



Department of  
Environmental  
Conservation

# The Mohawk River as a “reference” river for ecological and contaminant studies on the Hudson River: Density and Abundance of Mink

Sean Madden

NYS Department of Environmental Conservation

March 18, 2016

The opinions expressed in this presentation are those of the author, and they do not necessarily represent the official positions of the Department of Environmental Conservation, New York State, or the Hudson River Natural Resource Trustees

## Hudson River Natural Resource Damage Assessment

- assess, and **restore** or replace natural resources injured by hazardous substances to provide for the public's use and enjoyment.
- Past, present, and future

The Trustees =



different from...

- EPA: Superfund – clean up hazardous substances to protect the environment and public health.
- Present and future



## Injury vs. Damage

Injury: "...a measurable adverse change, long or short-term, in the chemical or physical quality or viability of a natural resource, directly or indirectly from exposure to hazardous substance..."

Damages = \$ = Restoration  
 responsible party is liable for  
 compensating the public for  
 injured natural resources

**Women under 50 and children under 15 should not eat ANY fish or crabs from the Hudson River from the Cortland Dam to the Battery**

**Men over 15 and women over 50 should follow the advice listed on this page:**

**Upstream of the Rt. 9 Bridge**  
 Visit [www.health.ny.gov/fish](http://www.health.ny.gov/fish) for this advice.

**Upper Hudson**  
 From the Rt. 9 Bridge to Troy Dam  
 Do not eat fish from the Route 9 Bridge to the Troy Dam.  
 From Baker's Falls to the Troy Dam, New York's State Department of Environmental Conservation's "catch and release" regulations apply.  
**Take No Fish. Eat No Fish.**

**Mid Hudson**  
 From Troy Dam to Bridge at Catskill  
 Eat up to one meal a month:  
 Rock bass, Blackchin shiner, Yellow perch.  
**Do not eat other fish from the Mid Hudson including striped bass.**

**Lower Hudson**  
 From Bridge at Catskill to the NYC Battery

**Don't eat:** White catfish, Channel catfish, American eel, Ground sardine.

**Eat up to one meal a month:** Striped bass, White perch, Carp, Walleye, Bluefish, Brown bullhead, Sanddollar herring, Longnose herring.

**Eat up to six crabs a week:** Blue crab. Do not eat the tomalley (green stuff, roe) or waste cooking water.

**Eat up to four meals a month:** All other species.

\*NYC regulations prohibit taking American eel for food from the Hudson River.

The health advice also applies to tributaries and connected waters if there are no dams, falls or barriers to stop the fish from moving upstream.

## Baseline or “reference”

### NRD – restoration is the ultimate goal

- Restore injured resources to “baseline”
- “the condition or conditions that would have existed at the assessment area had the discharge of oil or release under investigation not occurred.” 43 C.F.R. § 11.14(e).

How to measure baseline?

- Long-term datasets – rare that they predate release
- Reference areas



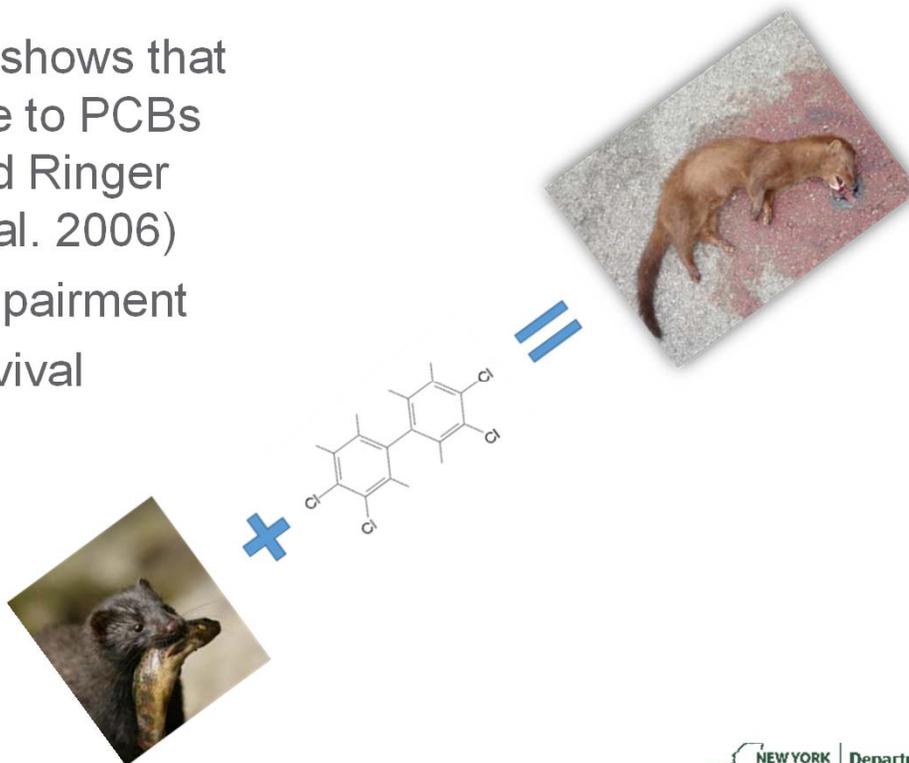
Department of  
Environmental  
Conservation



## Why mink?

Research clearly shows that mink are sensitive to PCBs (e.g., Aulerich and Ringer 1977, Bursian et al. 2006)

- Reproductive impairment
- Reduced kit survival
- Jaw lesions



# Hudson River Mink



Table 1. Frequency (percent) of mink and otters with PCB levels equal to or greater than specific PCB criteria of Leonards *et al.* (1994) and Smit *et al.* (1996) for animals collected from towns adjacent to the Hudson River between Hudson Falls and Troy.

Spp.	Collection Area	Sample Size	Proposed Safe Level ( $\geq 9 \mu\text{g}$ total PCBs/g lipid)	EC <sub>50</sub> for Health Impairment ( $\geq 21 \mu\text{g}$ total PCBs/g lipid)	EC <sub>50</sub> for Reproductive Impairment ( $\geq 50 \mu\text{g}$ total PCBs/g lipid)
Mink	Towns between Hudson Falls and Troy	35	10 (29)	6 (17)	2 (6)
Mink	< 1 km from Hudson River within towns between Hudson Falls and Troy	12	7 (58)	6 (50)	2 (17)
Otter	Towns between Hudson Falls and Troy (all collected < 10 km from Hudson River)	4	4 (100)	3 (75)	2 (50)

Table 2. Comparison of catch per unit effort for mink for locations within the upper Hudson River drainage,

1999-2000 season

Location	Number of Mink	Adjusted Trap-Nights	Catch/1000 Trap-Nights
Sites within 6 km of the Hudson River, south of Fort Edward	10	2828	3.5
Sites north of Hudson Falls or, if south, > 6 km from the Hudson River	21	801	26.2

Mayack and Loukmas 2001

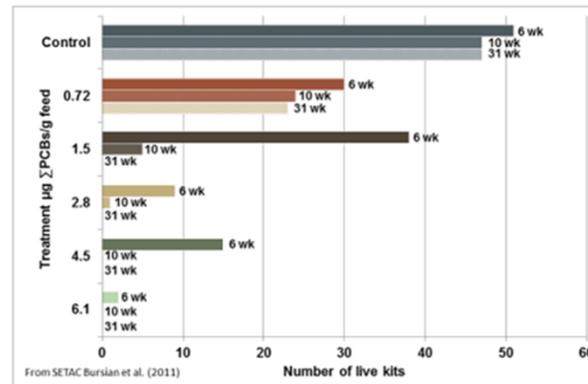
## Mink Feeding Study - 2006

Michigan State University

- Reproductive performance and offspring survival and growth were adversely affected by consumption of feed containing PCBs derived from fish collected from the Hudson River
- Jaw lesions were prevalent in adult mink consuming feed containing PCBs derived from fish collected from the Hudson River



Offspring Mortality Between 6 and 31 Weeks of Age

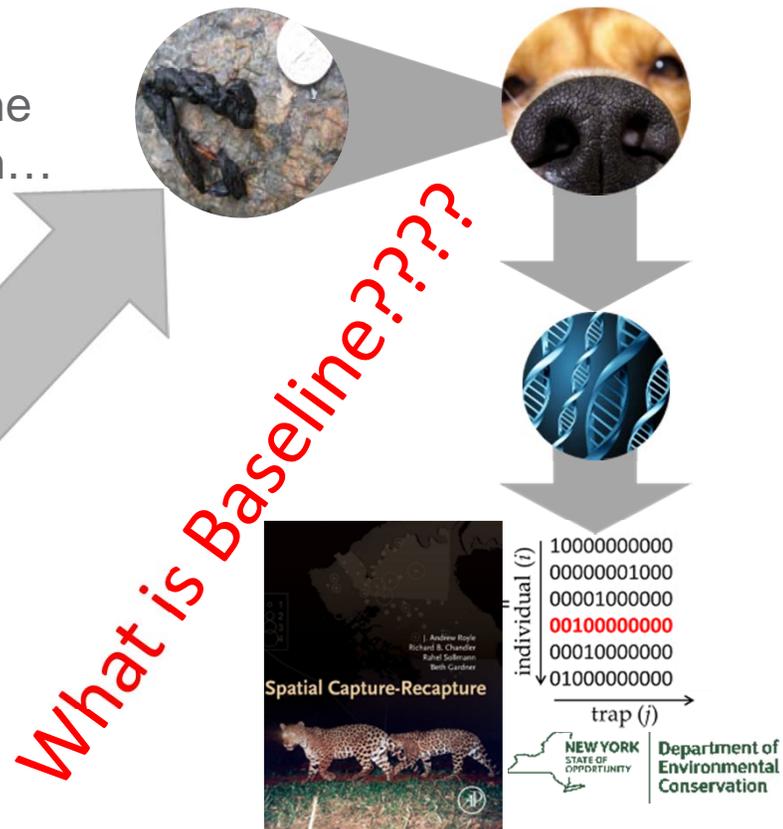


## How does that translate into the field?

The confluence of three advancing techniques in the field of ecological research...



Graphic courtesy of C. Sutherland



## A reference river for the upper Hudson?

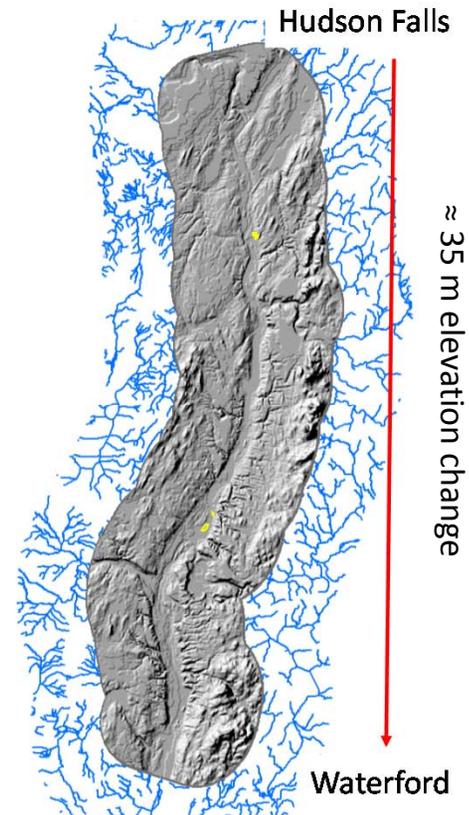
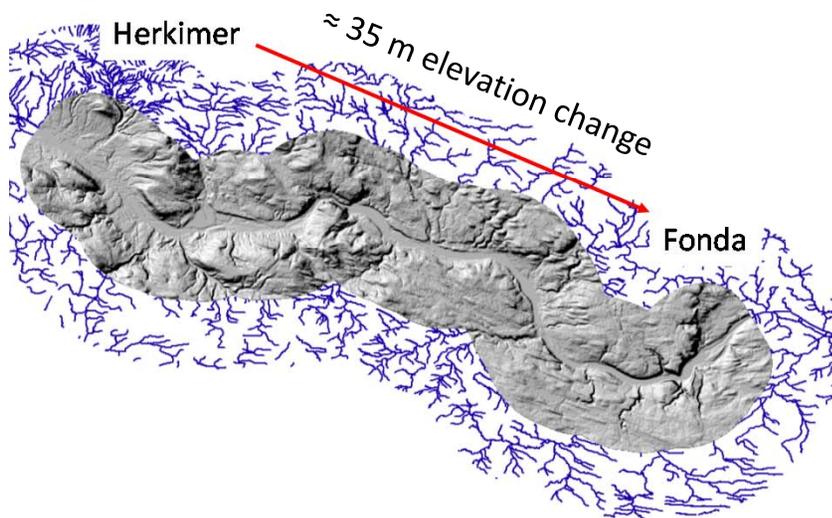
Mohawk River – a reasonable choice?

Upper Hudson drainage =  
11,987 km<sup>2</sup>

Mohawk drainage =  
9011 km<sup>2</sup>

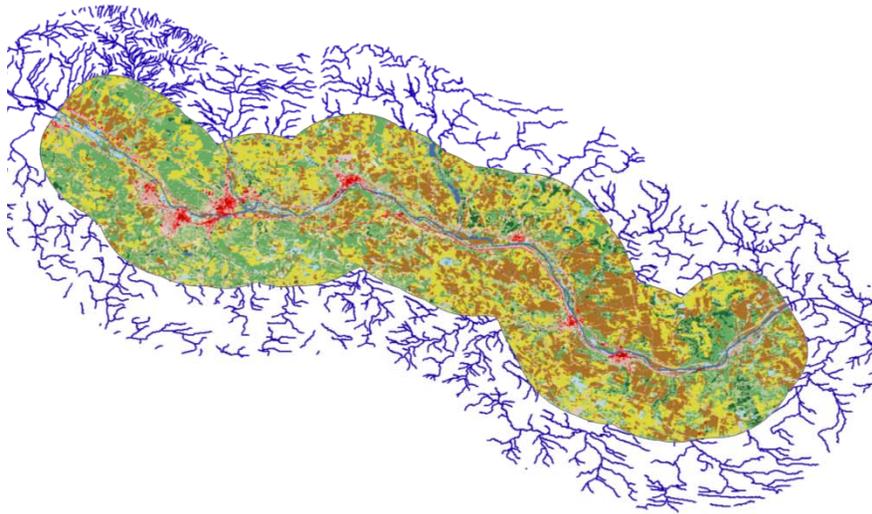


# Hudson vs. Mohawk Elevation

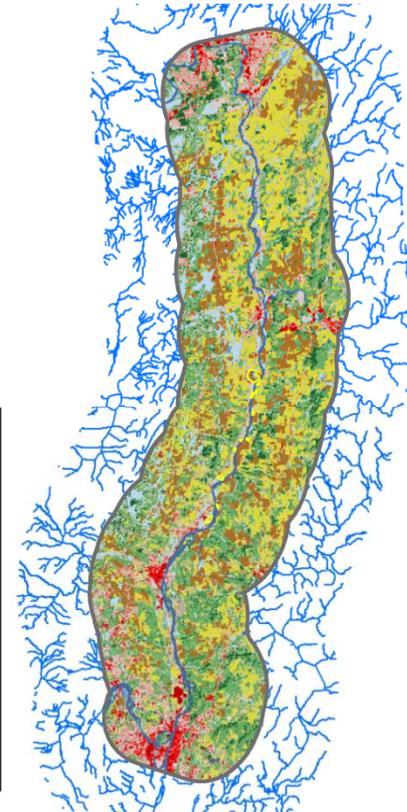


10 m hill shade

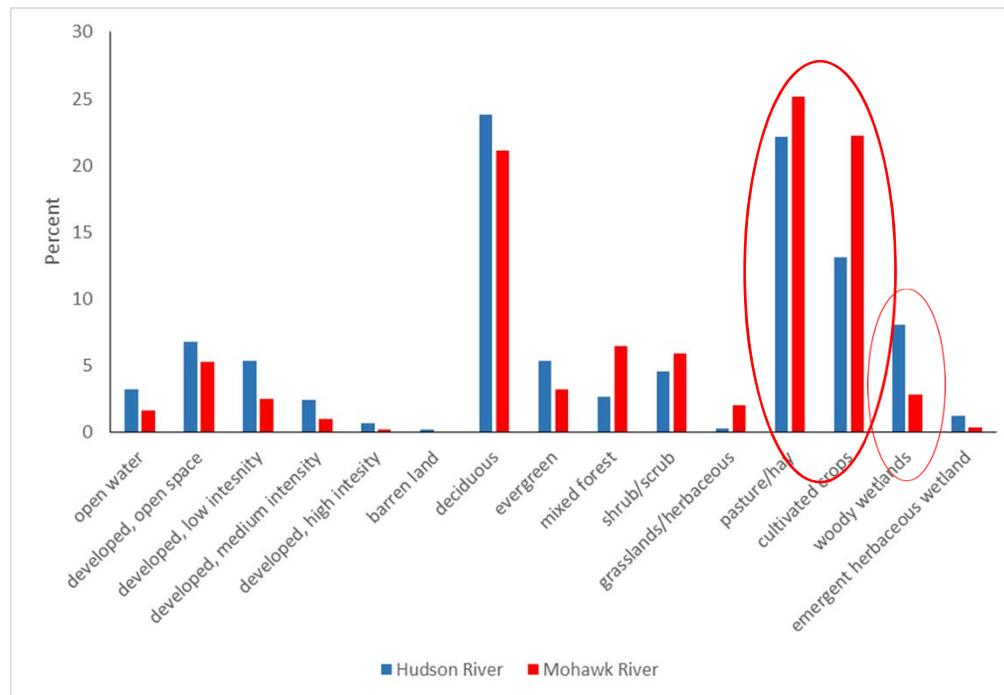
## Hudson vs. Mohawk Land use



NLCD 2011 - 30 m



## Hudson vs. Mohawk Land use



## Hudson vs. Mohawk NYS Canal System



Mohawk River study area—  
dams/locks = 6  
pools = 6

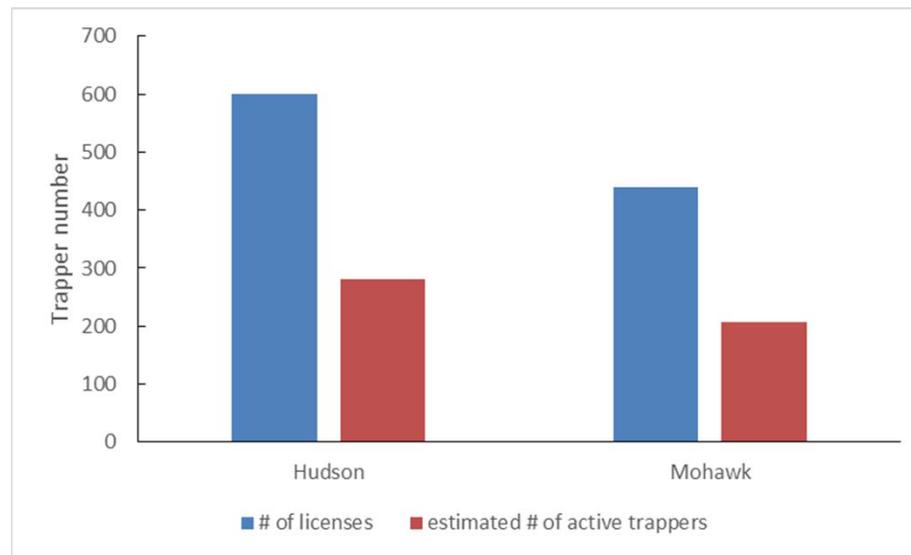
Hudson River study area –  
dams/locks = 6  
pools = 6



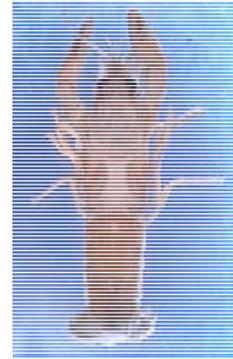
## Hudson vs. Mohawk Trappers by county (2010-2011)

Hudson = Rensselaer, Saratoga, Washington

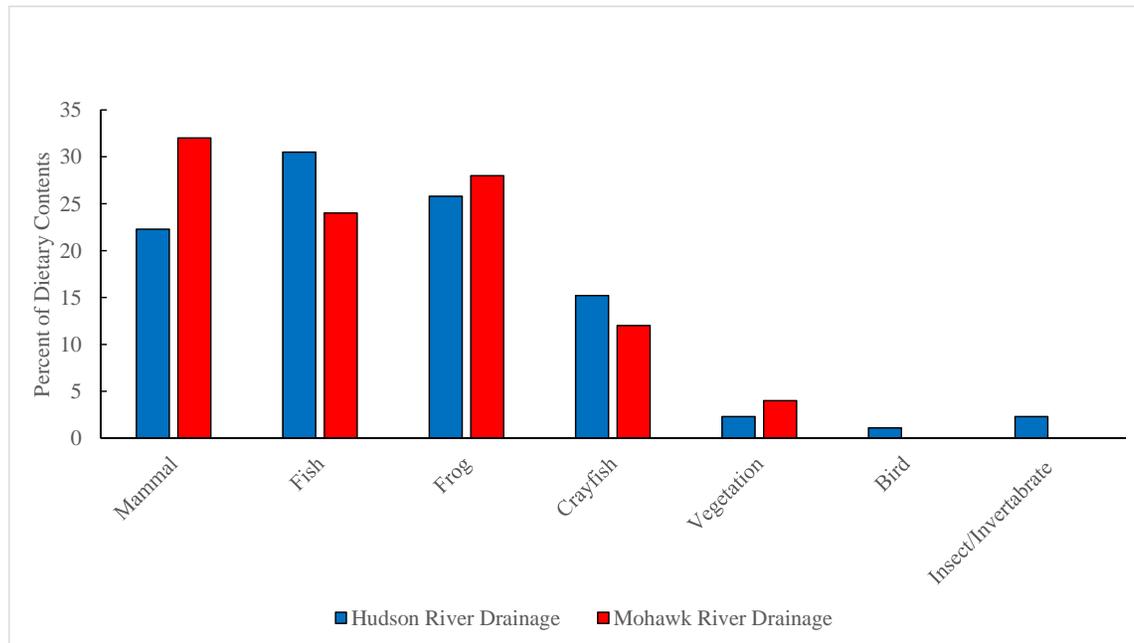
Mohawk = Fulton, Montgomery, Herkimer



## Hudson vs. Mohawk Prey



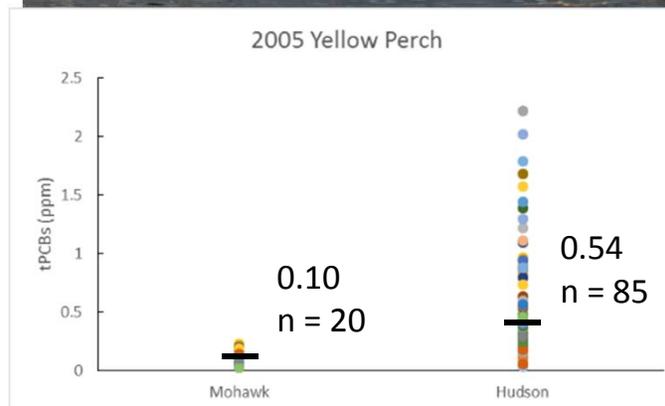
## Hudson vs. Mohawk Stomach contents



Data from NYSDEC (unpublished)

## Hudson vs. Mohawk Contamination

- Mohawk not “pristine” but a good representation of what you would find in a large river with an agricultural and industrial past...
- Like the upper Hudson absent the releases from Hudson Falls and Ft. Edward
- 1993 estimate of PCB loadings
- over the Federal Dam (TAMS 1997)
  - Hudson = 90%
  - Mohawk = 10%





## Hudson Sites

2012 = 28

2013 = 74

2014 = 76



## Mohawk Sites

2012 = 28

2013 = 68

2014 = 76

## Publications

From the pilot study 2012

- Sutherland et al. 2014. Modelling non-Euclidean movement and landscape connectivity in highly structured ecological networks. *Methods in Ecology and Evolution*
- Fuller et al. In Press. Estimating population density and connectivity of American mink using spatial capture-recapture. *Ecological Applications*. (accepted manuscript online 11/02/2015)

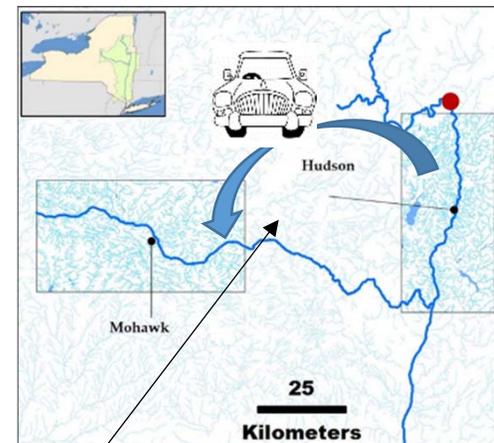
Awaiting final results from 2013 and 2014...

## Is it a perfect reference?

Well no...



But...a reasonable and justifiable choice when you factor in the similarities and logistics.



Hale Creek field lab

## Partners



<http://www.fws.gov/northeast/ecologicalservices/ HUDSON.html>

<https://darrp.noaa.gov/hazardous-waste/HUDSON-RIVER>

<http://www.dec.ny.gov/lands/25609.html>

## References

Aulerich RJ, Ringer RK. 1977. Current status of PCB toxicity to mink, and effect on their reproduction. *Arch Environ Contam Toxicol* 6:279–292.

Bursian SJ, Sharma C, Aulerich RJ, Yamini B, Mitchell RR, Orazio C, Moore D, Sivirski S, Tillitt DE. 2006. Dietary exposure of mink (*Mustela vison*) to fish from the Housatonic River, Berkshire County, Massachusetts, USA: Effects on reproduction and kit growth and survival. *Environ Toxicol Chem* 25:1533-1540.

Bursian, S. J., J. Kern, J. E. Link, and S. D. Fitzgerald. 2013. Dietary Exposure of Mink (*Mustela vison*) to Fish from the Upper Hudson River, New York, USA: Effects on Reproduction, Offspring Growth and Mortality. *ET&C* 32:780-793.

Hudson River Natural Resource Trustees (HRNRT). 2012. Study Plan for Mink Injury Determination: Investigation of Mink Abundance and Density Relative to Polychlorinated Biphenyl Contamination within the Hudson River Drainage, Hudson River Natural Resource Damage Assessment. Public Release Version. Final. July 13, 2012, 2012. U.S. Department of Commerce, Silver Spring, MD.

Mayack, D. T. and J. Loukmas. 2001. Progress report on Hudson River Mammals: Polychlorinated Biphenyl (PCB) levels in mink, otter, and muskrat and trapping results for mink, the upper Hudson River drainage, 1998-2000. Bureau of Habitat, Division of Fish, Wildlife and Marine Resources, New York State Department of Environmental Conservation. Albany, NY.

Royle, J. A., R. B. Chandler, R. Sollmann, and B. Gardner. 2013. Spatial Capture-Recapture. Academic Press/Elsevier. 612 pages.



## Thank You

- Sean Madden
- Biologist 2(Ecology)
- 625 Broadway, Albany, NY  
12233
- [Sean.madden@dec.ny.gov](mailto:Sean.madden@dec.ny.gov)

### Connect with us:

Facebook: [www.facebook.com/NYSDEC](http://www.facebook.com/NYSDEC)

Twitter: [twitter.com/NYSDEC](https://twitter.com/NYSDEC)

Flickr: [www.flickr.com/photos/nysdec](http://www.flickr.com/photos/nysdec)