



# **Project 80: Birds as Indicators of Contaminant Exposure and Effects in the Great Lakes – Waukegan Harbor**

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Introduction

Why swallows?

Overview – GLRI project

Specifics for Waukegan



- Contaminant research on birds since the 1970s
- Worked on the East Coast and Gulf Coast before moving to the upper Midwest in 1991
- Began working with tree swallows in the mid-1990s



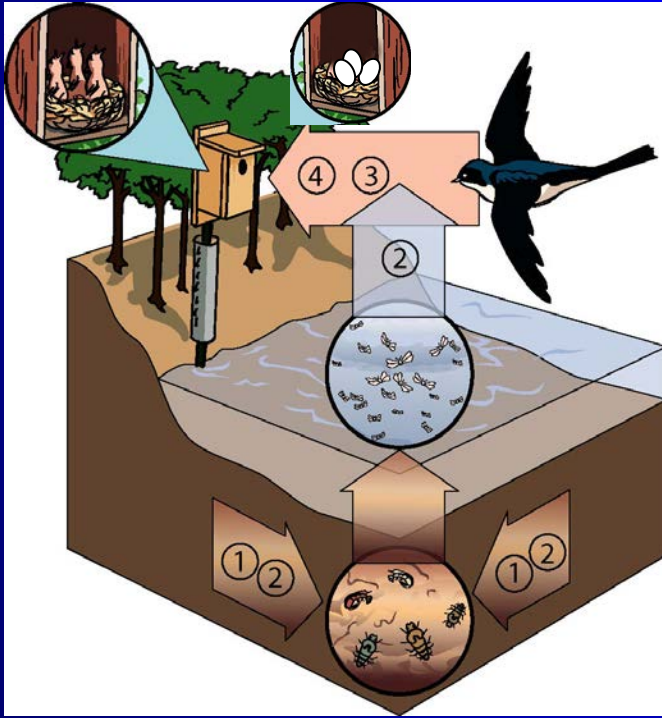
# Why swallows - rather than other bird species



## Attributes



- Feed on benthic invertebrates
- Close ties to sediment contamination
- Nest boxes at areas of interest
- Adequate sample size
- More localized feeding ( $\pm 0.5$  km)
- Integrate over appropriate time and space scales
- Linkage is short
- Numerous sampling points
- Efficient to sample



# Scope of Work for GLRI Project 80

Use tree swallows and colonial waterbirds to:

- 1) Assist States & EPA in the assessment of wildlife BUIs (n = 2 BUIs)
- 2) Evaluate remedy effectiveness
- 3) Enhance our understanding of contaminant effects





# BUI assessments

## 1. Bird or Animal Deformities or Reproduction Problems



## 2. Degradation of Fish and Wildlife Populations



## Wildlife BUIs



Tissue concentrations (e.g. PCBs, dioxins and furans, pesticides, PBDEs, trace elements [Hg, Se, Cd, etc.]), relative to effect concentrations



Directly measure reproductive rates

plus other effect endpoints (EROD, -omics, genetic damage, oxidative stress). Perfluorinated chemicals and other trace elements.

Diet samples for chemical analysis



## States (MI & WI) seek to address these two wildlife BUIs in two ways –

- Actual data on deformities or adverse reproductive effects associated with contaminants
- Comparison of tissue concentrations associated with adverse population-level effects

*“State of Wisconsin’s criterion for acceptable removal of the Deformities or Reproductive Problems BUI is to collect and evaluate observational data and make direct measurements for a minimum of two reproductive cycles. If reproductive rates at problem sites are not statistically different from those at minimally impacted reference areas, then the BUI can be delisted (WI DNR 2008, pg 25)”*

*“Michigan states that BUI of Bird or Animal Deformities or Reproductive Problems will be accomplished based on field assessment of birds or other wildlife (MI DEQ2006, pg 23). An alternative or additional approach identified by Michigan is to use levels of contaminants in biotic tissues known to cause reproductive or developmental problems, as an indicator of the likelihood of reproductive problems.”*

# Remedy Effectiveness

## Before and After assessments



AOCs where dredging has occurred

- Maumee River (Ottawa River)
- Milwaukee (Lincoln Park)
- Muskegon (Division St. outfall)

Raisin River  
Fox River/Green Bay  
St. Louis River

## Strengths of this Project 80 are that

- Sampling the same matrices across all AOCs which allows for a much better assessments and understanding of contaminant exposures
- Multiple classes of chemicals – legacy + newer chemical classes
- Benchmarks for effects are available for birds so can interpret our results
- Directly measuring endpoints identified by States in their RAP documents



## Overview and Progress -

- 60 sites (24 in 2010 ▲ ; 11 new in 2011 ▲ ; 12 more in 2012 ▲  
6 new in 2013 ▲ ; 7 new in 2014) are being assessed
- Sampling includes 27 AOCs & nearby areas for comparisons
- Sampling multiple bird species at 5+ AOCs to model to other parts of the aquatic ecosystem



Acknowledge our field teams

Tom and I – La Crosse

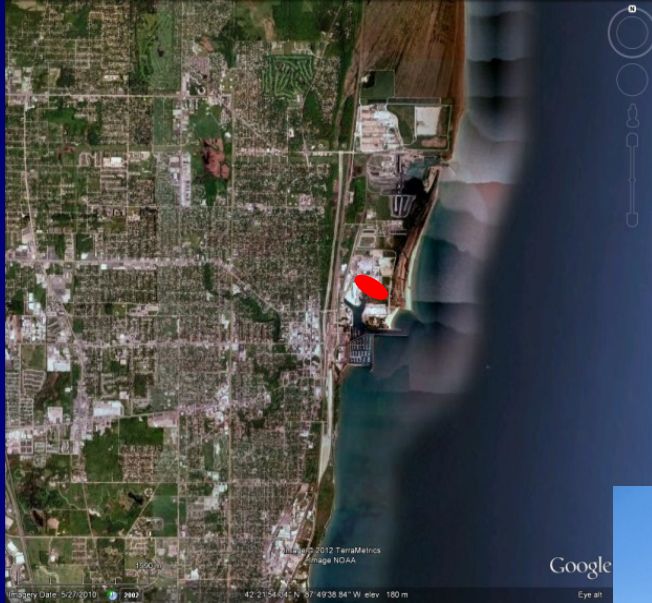
Paul Dummer & helpers – La Crosse

Chris Franson & helpers – USGS, National  
Wildlife Health Center, Madison, WI

Collaborators – other USGS offices, as well as,  
EPA and University personnel

[http://www.umesc.usgs.gov/wildlife\\_toxicology/  
glri\\_project80.html](http://www.umesc.usgs.gov/wildlife_toxicology/glri_project80.html)

# Waukegan Harbor AOC





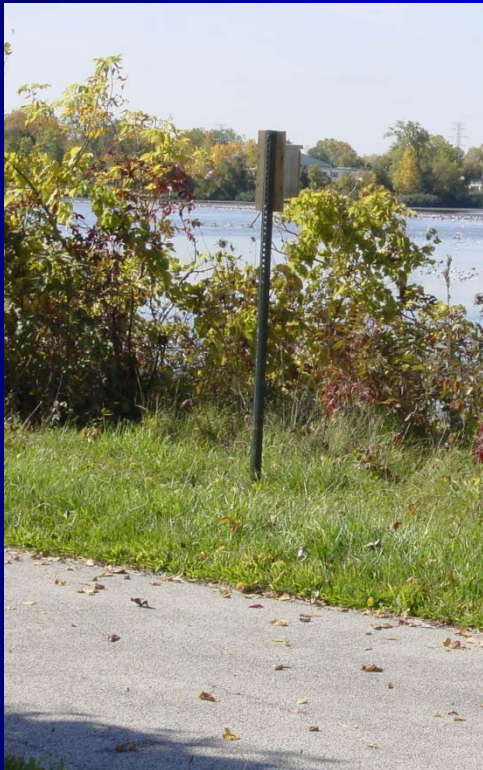
# Study Design and Overview

20 nest boxes per site

Monitor ~weekly (# eggs laid, # that hatch)

Collect samples at appropriate times

Chemical analysis done at Axys Analytical, Canada



Monitored nest boxes  
in 2012, 2013, 2014

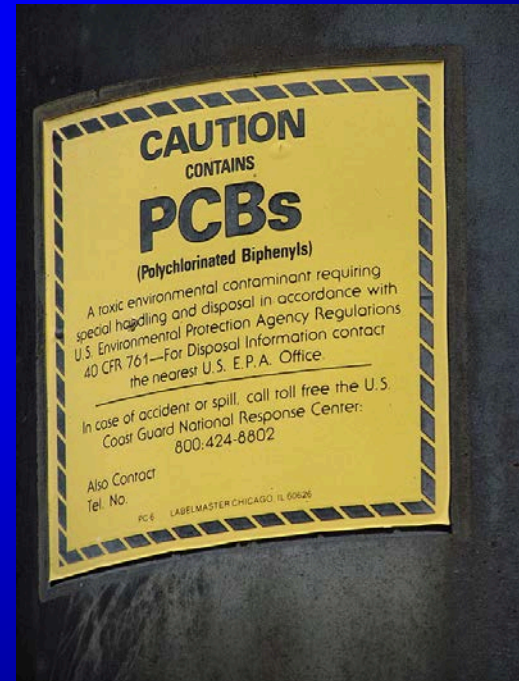
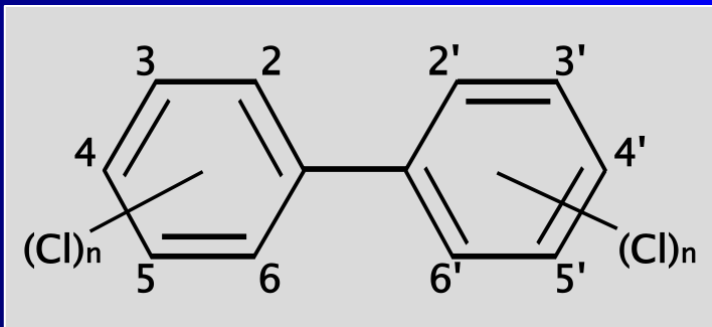
2012	3 boxes used
2013	4 boxes used
2014	5 boxes used

Data are from 2012 only

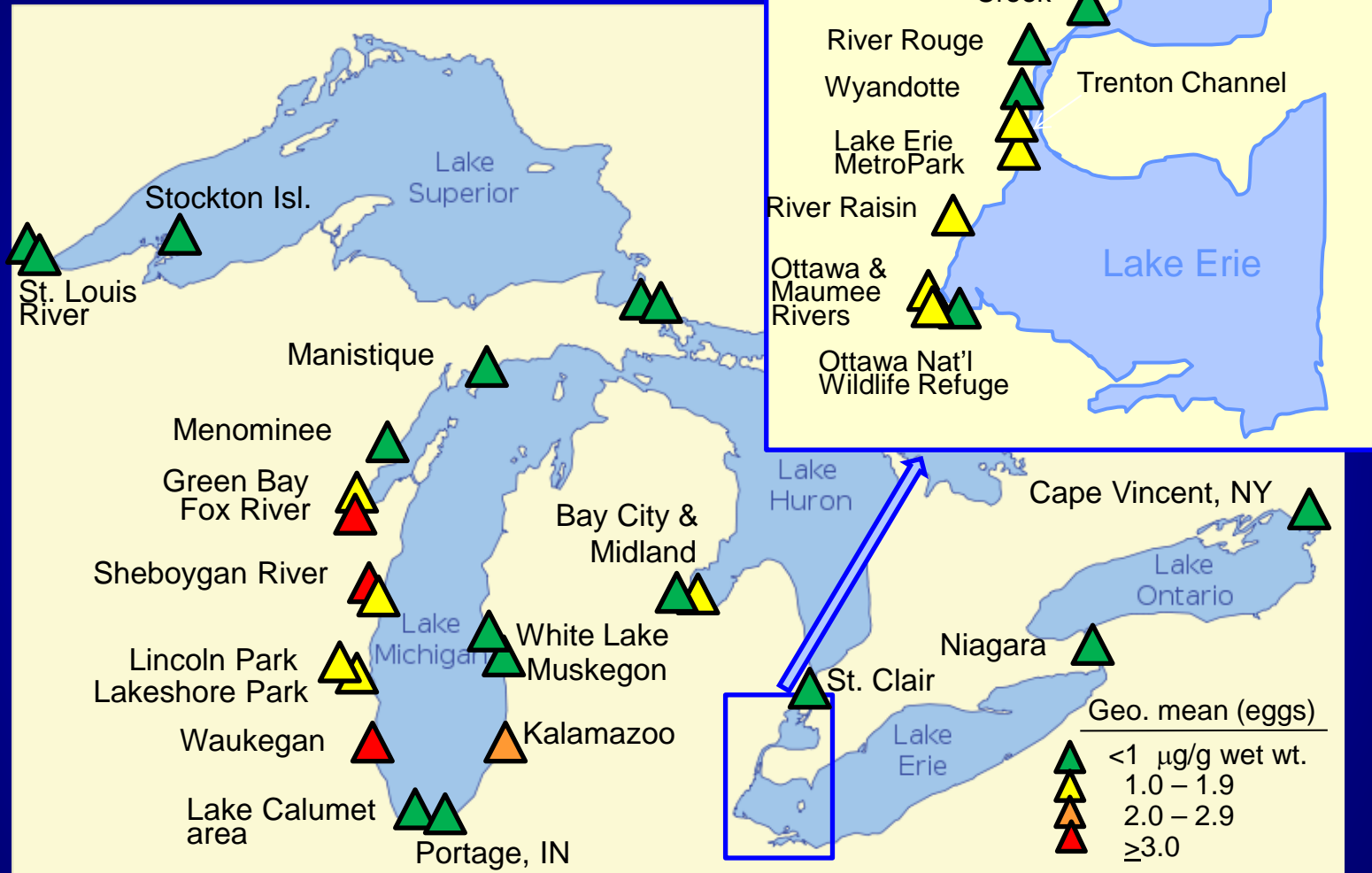
# PCBs (polychlorinated biphenyls)

Many industrial uses such as insulating and coolant functions in electrical apparatus and transformers, cutting fluids for machining operations, carbonless carbon paper, plasticizers, and many other uses. Stable in the environment and are lipophilic.

Banned in 1973



# PCBs – 2010, 2011, & 2012 Tree swallows





## New work

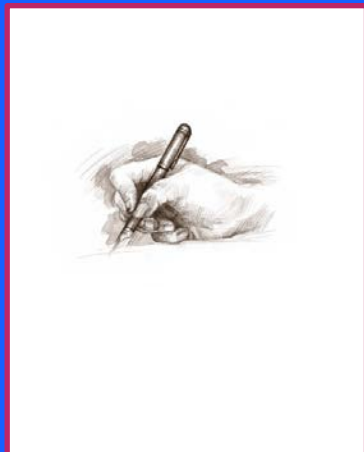
In 2014 collected barn swallow eggs from under the docks

Expand our information on contaminant exposure and also assess whether there are differences between the two species.

In 2015, if funding permits, add additional study sites north and south of the harbor to quantify the geographical distribution of these high PCBs



[http://www.umesc.usgs.gov/wildlife\\_toxicology/glri\\_project80.html](http://www.umesc.usgs.gov/wildlife_toxicology/glri_project80.html)



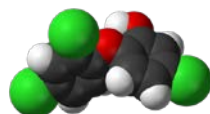
Goals and objectives



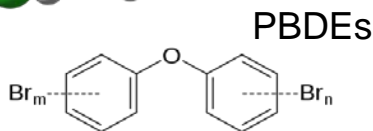
Maps and habitats at current study sites



Why use swallows?



PFCs



PBDEs



Thank you