



PINELANDS RESEARCH SERIES

“2013 Biomonitoring of Mercury in the Absecon Creek and Atlantic City Reservoir System”

THOMAS HUPF
Superfund Program Manager
at the FAA William J. Hughes Technical Center

**February 18, 2015
10 - 11 a.m.**

Pinelands Commission, Richard J. Sullivan Center, 15 Springfield Road, New Lisbon, NJ

The Pinelands Research Series provides a forum for scientists to present their research and is a free event that is open to the public and hosted by the New Jersey Pinelands Commission.

For research series: <http://www.state.nj.us/pinelands/science/pinseries/>
For directions: <http://www.state.nj.us/pinelands/about/direct/>

Photo: chain pickerel - one of the fish species monitored for mercury



Area of Concern U – Mercury Contamination



Mercury Source Wetland Seeps





**2013 Biomonitoring of Mercury
in the Absecon Creek and
Atlantic City Reservoir System
By Thomas H Hupf**

**Federal Aviation
Administration
William J. Hughes
Technical Center**



Biota Monitored

- **SBAC**

- Isopods (2005 – 2013)
- Odonates (2006 – 2012)
- N. Long-eared Bats (2006 – 2012)
- Forage Fish (2002, 2009 - 2013)

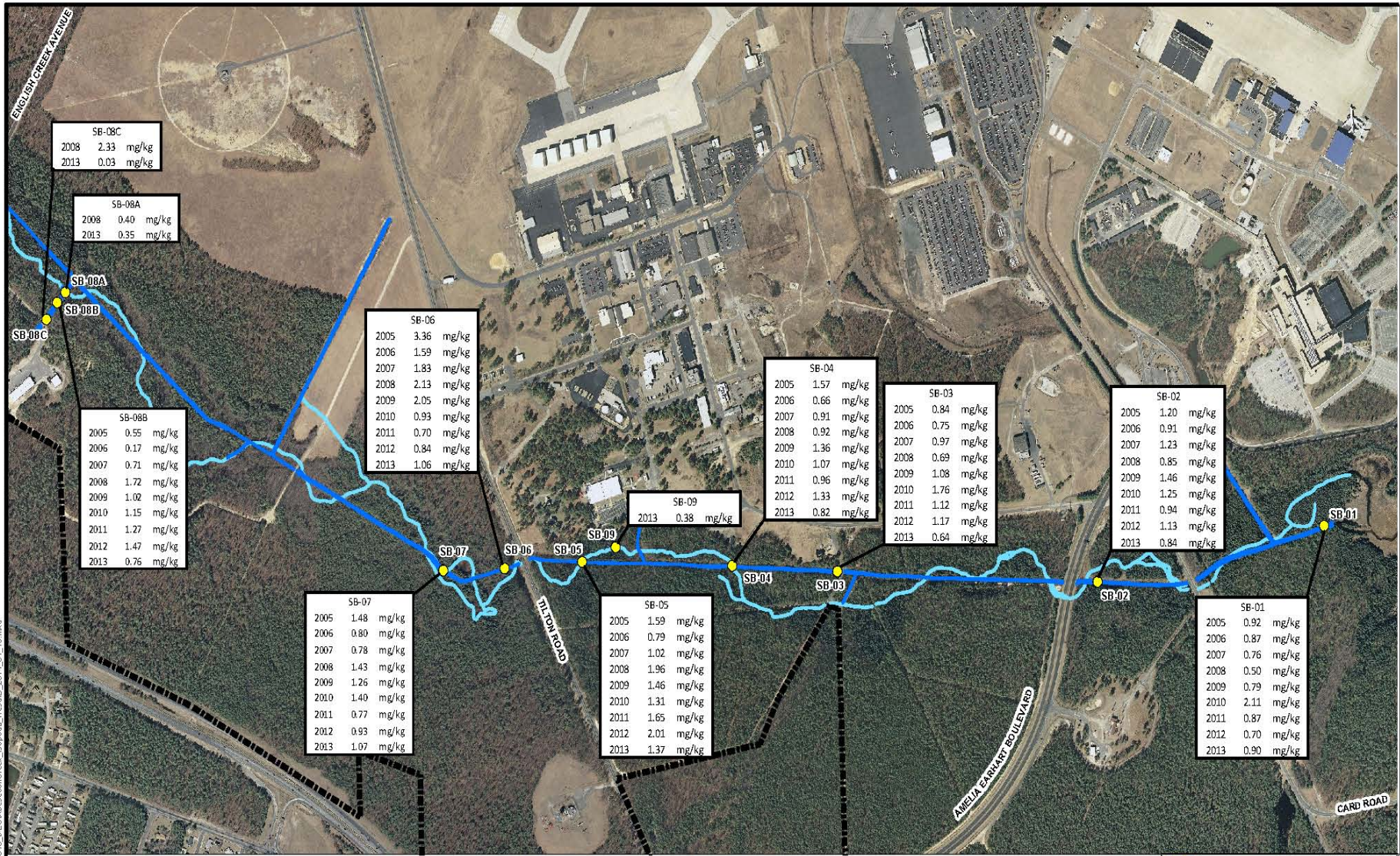
- **Upper/Lower Reservoirs**

- Zooplankton (2004 - 2013)
- Forage Fish (2002, 2004 – 2013)
- Average-Sized Fish - 4 Species (2004 – 2013)
- Large Fish – 2 Species (2002, 2009, 2013)
- Tree Swallow Eggs (2004 – 2009; 2012, 2013)

Mean Concentrations (mg/kg wet weight) of MeHg within Isopods, SBAC, 2005 - 2013



- No significant overall trend
- Significantly decreasing trend since 2009



E:\Projects\GIS_200402188_FAA\2013_DECO\Assesson\Creek_Isopoda_Results_2014_01_15.mxd

SB-08C	
2008	2.33 mg/kg
2013	0.03 mg/kg

SB-08A	
2008	0.40 mg/kg
2013	0.35 mg/kg

SB-08B	
2005	0.55 mg/kg
2006	0.17 mg/kg
2007	0.71 mg/kg
2008	1.72 mg/kg
2009	1.02 mg/kg
2010	1.15 mg/kg
2011	1.27 mg/kg
2012	1.47 mg/kg
2013	0.76 mg/kg

SB-06	
2005	3.36 mg/kg
2006	1.59 mg/kg
2007	1.83 mg/kg
2008	2.13 mg/kg
2009	2.05 mg/kg
2010	0.93 mg/kg
2011	0.70 mg/kg
2012	0.84 mg/kg
2013	1.06 mg/kg

SB-04	
2005	1.57 mg/kg
2006	0.66 mg/kg
2007	0.91 mg/kg
2008	0.92 mg/kg
2009	1.36 mg/kg
2010	1.07 mg/kg
2011	0.96 mg/kg
2012	1.33 mg/kg
2013	0.82 mg/kg

SB-03	
2005	0.84 mg/kg
2006	0.75 mg/kg
2007	0.97 mg/kg
2008	0.69 mg/kg
2009	1.08 mg/kg
2010	1.76 mg/kg
2011	1.12 mg/kg
2012	1.17 mg/kg
2013	0.64 mg/kg

SB-02	
2005	1.20 mg/kg
2006	0.91 mg/kg
2007	1.23 mg/kg
2008	0.85 mg/kg
2009	1.46 mg/kg
2010	1.25 mg/kg
2011	0.94 mg/kg
2012	1.13 mg/kg
2013	0.84 mg/kg

SB-09	
2013	0.38 mg/kg

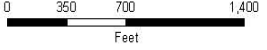
SB-07	
2005	1.48 mg/kg
2006	0.80 mg/kg
2007	0.78 mg/kg
2008	1.43 mg/kg
2009	1.26 mg/kg
2010	1.40 mg/kg
2011	0.77 mg/kg
2012	0.93 mg/kg
2013	1.07 mg/kg

SB-05	
2005	1.59 mg/kg
2006	0.79 mg/kg
2007	1.02 mg/kg
2008	1.96 mg/kg
2009	1.46 mg/kg
2010	1.31 mg/kg
2011	1.65 mg/kg
2012	2.01 mg/kg
2013	1.37 mg/kg

SB-01	
2005	0.92 mg/kg
2006	0.87 mg/kg
2007	0.76 mg/kg
2008	0.50 mg/kg
2009	0.79 mg/kg
2010	2.11 mg/kg
2011	0.87 mg/kg
2012	0.70 mg/kg
2013	0.90 mg/kg

Legend

- Isopoda Sample (Stream Gage)
- SBAC Main Channel
- 1957 SBAC Stream Channel
- FAA Property Line



Note: Orthoimagery, New Jersey Office of Geographic Information Systems, 2007

TRC Environmental Corporation
 21 Griffin Road North
 Windsor, CT 06095
 (860) 298-9692

FAA WILLIAM J. HUGHES TECHNICAL CENTER
 ATLANTIC CITY AIRPORT, NEW JERSEY 08405
 AREA U - BIOMONITORING STUDY

**ISOPODA SAMPLING RESULTS
 SOUTH BRANCH ABSECON CREEK**

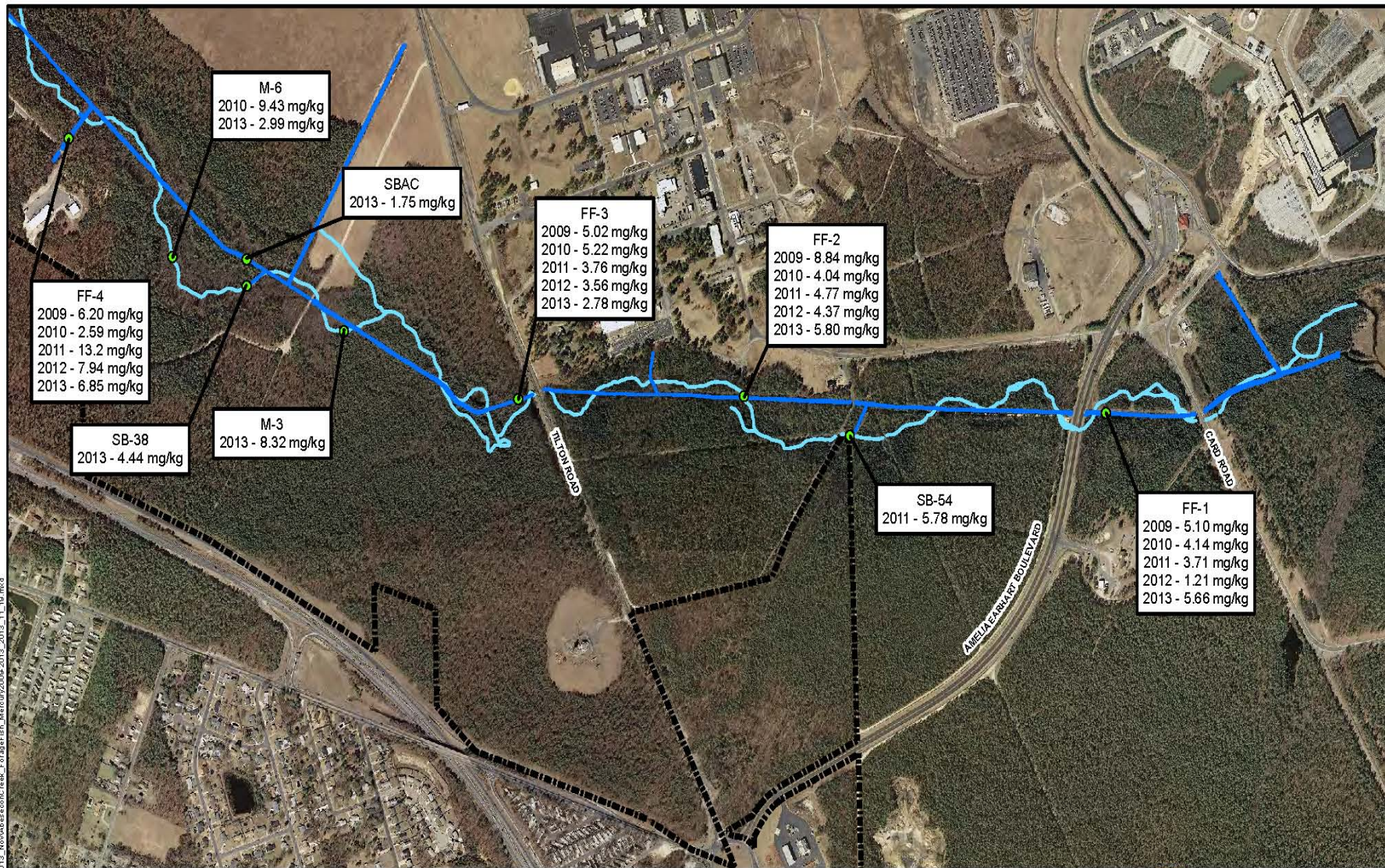
Figure 3-4 Date: 12/13 Project No: 16.2662-0100-0562

Mean Concentrations (mg/kg wet weight) of Hg within Forage Fish, SBAC, 2002 and 2009 - 2013



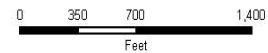
- No significant trends overall or since 2009

R:\Projects\VIS_2004\02185_FAA\2013_Nov\AbseconCreek_ForageFish_Mercury\2009-2013_11_19.mxd



Legend

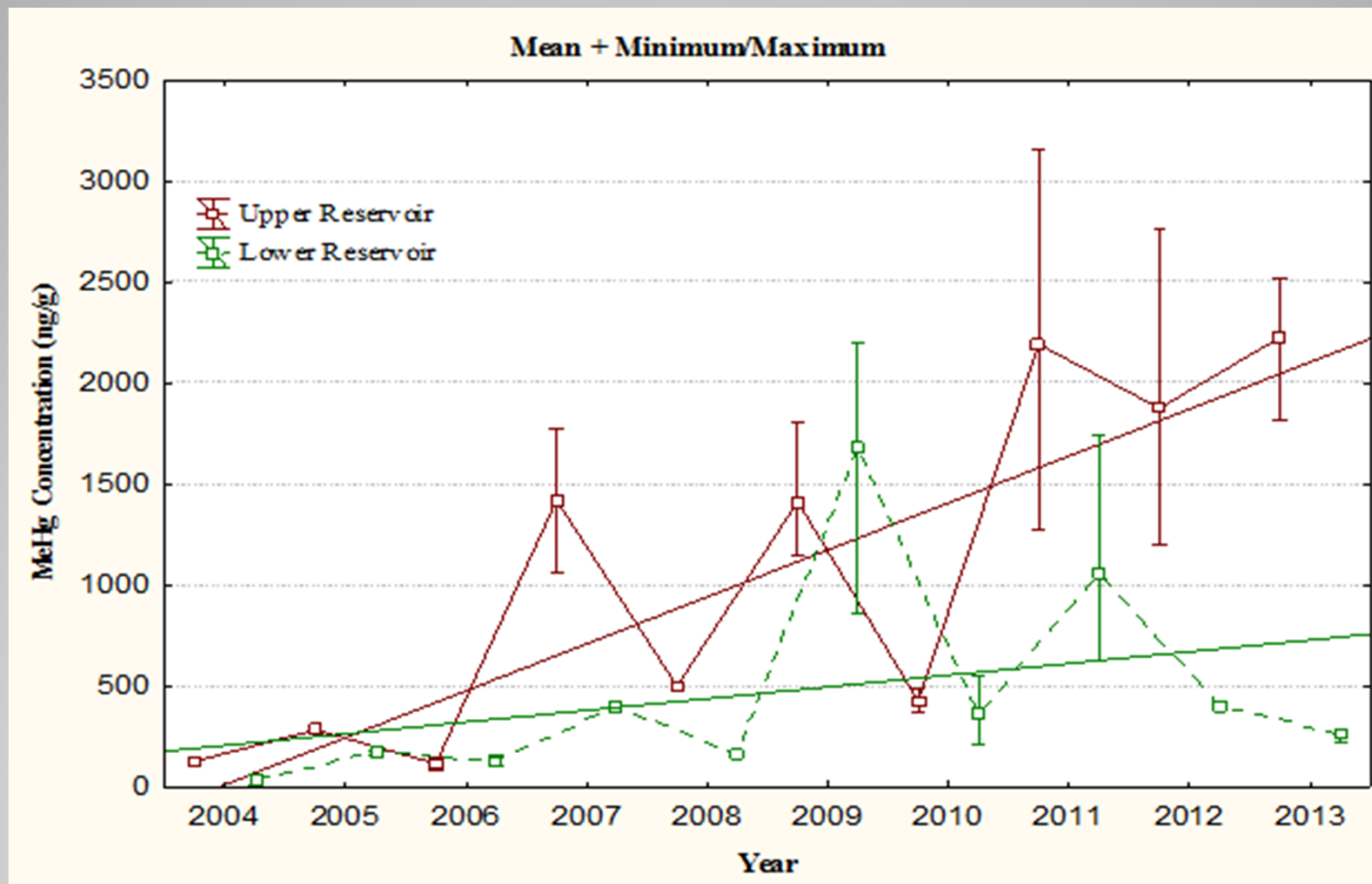
- Forage Fish Sample
- SBAC Main Channel
- 1957 SBAC Stream Channel
- FAA Property Line



Note: The orthophoto shown in this map was taken in 2007.

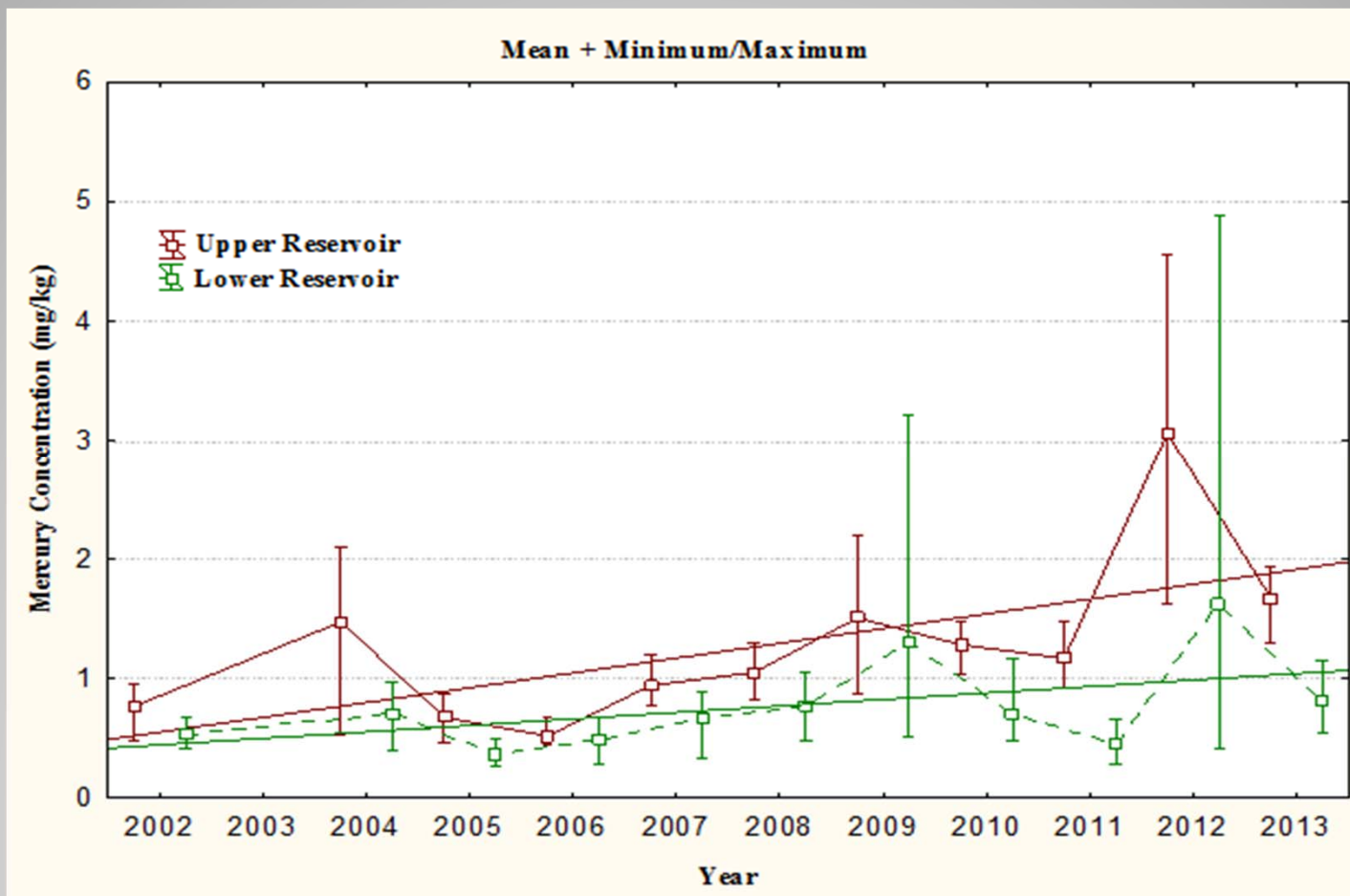
TRC Environmental Corporation	21 Griffin Road North Windsor, CT 06095 (860) 298-9692
	FAA WILLIAM J. HUGHES TECHNICAL CENTER ATLANTIC CITY AIRPORT, NEW JERSEY 08405 AREA U - BIOMONITORING STUDY
2009-2013 FORAGE FISH MERCURY RESULTS SOUTH BRANCH ABSECON CREEK	
Figure 3-5	Date: 11/13 Project No: 162662-00100-00562

Mean Concentrations (ng/g dry weight) of MeHg within Zooplankton, Upper and Lower Reservoirs, 2004 – 2013



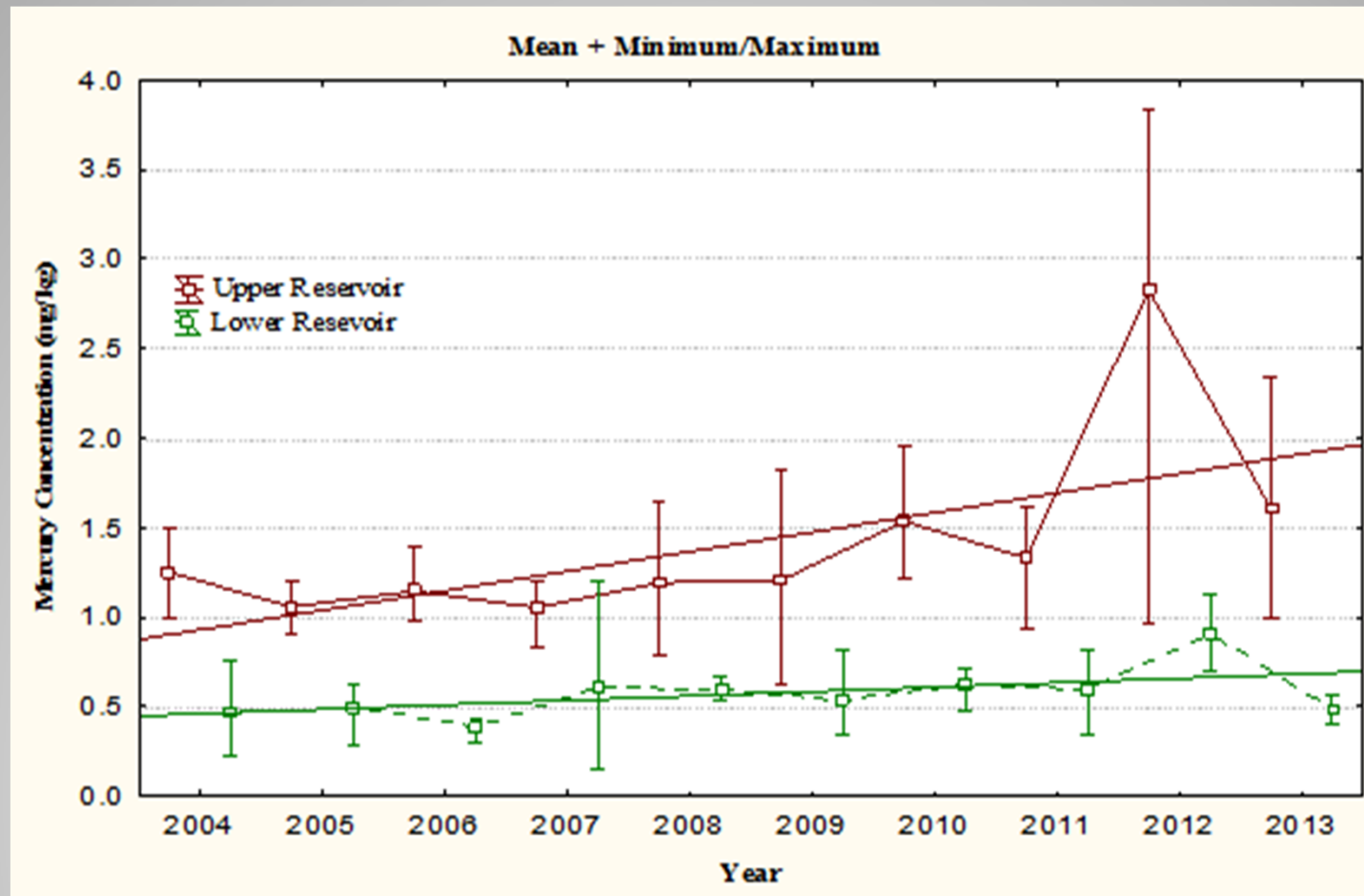
- Significantly increasing MeHg trends at Upper Reservoir and Lower Reservoir
- Significantly decreasing trend at Lower Reservoir since 2011 – no trend for Upper Reservoir

Mean Concentrations (mg/kg wet weight) of Hg within Forage Fish, Upper and Lower Reservoirs, 2002-2013



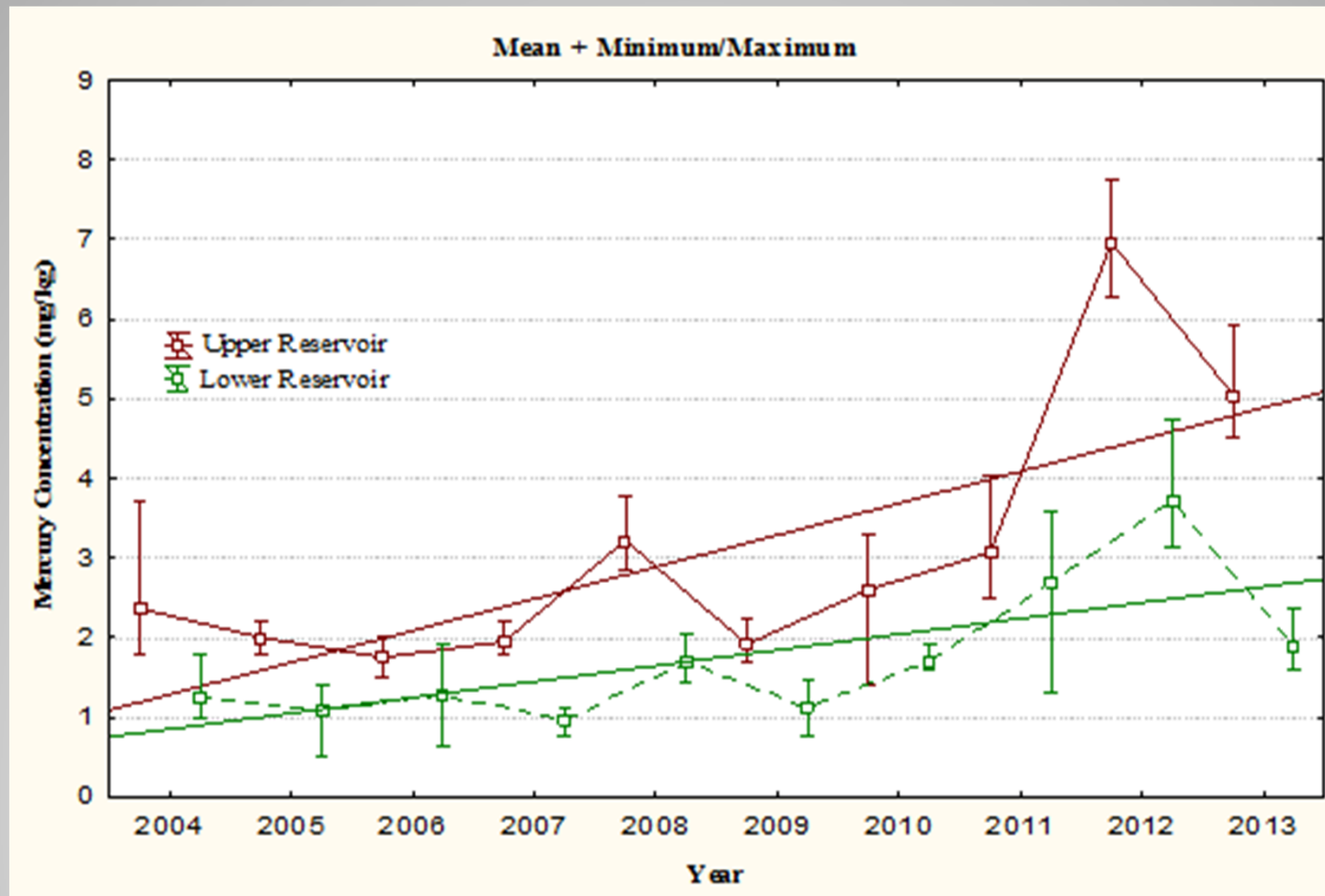
- Significantly increasing trends at Upper and Lower Reservoirs

Mean Concentrations (mg/kg wet weight) of Hg within Bluegill, Upper and Lower Reservoirs, 2004-2013



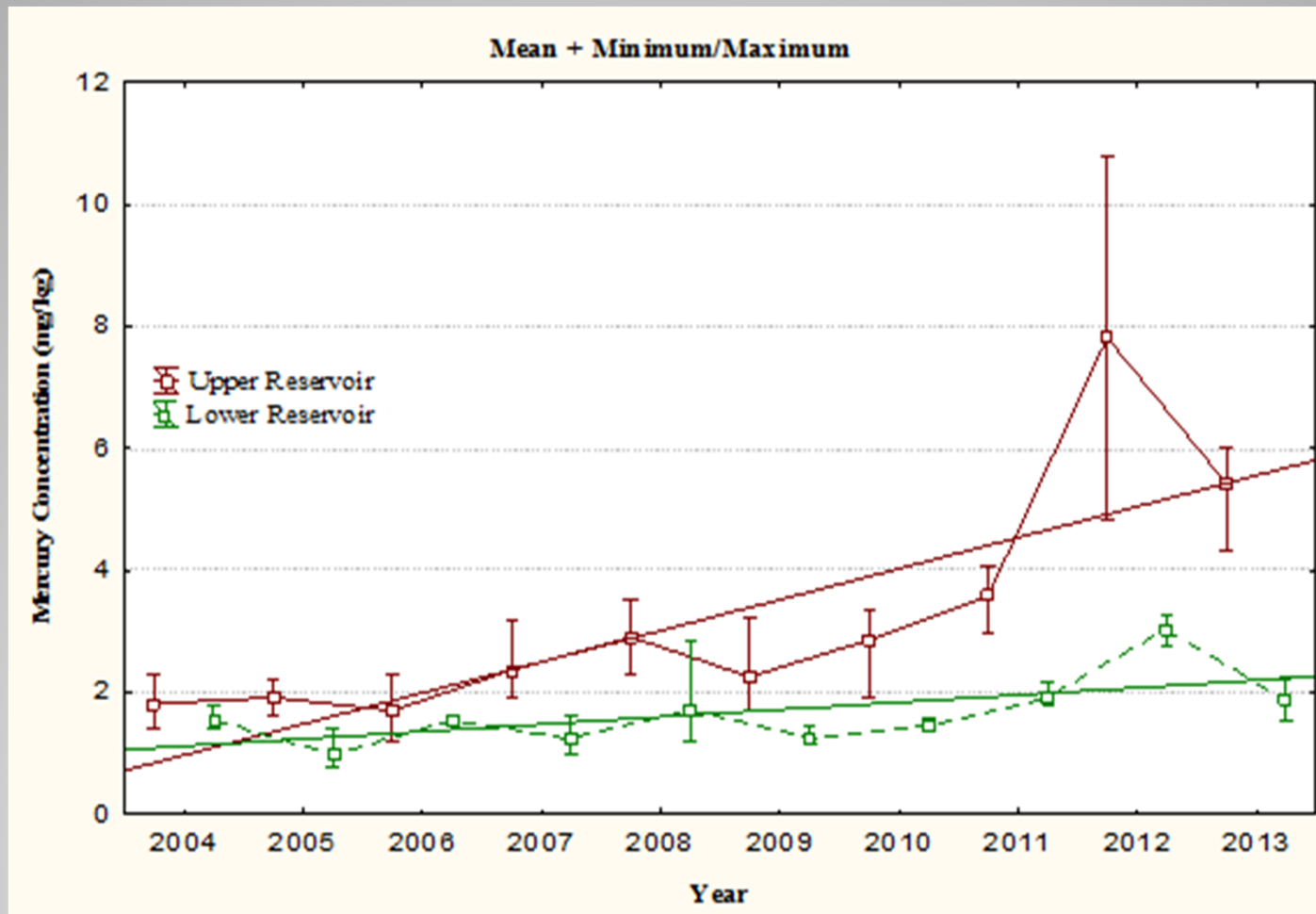
- Significantly increasing trends at Upper Reservoir and Lower Reservoir

Mean Concentrations (mg/kg wet weight) of Hg within Chain Pickerel, Upper and Lower Reservoirs, 2004-2013



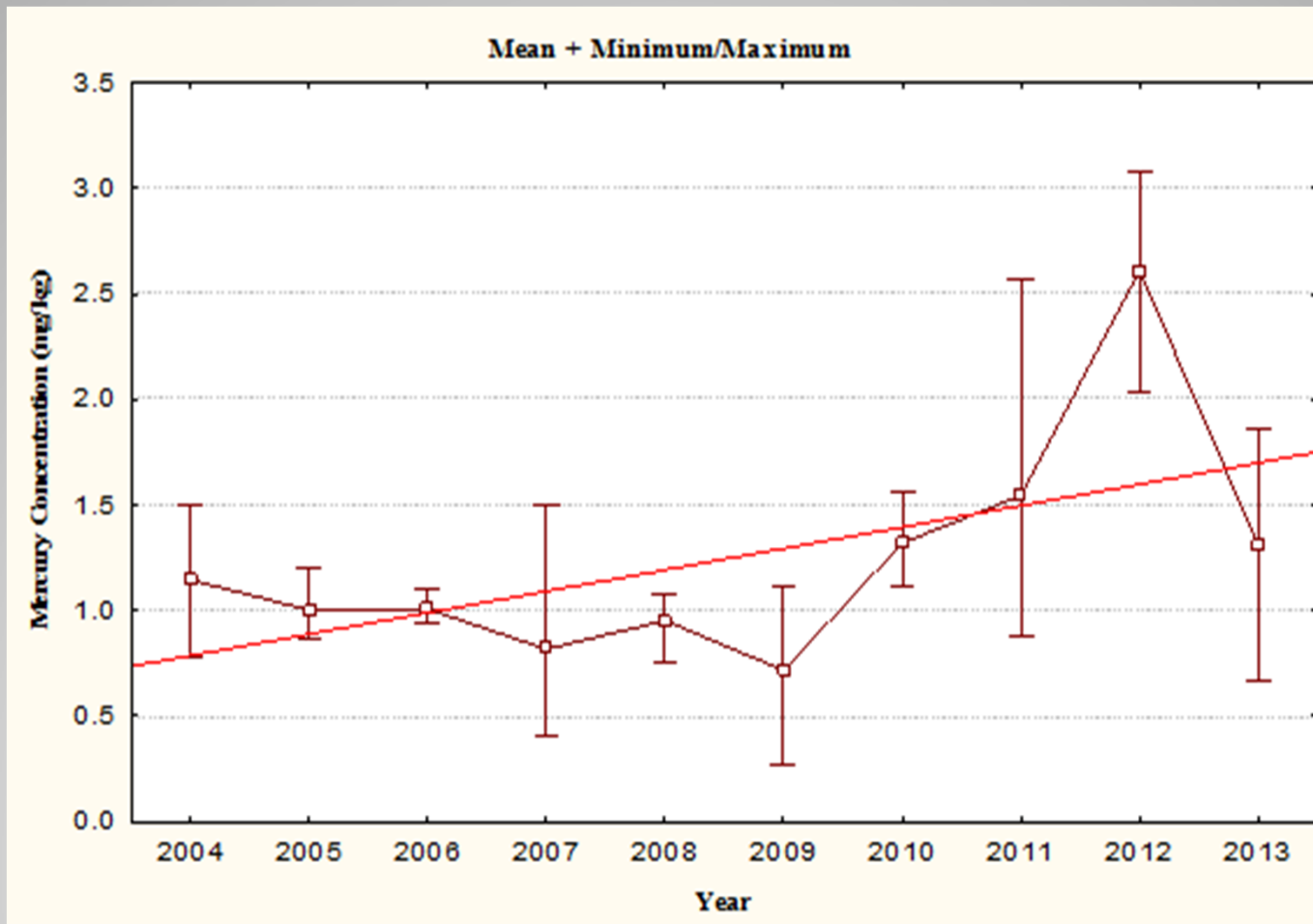
- Significantly increasing trends at Upper Reservoir and Lower Reservoir

Mean Concentrations (mg/kg wet weight) of Hg within Largemouth Bass, Upper and Lower Reservoirs, 2004-2013



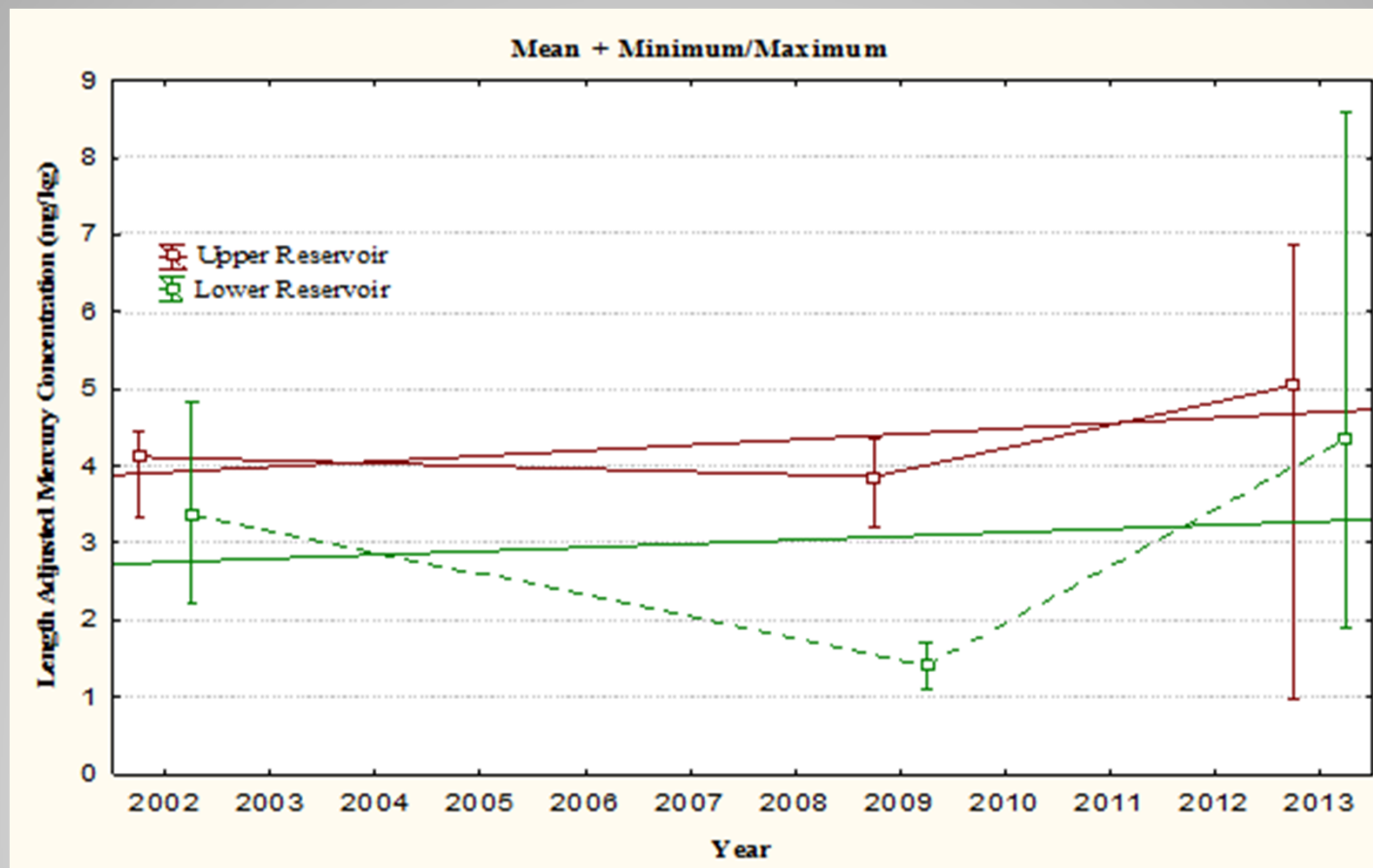
- Significantly increasing trends at Upper Reservoir and Lower Reservoir

Mean Concentration (mg/kg wet weight) of Hg within Yellow Perch, Lower Reservoir, 2004-2013



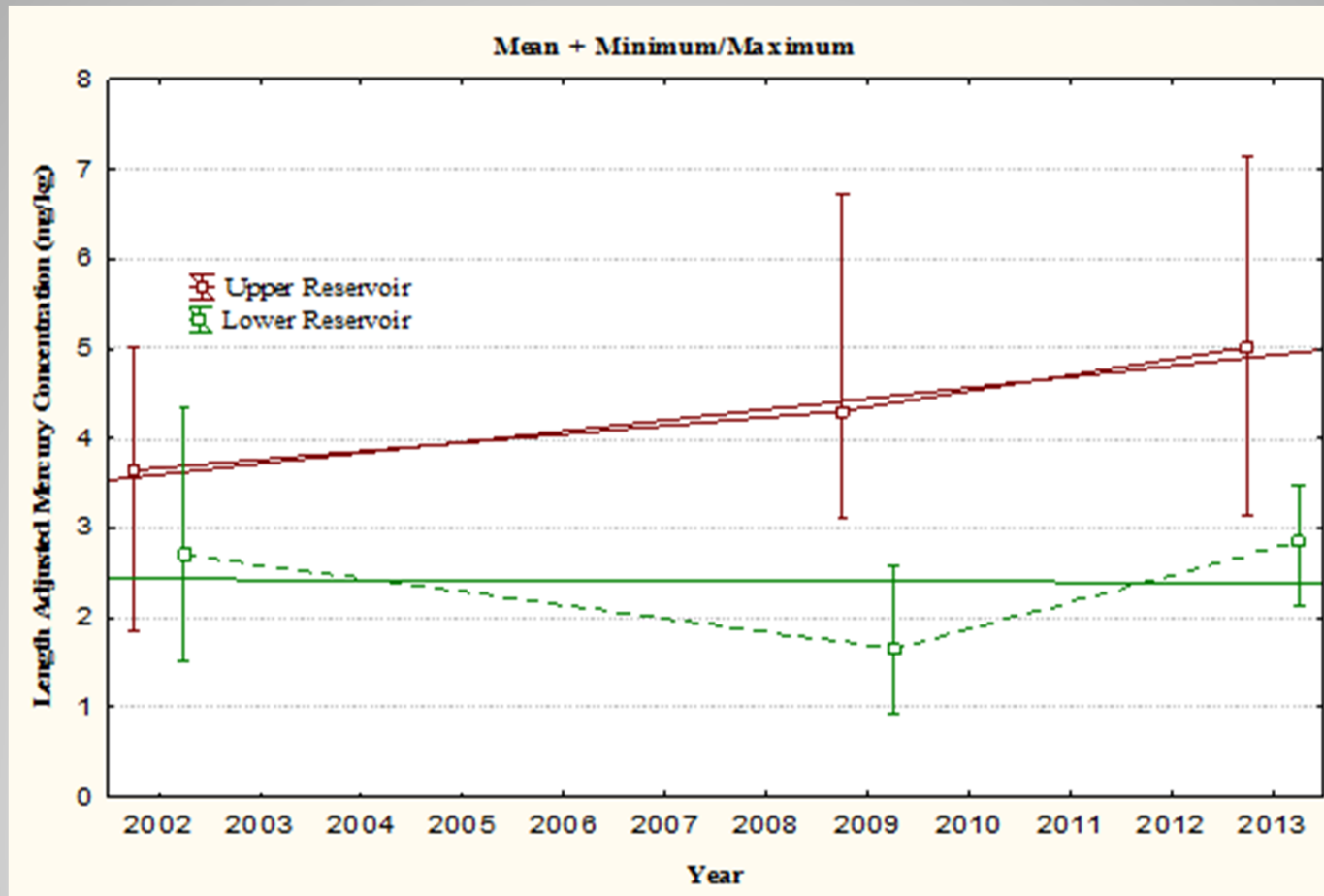
- Significantly increasing trend at Lower Reservoir

Mean Concentrations (mg/kg wet weight) of Hg within Large Chain Pickerel, Upper and Lower Reservoirs, 2002, 2009, and 2013



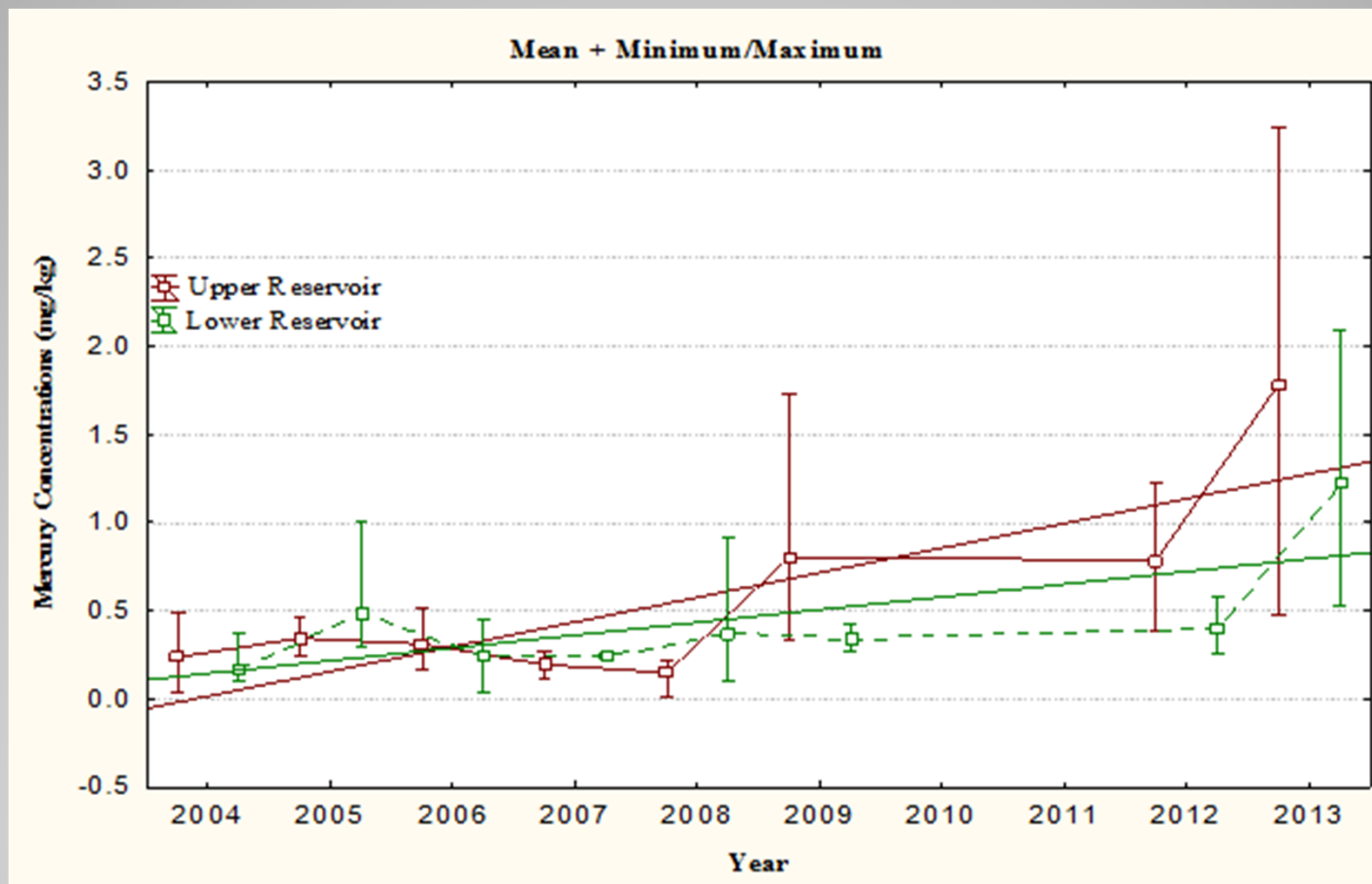
- No significant trends for Upper and Lower Reservoirs

Mean Concentrations (mg/kg wet weight) of Hg within Large Largemouth Bass, Upper and Lower Reservoirs, 2002, 2009, and 2013



- Significantly increasing trend for Upper Reservoir
 - No significant trend for Lower Reservoir

Mean Concentrations (mg/kg) of Hg within Tree Swallow Eggs, Upper and Lower Reservoirs, 2004-2013



- Significantly increasing trend at Upper Reservoir and Lower Reservoir

TREND SUMMARY



Upper Reservoir Trends

- Zooplankton MeHg Increasing
- Forage Fish Hg Increasing
- Bluegill Hg Increasing
- Chain Pickerel Hg Increasing
- Largemouth Bass Hg Increasing
- Large Largemouth Bass Hg Increasing
- Tree Swallow Egg Hg Increasing

Lower Reservoir Trends

- Zooplankton MeHg Increasing
- Forage Fish Hg Increasing
- Bluegill Hg Increasing
- Chain Pickerel Hg Increasing
- Largemouth Bass Hg Increasing
- Yellow Perch Hg Increasing
- Tree Swallow Egg Hg Increasing



SBAC Trends

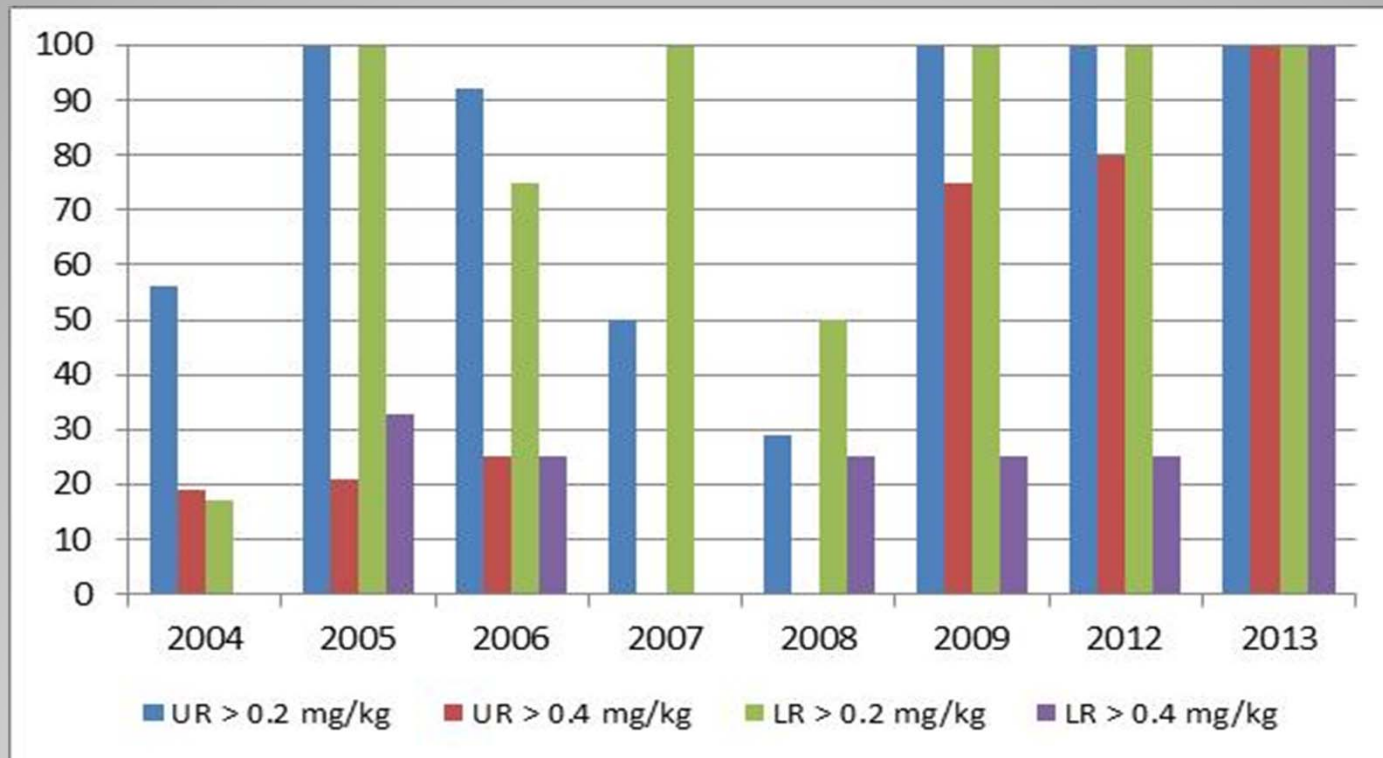
- Isopods Hg Decreasing (2009 – 2013)

RISKS

Fish, Aerial Insectivores & Piscivores

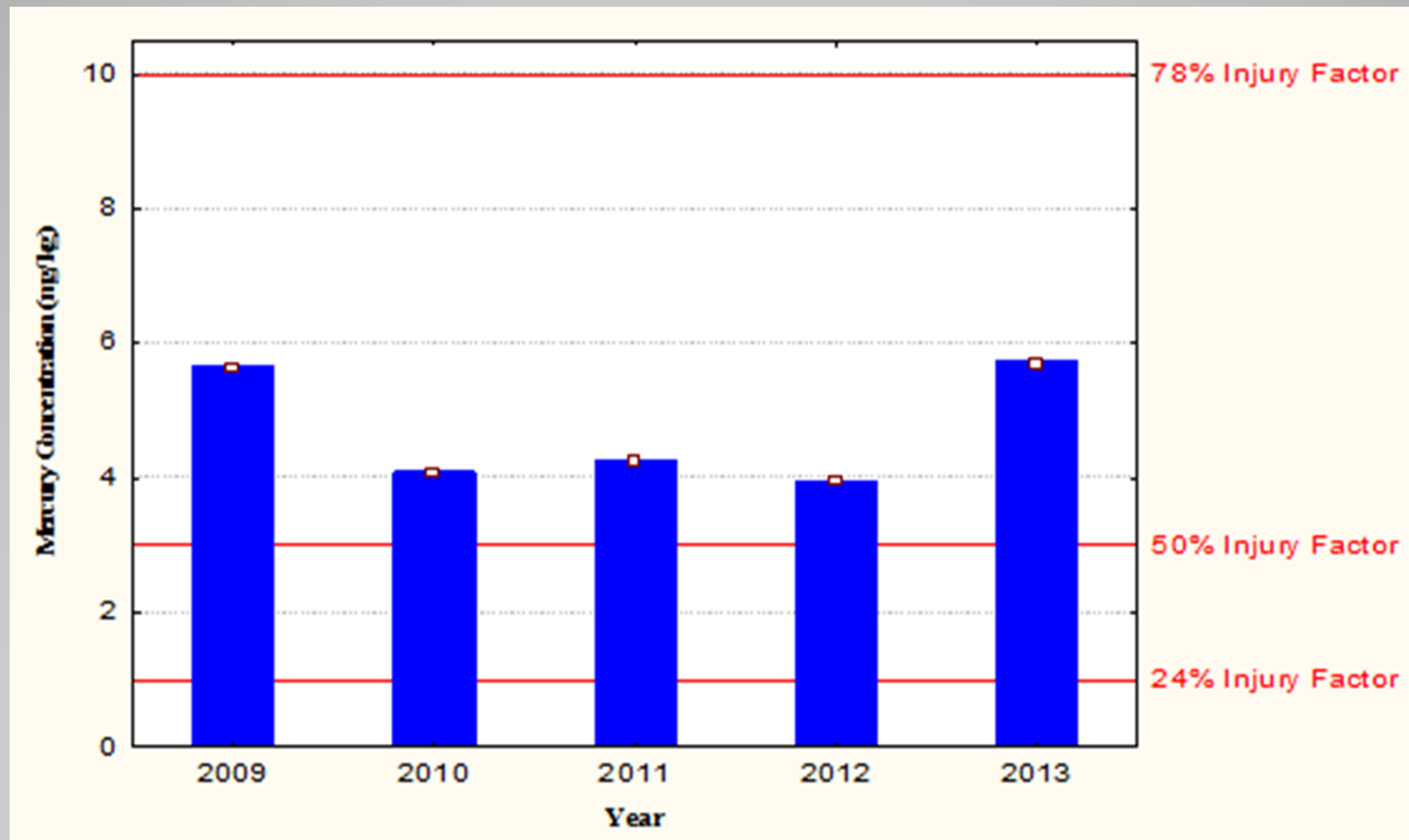
- Fish
- Tree Swallow
- Belted Kingfisher
- Osprey
- Mink

Tree Swallow – Risks at Upper and Lower Reservoir from Hg Egg Concentrations (% Exceeding Effect Levels)



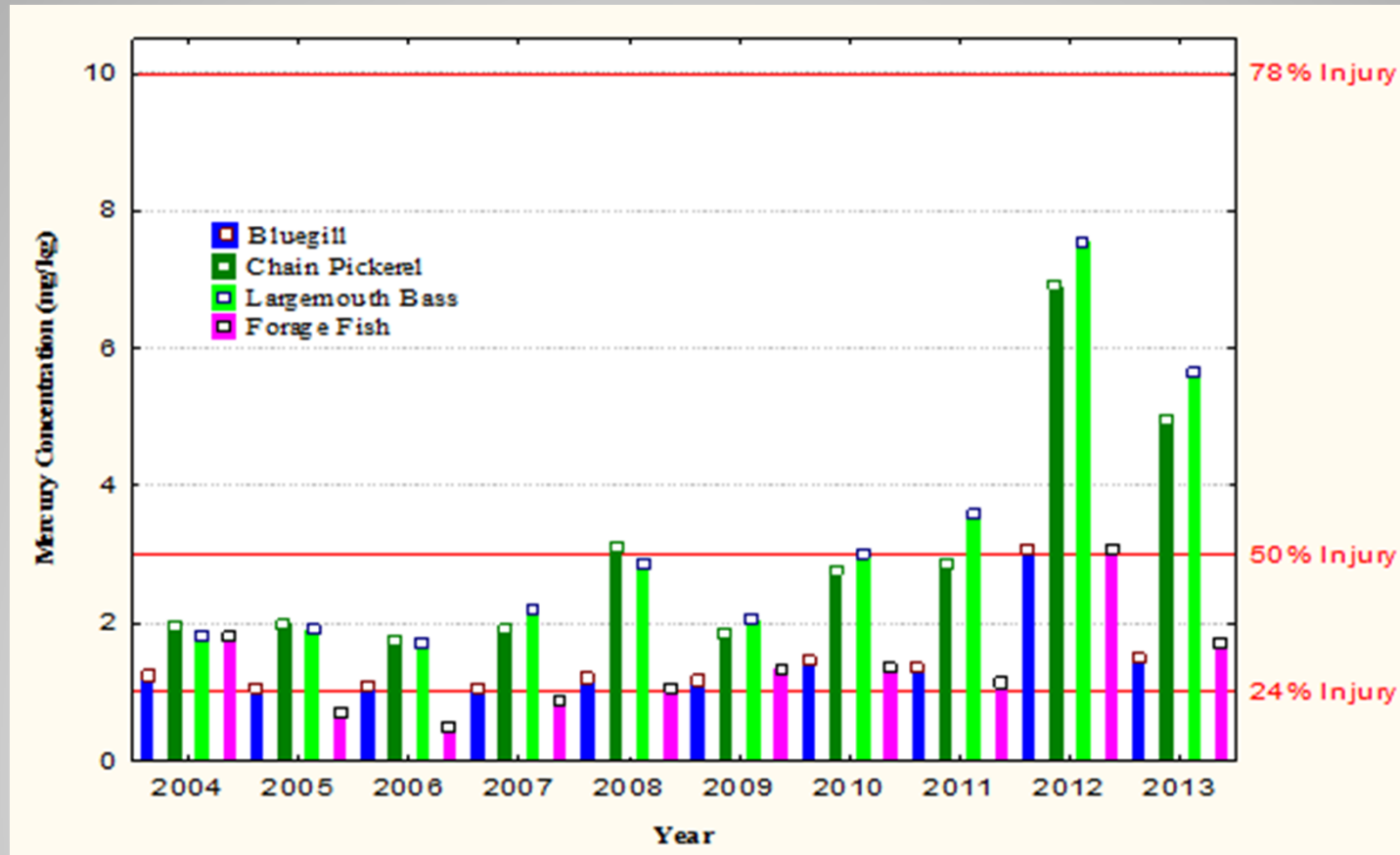
- 0.2 mg/kg Tree Swallow Effect Concentration (Jackson, 2011)
- 0.4 mg/kg Tree Swallow Effect Concentration (Heintz et al., 2009)

SBAC Fish – Comparison of Whole-Body Hg Concentrations with Injury Factors



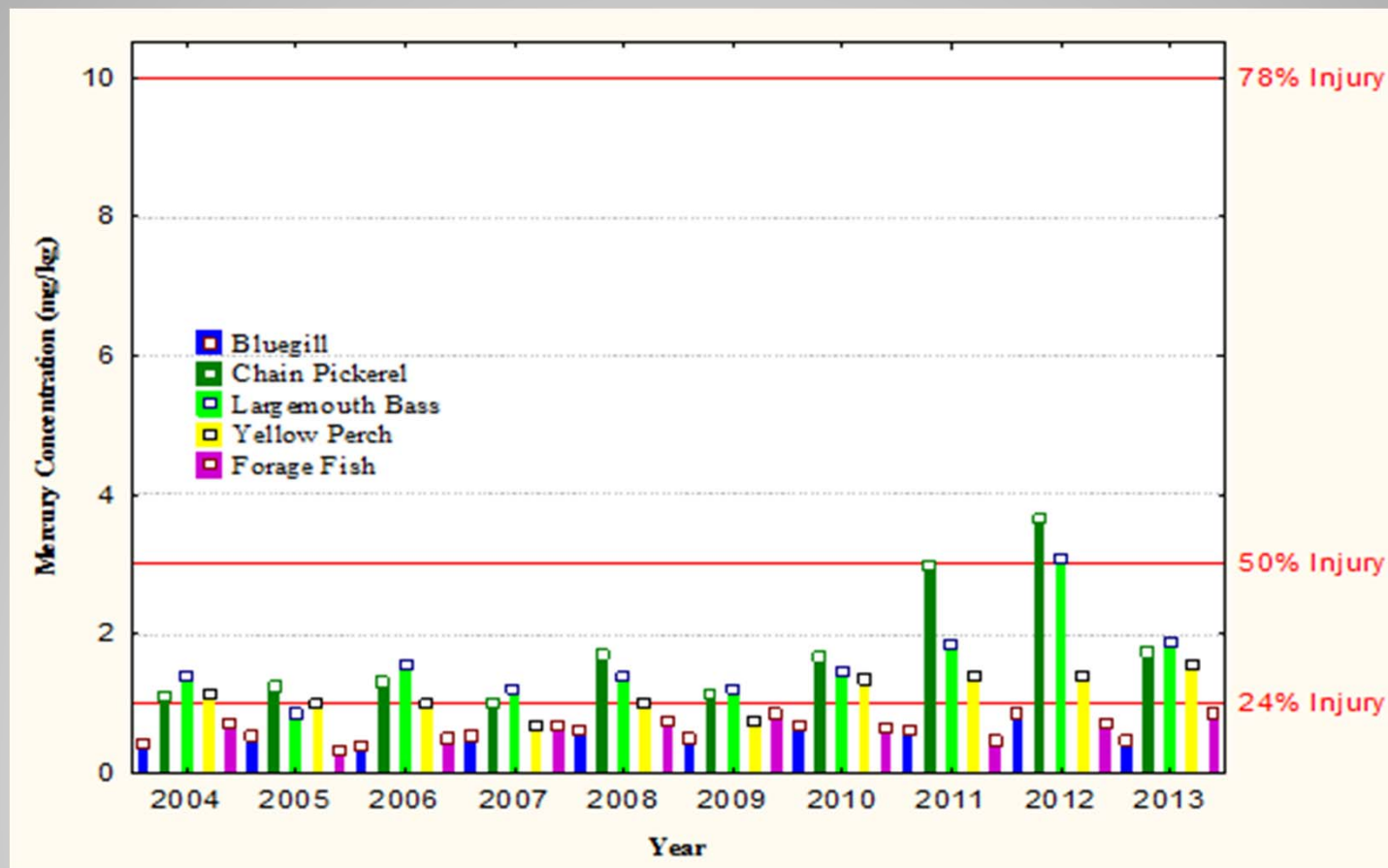
- Pinelands Mean Background Eastern Mudminnow Concentration is 0.15 mg/kg

Upper Reservoir Fish – Comparison of Whole-Body Hg Concentrations with Injury Factors



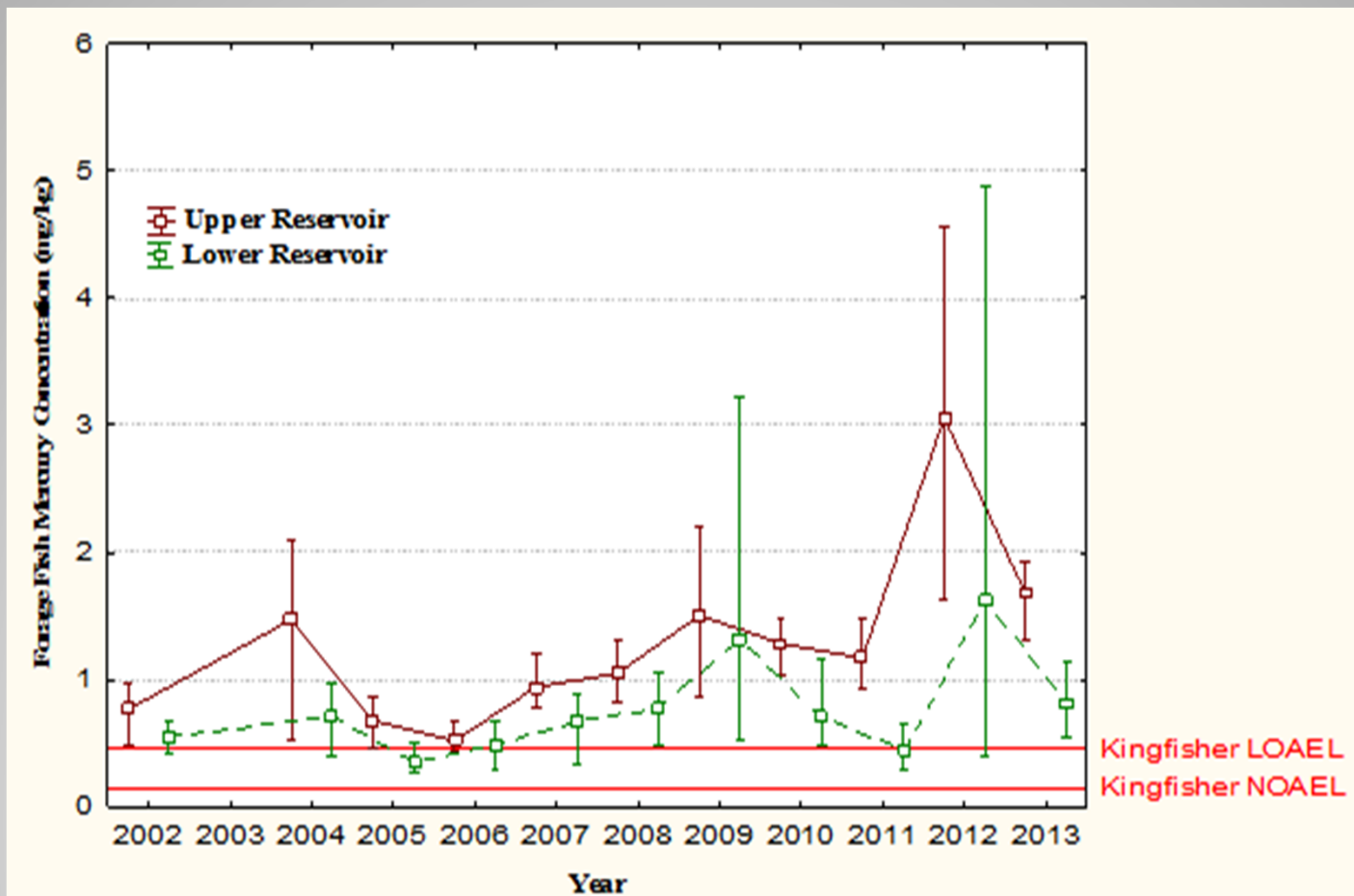
- Pinelands Background Forage Fish Concentration is 0.19 mg/kg
- Pinelands Background Predatory Fish Concentration is 0.58 mg/kg

Lower Reservoir Fish – Comparison of Whole-Body Hg Concentrations with Injury Factors



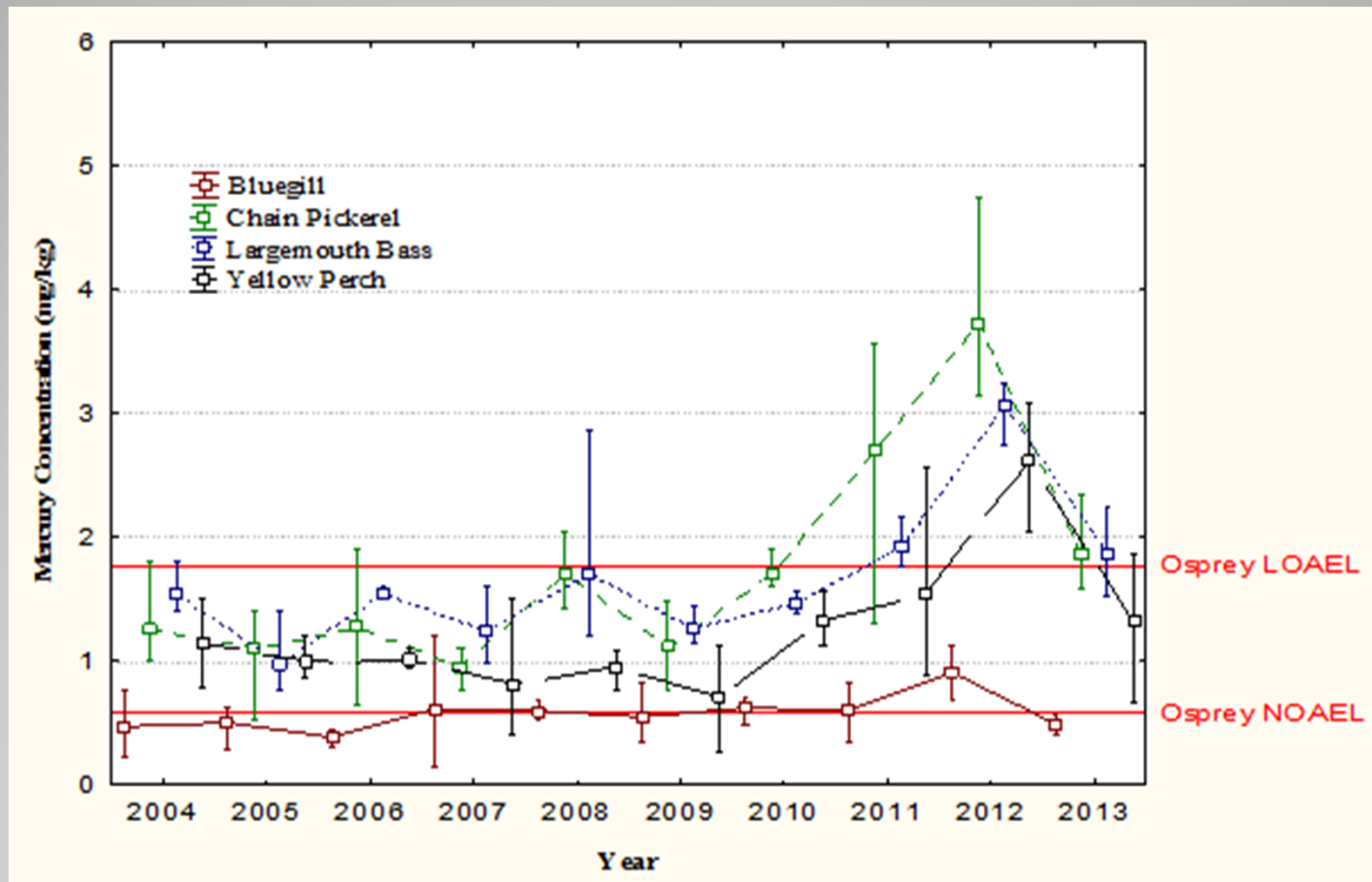
- Pinelands Background Forage Fish Concentration is 0.19 mg/kg
- Pinelands Background Predatory Fish Concentration is 0.58 mg/kg

Belted Kingfisher – Comparison of Forage Fish Hg Concentrations with Forage Fish TRVs



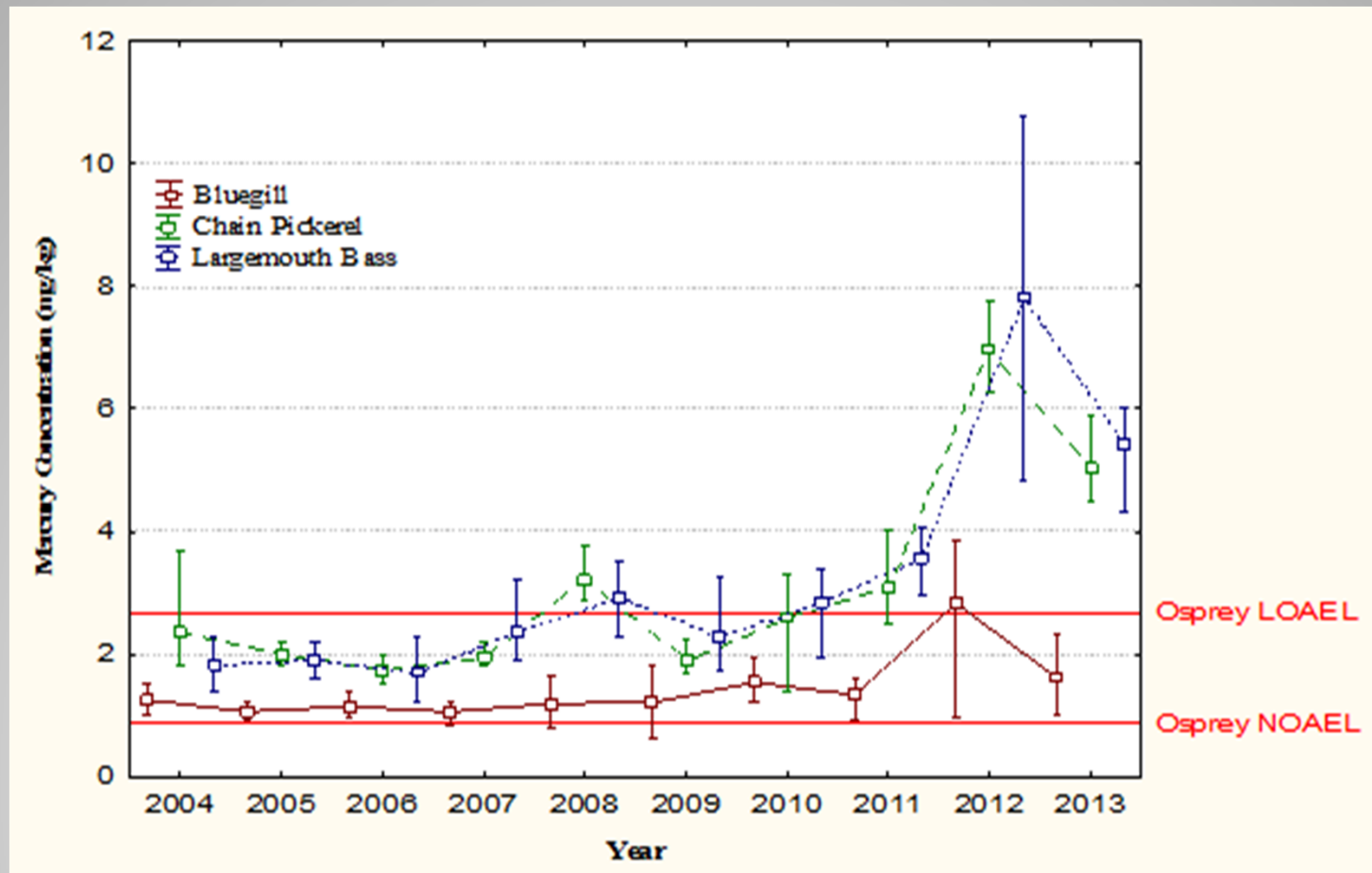
- Pinelands Background Forage Fish Concentration is 0.19 mg/kg

Osprey – Risks at Lower Reservoir from Average-Size Fish Hg Concentrations



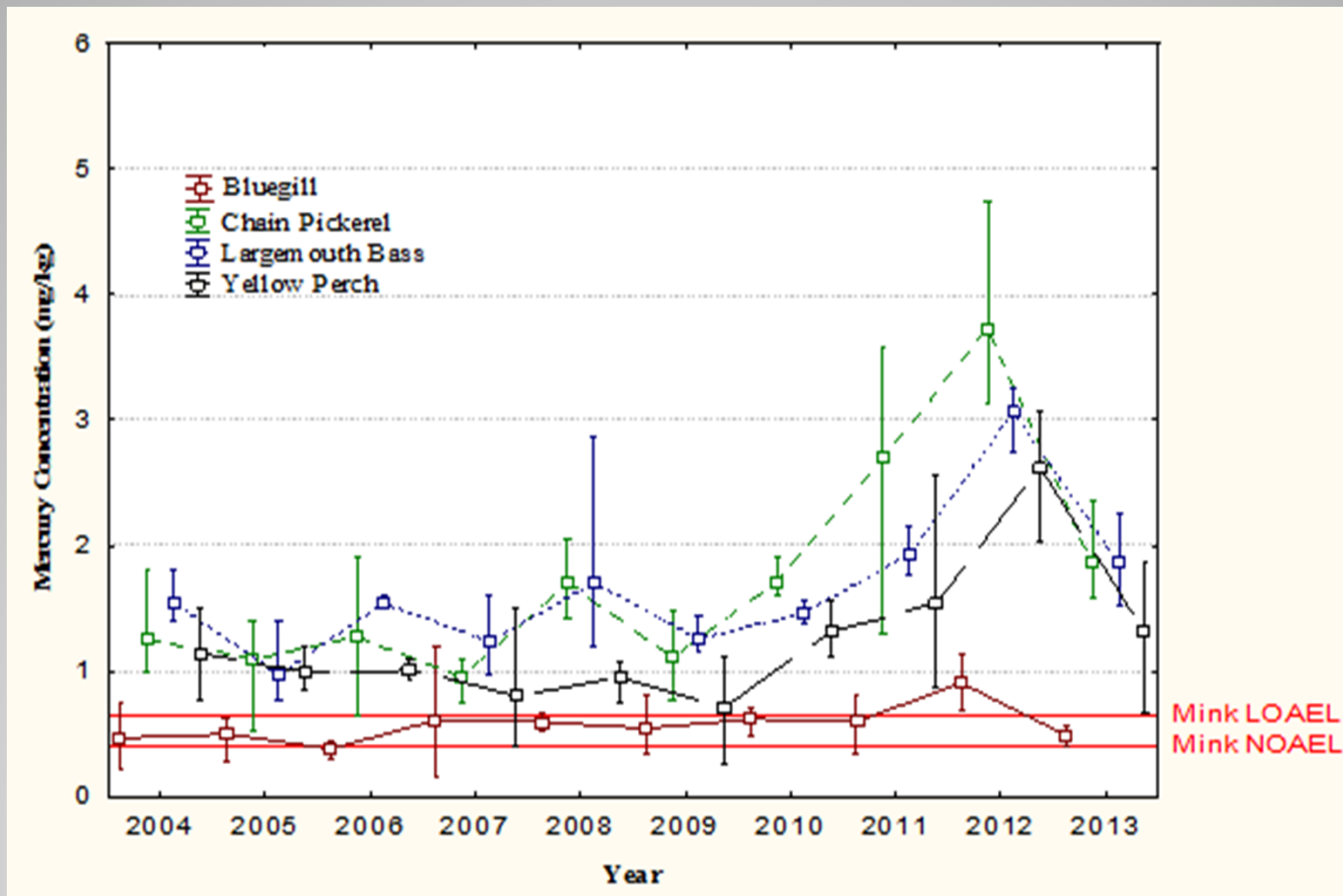
- Pinelands Background Predatory Fish Concentration is 0.58 mg/kg

Osprey – Risks at Upper Reservoir from Average-Size Fish Hg Concentrations



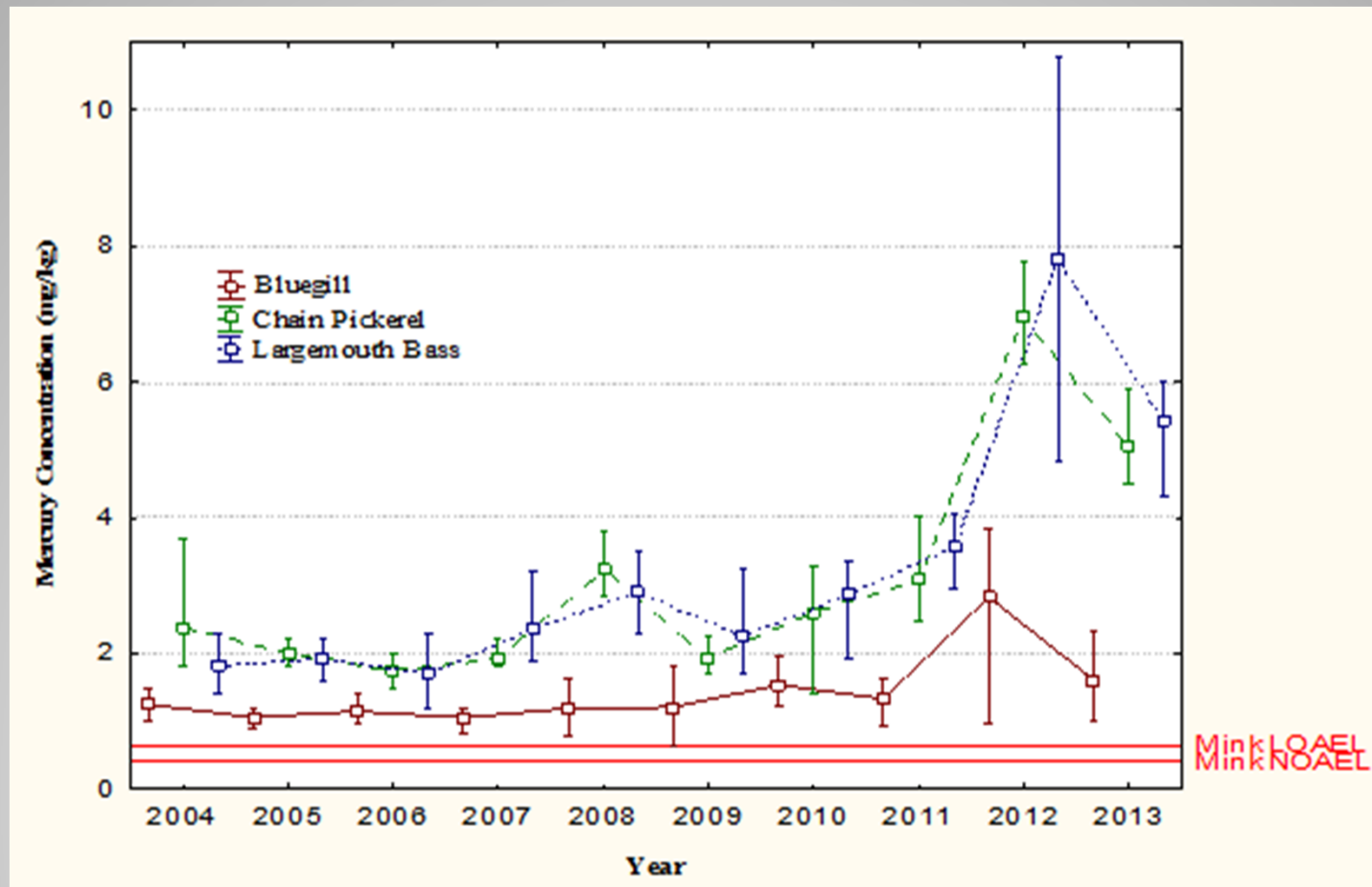
- Pinelands Background Predatory Fish Concentration is 0.58 mg/kg

Mink – Risks at Lower Reservoir from Average-Size Fish Hg Concentrations



- Pinelands Background Predatory Fish Concentration is 0.58 mg/kg

Mink – Risks at Upper Reservoir from Average-Size Fish Hg Concentrations



- Pinelands Background Predatory Fish Concentration is 0.58 mg/kg

BIOMONITORING BIOTA CONCLUSIONS



- SBAC – Decreasing Trends in Isopods from 2009 – 2012
- Upper Reservoir – Increasing Trend in Zooplankton, Forage Fish, Bluegills, Chain Pickerel, Largemouth Bass & Tree Swallow Eggs
- Lower Reservoir – Increasing Trends in Zooplankton, Bluegills, Chain Pickerel, Largemouth Bass, Yellow Perch & Tree Swallow Eggs
- Large Increases in Reservoir Biota Hg in 2011/2012 Likely Attributable to Re-Inundation of Hg-Contaminated Sediments in Upper Reservoir

SUMMARY



- Classic Hg Biomagnification in Reservoirs.
- SBAC Degraded Area is Different than Reservoir Impacts to Biota.

REASONS FOR CONCERN

- Upward trends in Hg in most biota.
- Hg in zooplankton and forage fish are 3X higher in UR and 2X higher in LR in 10 yrs.
- Hg in ECP is 5X higher in UR and 2X higher in LR in 10 yrs.
- Hg in LMB IS 6X higher in UR and 2X higher in LR in 10 yrs.
- Increasing Ecological Risks and potential injury to the fish, tree swallows and Piscivores due to high Hg levels.