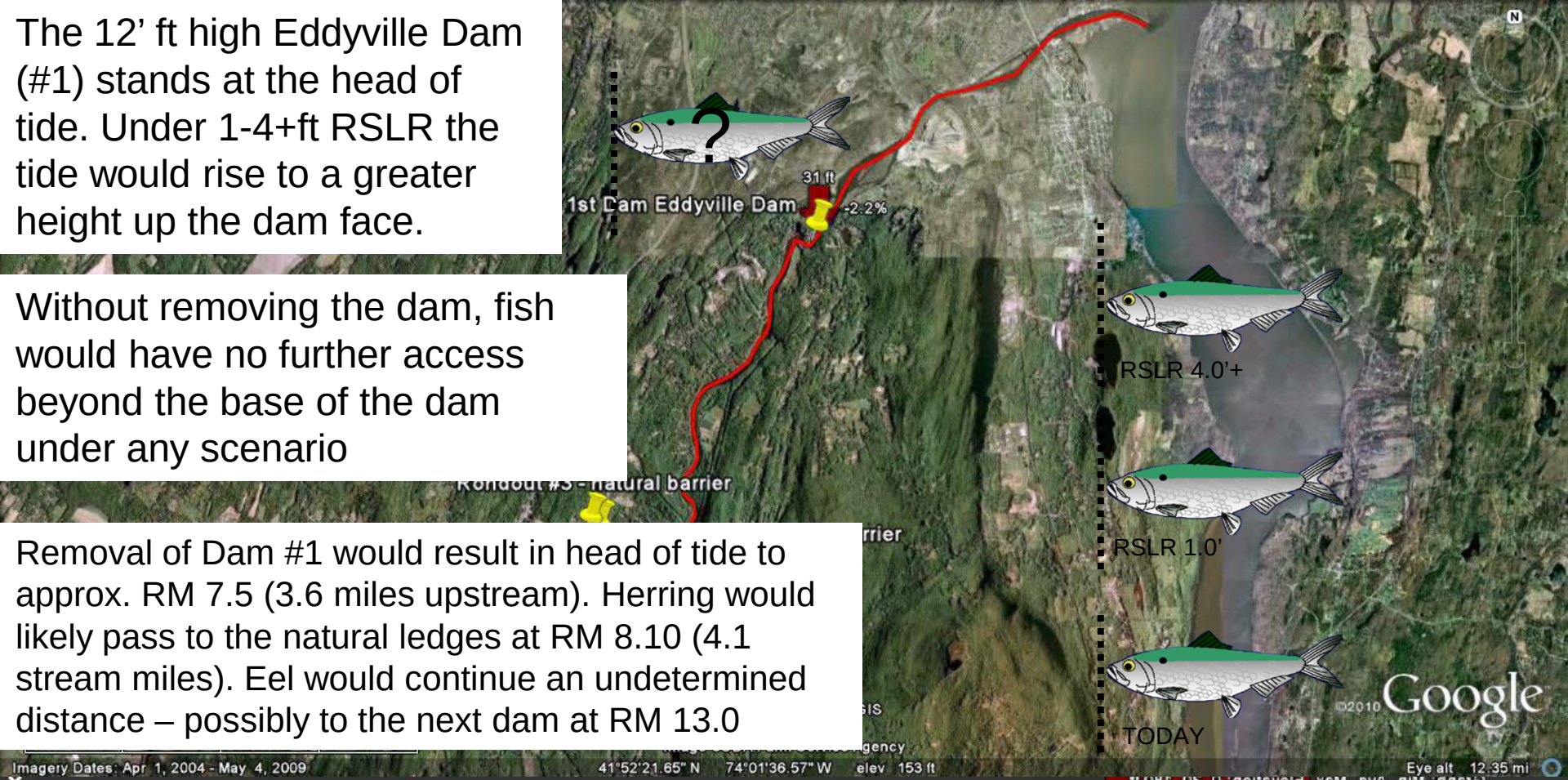
Roundout Creek

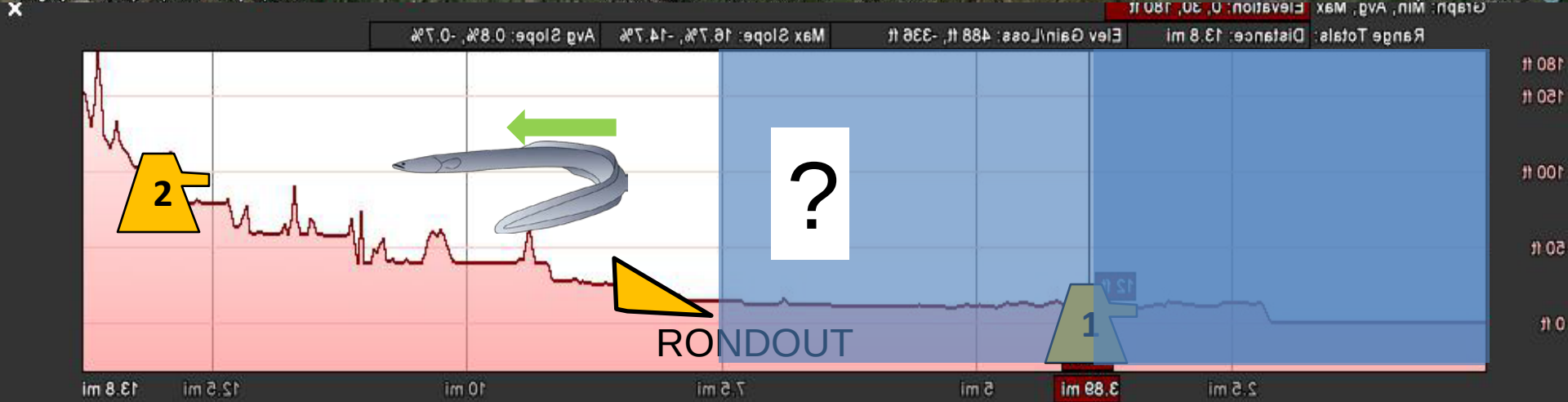
Dams, ledges, falls

The 12’ ft high Eddyville Dam (#1) stands at the head of tide. Under 1-4+ft RSLR the tide would rise to a greater height up the dam face.

Without removing the dam, fish would have no further access beyond the base of the dam under any scenario

Removal of Dam #1 would result in head of tide to approx. RM 7.5 (3.6 miles upstream). Herring would likely pass to the natural ledges at RM 8.10 (4.1 stream miles). Eel would continue an undetermined distance – possibly to the next dam at RM 13.0





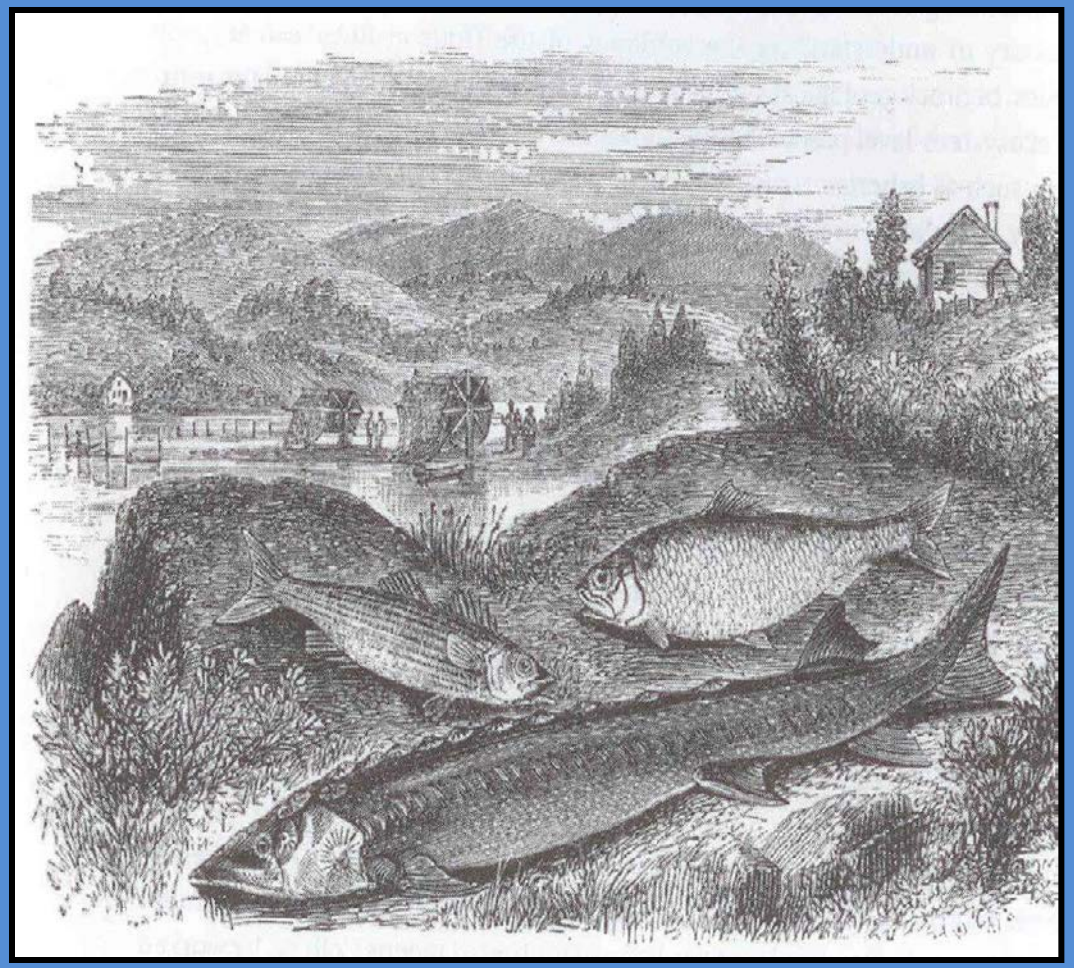
Conclusions of the Change Analysis

- Digital desktop tools were a factor in the identification of impediments downstream of the 1st and 2nd barriers identified in earlier studies.
- 93 barrier visits were made, primarily at the 1st and 2nd dams. Desktop tools allowed us to "visit" an additional 113 dams. A better picture emerged of the overall habitat and potential ecologic uplift to be provided by the tributary.
- An additional barrier category emerged from the study: Reaches where slopes exceed >3-5%. Though crude, the accuracy and precision of the tools carries enough weight to allow the flagging of these locations of concern.
- Availability of High tech, low resolution tools such as the Google Earth Elevation Tool greatly assist in large scale planning but carry a warning of caution to the user!

Conclusions of Climate Change Analysis

- RSLR Relative Sea Level Rise under NYS Clim-AID Scenarios are not a significant factor in decision to recommend an action to remove a dam or employ a fish passage structure

- Predicted Increases of Rainfall Intensity are likely to have a critical effect in the near future (2050). Likely to have deleterious effects on older, less structurally sound dams –and should be considered a factor in calling for the removal of a dam structure.



River, take me along,
In your sunshine, sing me a song
Ever moving and winding and free;
You rolling old river, you changing old river
Lets you and me, river, go down to the sea.

Source: Bill Staines in Levinton and Waldman 2006