

# POPULATION, REPRODUCTION, AND HEALTH IMPAIRMENTS IN COLONIAL WATERBIRDS BREEDING IN AREAS OF CONCERN

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RESTORATION



# Study Sites and Michigan AOC's



◆ Study colonies at AOCs

▲ Reference colonies in lower St. Mary's River and Chantry Island, Lake Huron

# Birds Studied

- Saginaw Bay (2010-2011)
  - two herring gulls colonies (Confined Disposal Facility (CDF) in the southern bay and Little Charity Island in the outer bay)
  - two Caspian tern colonies (CDF and Charity Reef)
  - one black-crowned night heron colony (CDF)
- Raisin River AOC
  - herring gulls colony at the Detroit Edison Monroe Power Plant on the western shore of Lake Erie.



# Background

- Great Lakes fish-eating birds are sensitive to PCBs, dioxins and other chemicals which cause developmental deformities, reproductive problems, immune suppression, and endocrine disruption
- Great Lakes embryo mortality, edema, and deformity syndrome (GLEMEDS) linked to dioxin-like PCB contamination in Caspian terns and herring gulls .
- Immunosuppression:
  - T-cell-mediated immunity - low phytohemagglutinin (PHA) responses → low survival
  - Antibody-mediated immunity – low antibody production in response to sheep red blood cells
- Previous study over 20 years by Grasman et al.
- This study with Great Lakes Restoration Initiative funding thru FWS
- Objective: investigate population-level effects associated with contaminants by assessing reproduction and immunological function in birds at AOCs, including Caspian terns, designated as threatened in Michigan.

# Embryo Viability Test

- In herring gulls, embryonic viability was assessed in 3-egg clutches during mid-late incubation
- Embryonic viability detector (Avitronics Digital Egg Monitor, Cornwall, England) detects vibrations in the egg from heartbeat or motion.
- One and two egg clutches were marked during laying and revisited during mid-late incubation.
- Nonviable eggs were opened and examined for infertility, embryonic development, and deformities.

# Embryo Viability Results

- In 2010 embryonic nonviability in herring gulls at Saginaw Bay and Raisin River AOCs (4-5%) was higher than at reference sites (<2%, Craig Hebert, Environment Canada, personal communication).
- Saginaw Bay: nonviability was most influenced by early failed development on the CDF and infertility on Little Charity
- River Raisin: nonviability was spread out through various stages of development causing lower productivity.

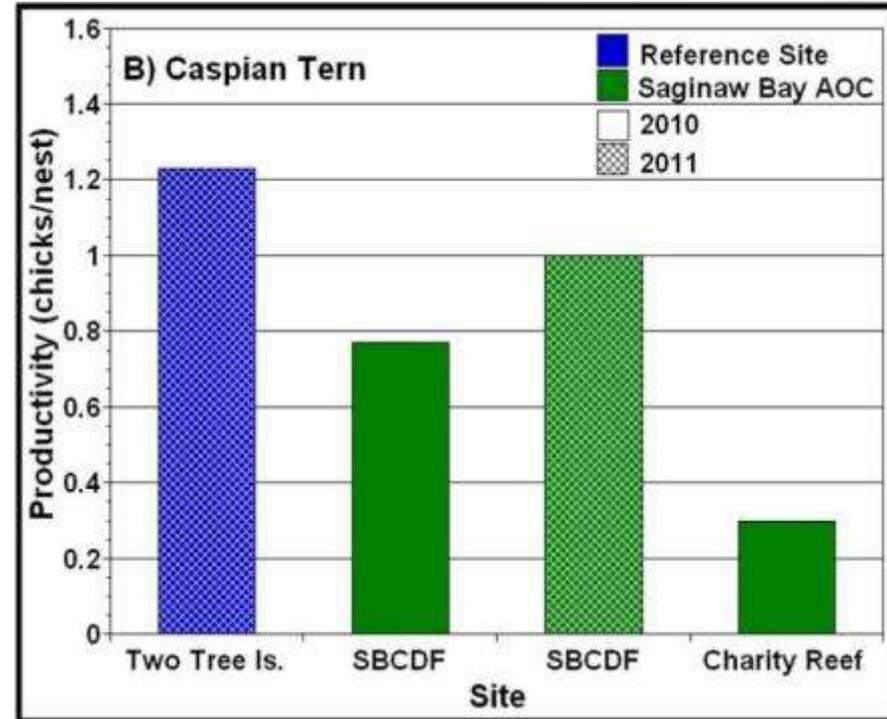
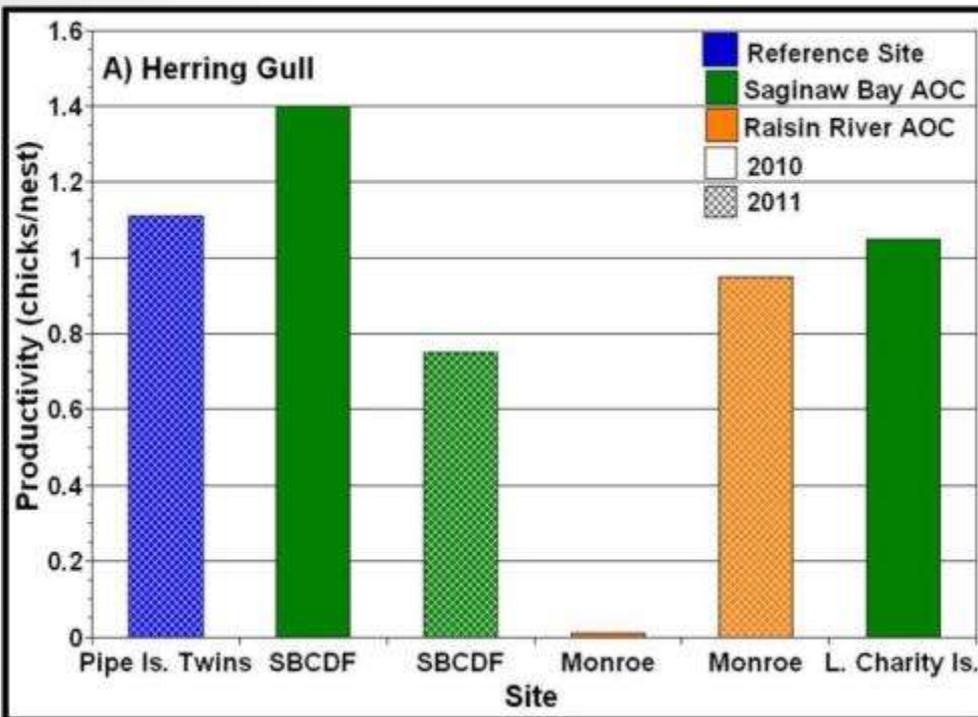
# Growth and Productivity

- Enclosures were set up around high density nesting areas for gulls and terns.
- Mass and body measurements were conducted at 3 and 4 weeks of age.
- Productivity was calculated by dividing the number of 3 week chicks by the total number of enclosed nests.



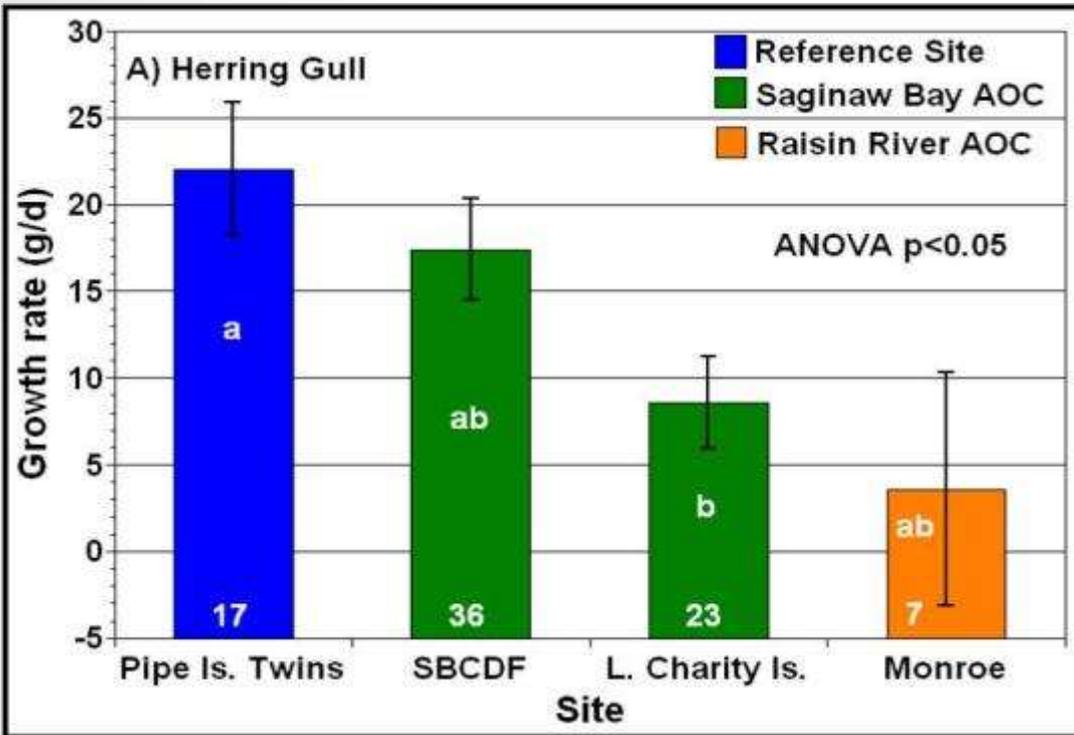


# Productivity

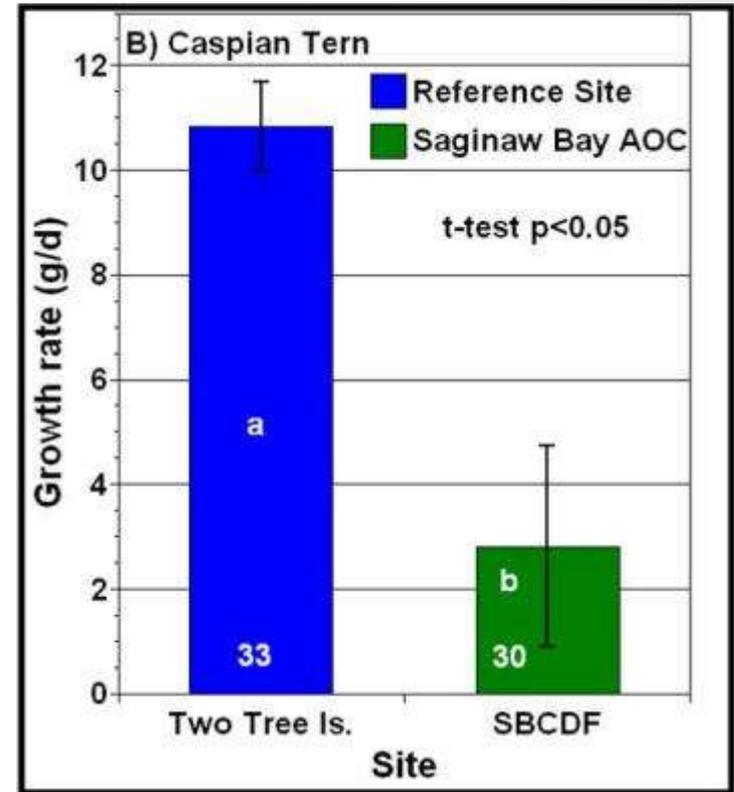


A stable herring gull population can be maintained if the productivity rate is at least 0.75 chicks/nest (Kadlec & Drury 1968)

# Growth



Significant growth impairment. 29% of chicks at Monroe *lost* weight from three to four weeks of age.

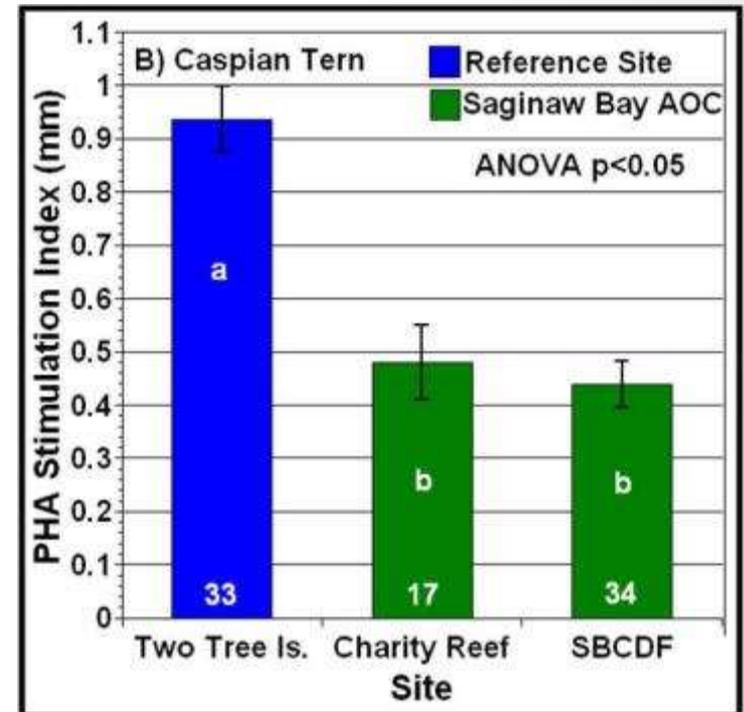
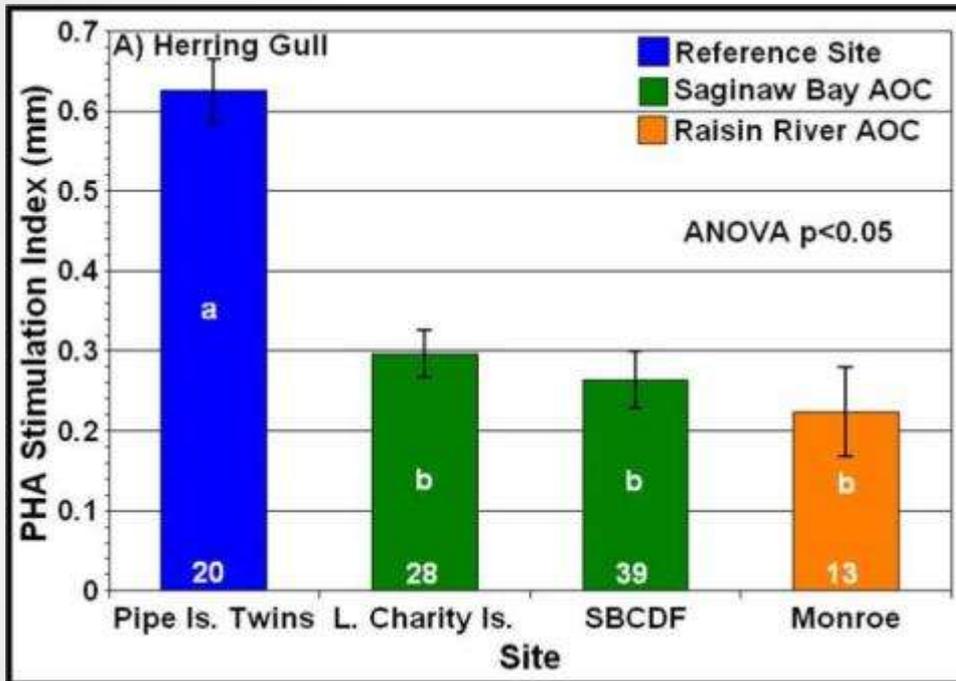


Significant growth impairment.

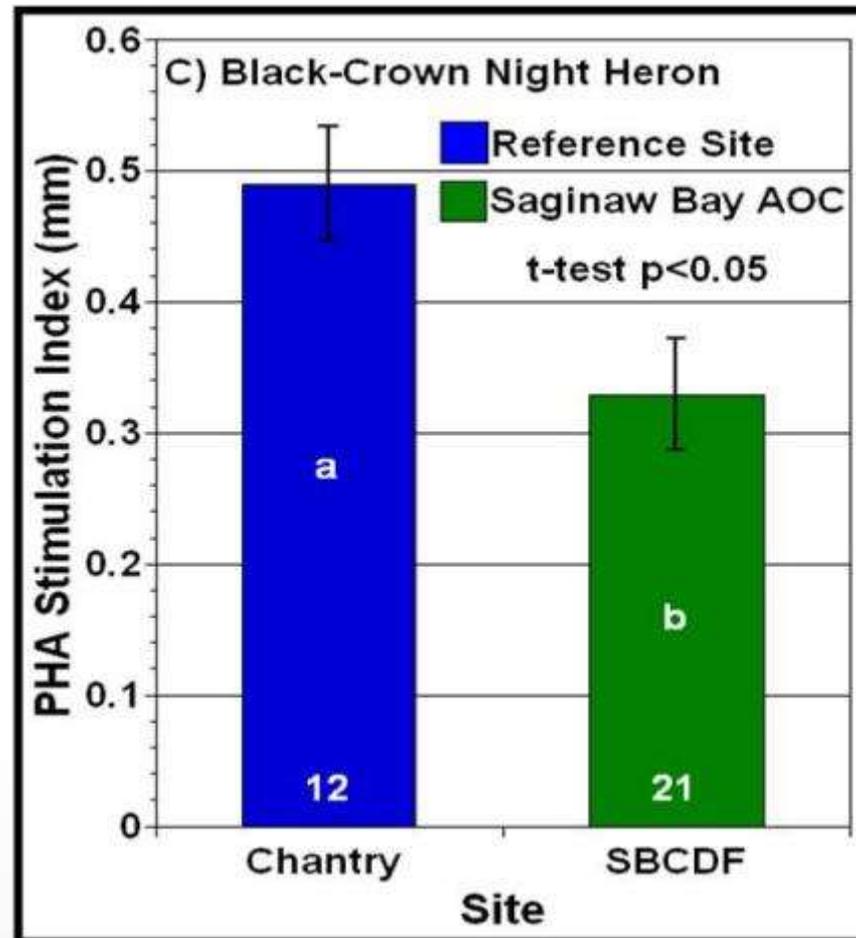
# Immunesuppression Testing

- Phytohemagglutinin skin test to assess T-cell mediated immunity
- PHA in phosphate buffer saline (PBS) was injected into one wing and PBS was injected into the opposite wing at 3 weeks of age for herring gulls and Caspian terns and at 2 weeks for black-crowned night herons.
- Pressure sensitive calipers were used to measure the wing web to the nearest 0.05mm before and twenty-four hours after injection. The thickness of the wing web indicated the level of T-cell mediated immune response.

# Immunesuppression Results



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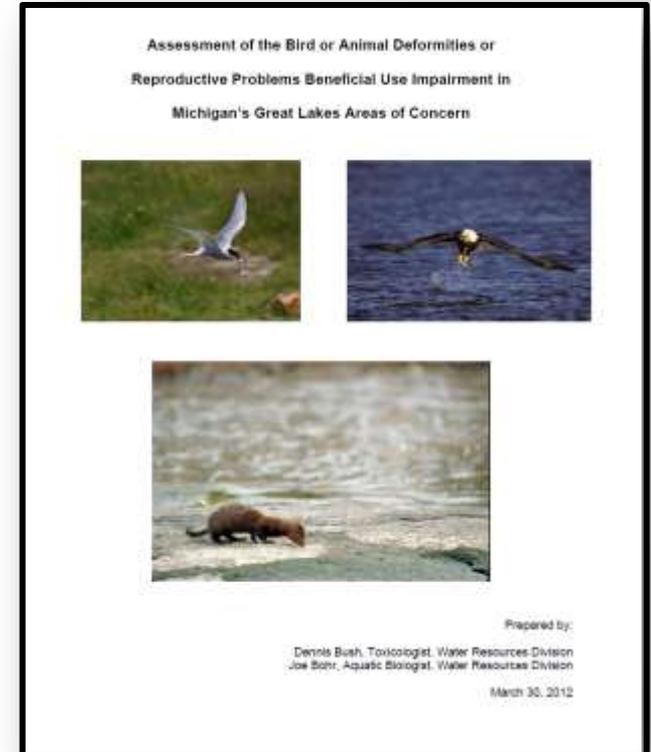


# Study Conclusions

- Herring gulls, Caspian terns, and black-crowned night herons at Saginaw Bay and Raisin River AOCs exhibited reproductive, growth, and/or immunological impairments consistent with previous studies on the effects of persistent pollutants.
  - In 2010, herring gulls at Monroe (Raisin River AOC) failed to produce fledglings and Caspian terns at Charity Reef (Saginaw Bay AOC) had an extremely low productivity rate.
  - Growth rates of Caspian terns and black-crowned night herons on the CDF were significantly reduced, along with growth rates of herring gulls at Monroe.
  - Immunity (T-cell mediated PHA response) was suppressed dramatically in herring gulls, Caspian terns, and black-crowned night herons on Saginaw Bay AOC islands (CDF, Charity Island and Charity Reef).
- Collection of more embryonic viability data is needed to determine if GLEMEDS is still a concern for herring gulls at AOCs.
- Caspian terns at Saginaw Bay AOC exhibited low growth rates and immune responses, which may correlate with their population decline

# Relevance to Delisting

- MDEQ, in collaboration with USFWS, is completing a report the Bird or Animal Deformities or Reproductive Problems BUI at Michigan's AOCs
- Based on this and other work:



The Wildlife BUI for the Saginaw River/Bay AOC should be retained based on potential effects of contaminants on colonial nesting birds and other wildlife.

The Wildlife BUI for the River Raisin AOC should be retained based on potential effects of contaminants on bald eagles and colonial nesting birds.

# Acknowledgments

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