

# Reproductive success of three passerine species as part of a site-specific risk assessment on the Tittabawassee River

MP178

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## ABSTRACT

Reproductive success of passerine birds nesting in the Tittabawassee and Chippewa River floodplains near Midland, Michigan, was examined due to the presence of polychlorinated dibenzofurans (PCDFs) and dibenzo-p-dioxins (PCDDs) in both the terrestrial and aquatic food webs. Historical chemical production around the turn of the century is a possible source of the PCDF/PCDD compounds currently occurring downstream of Midland. Mean concentrations of PCDF/PCDDs in soil and sediment were 10- to 20-fold greater downstream (target sites) of Midland compared to upstream (reference sites). Based on life history, site presence and availability of on and off site historical data, tree swallow, eastern bluebird, and house wren were chosen as passerine receptor species of interest. Over 200 nest boxes were monitored upstream (n=69) and downstream (n=133) of Midland as one part of a large scale site-specific ecological risk assessment of the Tittabawassee River floodplain during the 2005, 2006, and 2007 breeding seasons. Reproductive measurements were taken on all three species including egg mass, clutch size, hatching success, nestling growth rate, and fledging success. Comparisons of reproductive measurements were made by species between years (2005/2006/2007) and site type (reference/target). Year effects were rare and possibly due to weather conditions and/or prevalence of second year breeding adults (eastern bluebird and tree swallow) in 2005 at some sites. Clutch sizes for house wren and tree swallow varied between areas but were still similar to previously reported values. Egg mass was not different between reference and target areas for all species, while hatching success, fledging success, and productivity varied for tree swallow and eastern bluebirds by area. Habitat (availability and quality), weather variables, detailed age-class comparisons, and residue analyses at these sites will be included in future analyses.

## INTRODUCTION

- Site located in Midland Co, Michigan, USA on the Tittabawassee River
- Elevated concentrations of PCDFs and PCDDs downstream of Midland, MI [1]
- Upstream ("reference", RA) and downstream ("target", TA) areas identified
- Receptor species of interest: tree swallow (*Tachycineta bicolor*, TS), house wren (*Troglodytes aedon*, HW), and eastern bluebird (*Sialia sialis*, EB)
- Results are representative of only a preliminary dataset

## METHODS

- Nest boxes placed at 2 reference areas (n=69) and 4 target areas (n=133) in 2004 and monitored during the 2005, 2006, and 2007 breeding seasons
- Reproductive parameters measured: egg mass (g), clutch size (# eggs laid), hatching success (# eggs hatched/total # eggs), nestling growth, fledging success (# fledged/#hatched), and productivity (# fledged/total # eggs)
- Reproductive parameters were back corrected to account for sampled tissues
- Comparisons of measurements were made by species between years (2005/2006/2007) and site type (reference/target)
- Values reported on a per nesting attempt basis, differences were considered significant at  $\alpha=0.05$ , and percentages reported represent differences associated with at most  $\beta=0.20$  (unless otherwise noted)

Table 1. Nest fate (% of total) of nesting attempts for eastern bluebird, house wren, and tree swallow nests combined by Reference Area (RA) and Target Area (TA) on the Emburytown and Chippewa Rivers, Michigan, USA (2005-2007)

	2005		2006		2007	
	RA	TA	RA	TA	RA	TA
<b>House wren</b>						
Successful	62%	57%	31%	64%	66%	66%
Pre-fledged	0%	14%	20%	1%	0%	27%
Failed	38%	29%	49%	35%	34%	6%
Abandoned	17%	13%	0%	9%	0%	3%
Unknown	12%	10%	0%	10%	0%	2%
	n=24	n=26	n=109	n=109	n=36	n=88
<b>Tree swallow</b>						
Successful	30%	64%	34%	66%	74%	74%
Pre-fledged	4%	6%	0%	3%	0%	0%
Failed	6%	29%	7%	18%	17%	20%
Abandoned	1%	0%	7%	0%	3%	3%
Unknown	4%	0%	11%	3%	0%	0%
	n=24	n=31	n=27	n=18	n=23	n=44
<b>Eastern bluebird</b>						
Successful	52%	56%	60%	55%	64%	84%
Pre-fledged	10%	17%	7%	21%	23%	16%
Failed	27%	26%	26%	12%	12%	16%
Abandoned	10%	11%	27%	16%	0%	0%
Unknown	0%	13%	0%	3%	0%	0%
	n=12	n=18	n=15	n=11	n=14	n=19

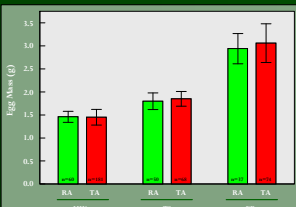


Fig. 1. Average egg mass (g,  $\pm$ 1SD) per clutch for house wren (HW), tree swallow (TS), and eastern bluebird (EB) on reference (RA) and target (TA) areas.



## RESULTS AND DISCUSSION

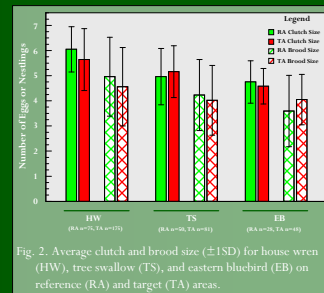


Fig. 2. Average clutch and brood size ( $\pm$ 1SD) for house wren (HW), tree swallow (TS), and eastern bluebird (EB) on reference (RA) and target (TA) areas.

- Nest fate of all initiated house wren (369), tree swallow (193), and eastern bluebird (119) nests for the 2005 through 2007 breeding seasons (Table 1.)
- Mean egg mass differed by no more than 3.6% for any species between reference and target areas (Fig. 1.)
- House wren clutch size was 6.8% greater in the reference compared to target areas (Fig. 2.)
- Clutch sizes for HW and TS were similar to those previously reported ([2] and [3], respectively)

- Tree swallows had 7.0% greater fledging success and 15% higher productivity in reference areas (Fig. 3.)
- Tree swallows had 8.4% greater hatching success at reference compared to target areas ( $\beta=0.39$ )
- Eastern bluebirds had 14.5% lesser hatching success at reference as compared to target areas ( $\beta=0.36$ )
- Tree swallows at 2,3,7,8-TCDD contaminated sites (WHO<sub>Air</sub> TEQs in eggs ranged from 300 to  $>1,000$  pg/g ww) had 34-49% lesser hatching success compared to reference areas on the Woonasquatucket River, Rhode Island, USA [4]
- Eastern bluebirds had 23% lesser productivity in reference areas (Fig. 3.)
  - Productivity difference is reduced to 17% lesser in reference areas when 1 highly unproductive female is removed from calculations
- Eastern bluebird nestlings had 5.4-10% lesser masses at reference areas on mass days 2-4 (Fig. 4.)
- Tree swallow nestling growth rates and immune function were correlated to egg mass [5]

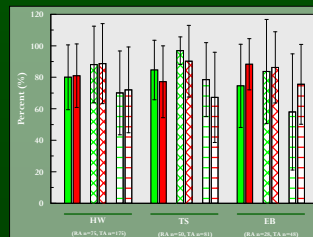


Fig. 3. Hatching success, fledging success, and productivity of house wren (HW), tree swallow (TS), and eastern bluebird (EB) on reference and target areas.

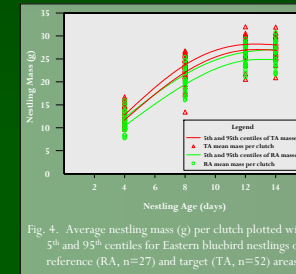


Fig. 4. Average nestling mass (g) per clutch plotted with 5<sup>th</sup> and 95<sup>th</sup> centiles for Eastern bluebird nestlings on reference (RA, n=27) and target (TA, n=52) areas.



- Corresponding residue and congener profile analyses are reported on an accompanying poster (MP203 - PCDF and PCDD accumulation rates for three passerine species as part of a site-specific risk assessment on the Tittabawassee River.)

## CONCLUSIONS

- Overall most parameters were similar between reference and target areas with some subtle differences
- Some abandonments and depredations were due to inter-specific competition between the 3 species of interest [6] (Table 1.)
- Residue analyses have not been completed for all site-specific samples and therefore hatching success and other productivity measurements cannot be correlated to specific concentrations on a per box basis
- Initial residue analyses indicate that tree swallow egg concentrations at reference areas are similar to target, while NS concentrations and profiles are representative of other area specific samples
- Habitat (availability and quality), weather variables, and age-class comparisons will be included in future data analyses
- Data reported represent preliminary comparisons from one of three lines of evidence being considered in the Tittabawassee River Risk Assessment Process

## LITERATURE CITED

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