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An Assessment of Wildlife Reproduction and Deformities in the St. Clair River Area of Concern (AOC)

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- Research and monitoring of effects of toxicological and ecological stressors on wildlife
- Measurement of contaminants (PCBs, metals, pesticides, etc) in body burdens
- Assessment of health

Wildlife Species Studied in the St. Clair River AOC

- To assess BUI #5, wildlife deformities and reproduction, we used two aquatic sentinel species: northern leopard frog and snapping turtle
- Examined reproduction, deformities & contaminant burdens
- Studied both in laboratory and in wild

Northern Leopard Frogs

Conducted laboratory exposure studies to sediment and water from multiple AOC sites to assess hatching success and embryonic deformities.

Conducted surveys of wild populations of frogs to assess:

- reproduction
- deformities
- contaminants

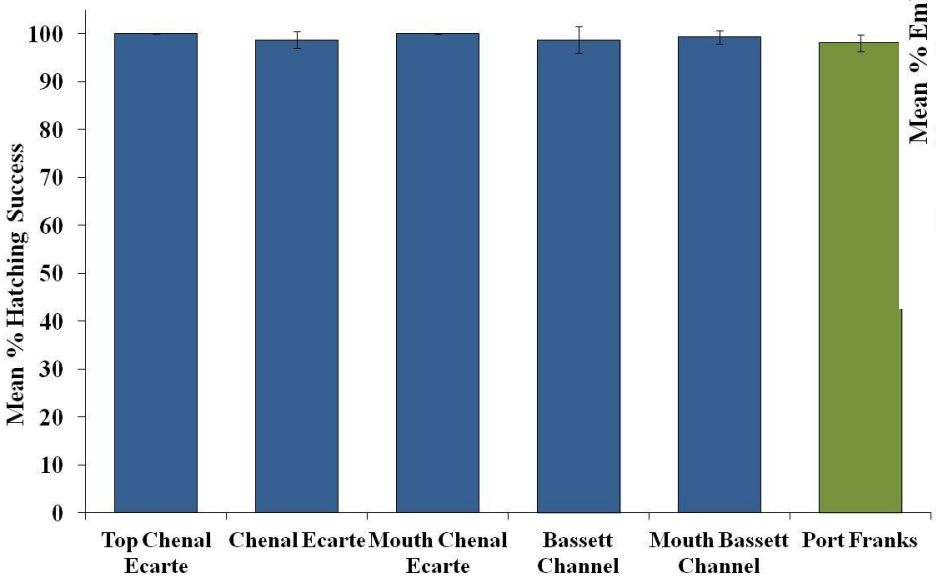
Sites in Lake Huron were reference sites.

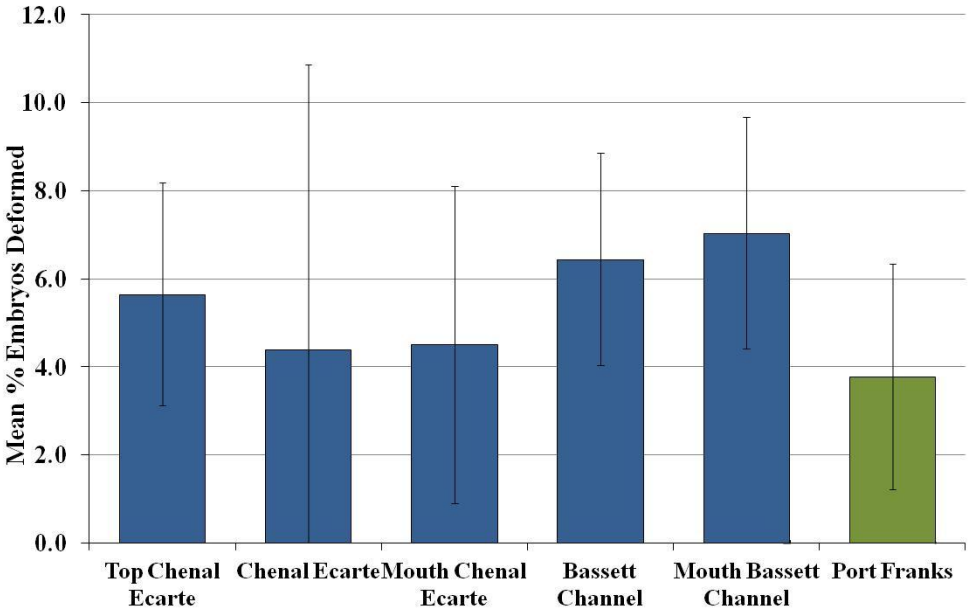
Embryonic Development of Leopard Frogs

- Laboratory exposures: embryos raised in water and sediment from St. Clair River AOC and reference sites
- Examined hatching success and embryonic development (i.e., frequency of deformities)

Northern Leopard Frogs Exposure to Water & Sediment Study

Both hatching success & frequencies of deformities in embryos are not significantly from the reference site.





Northern Leopard Frog Surveys 2006, 2007 & 2011

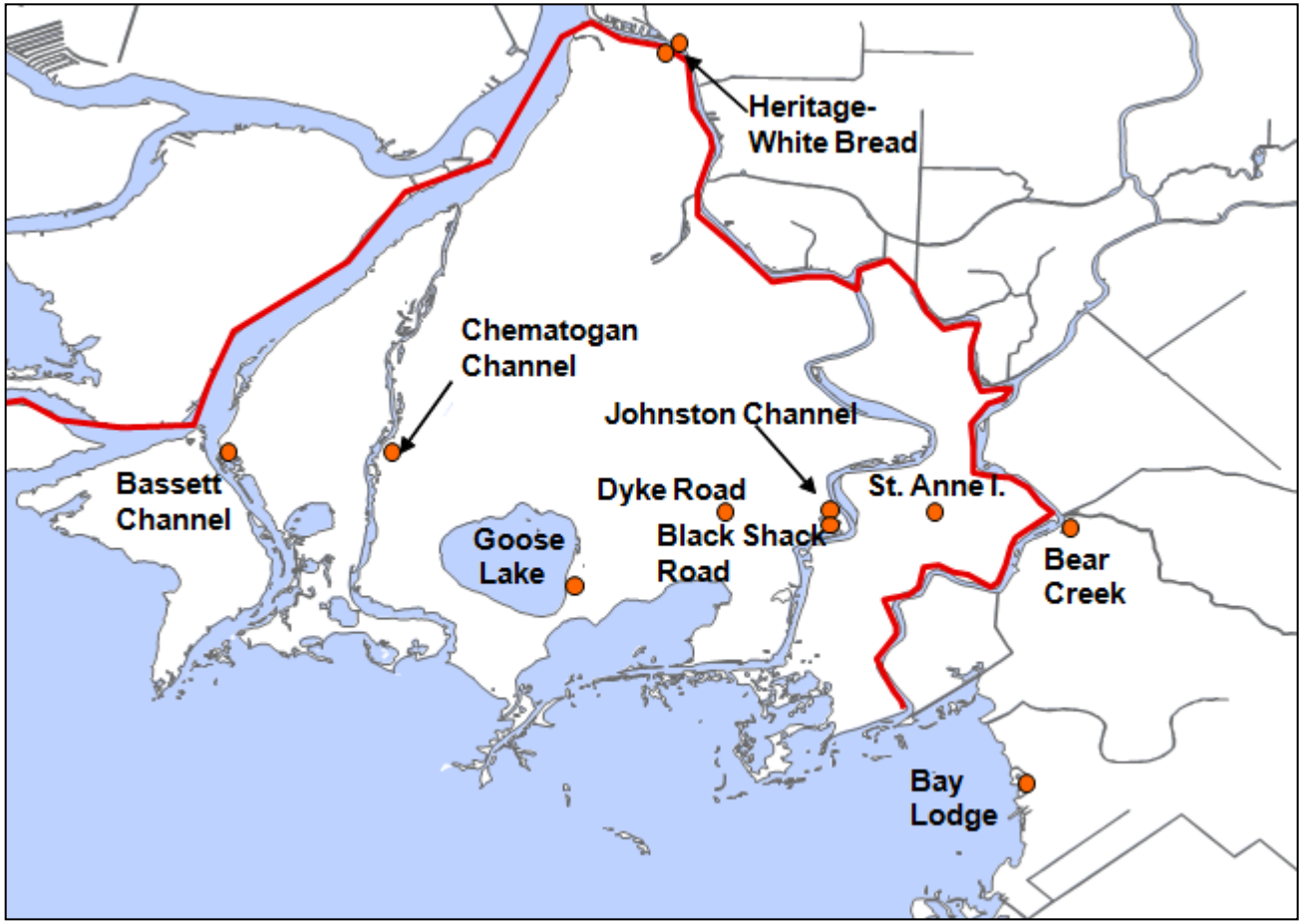
Summer = newly transformed froglets

- Examine for deformities in 100 frogs

Fall = pre-hibernation young of year frogs

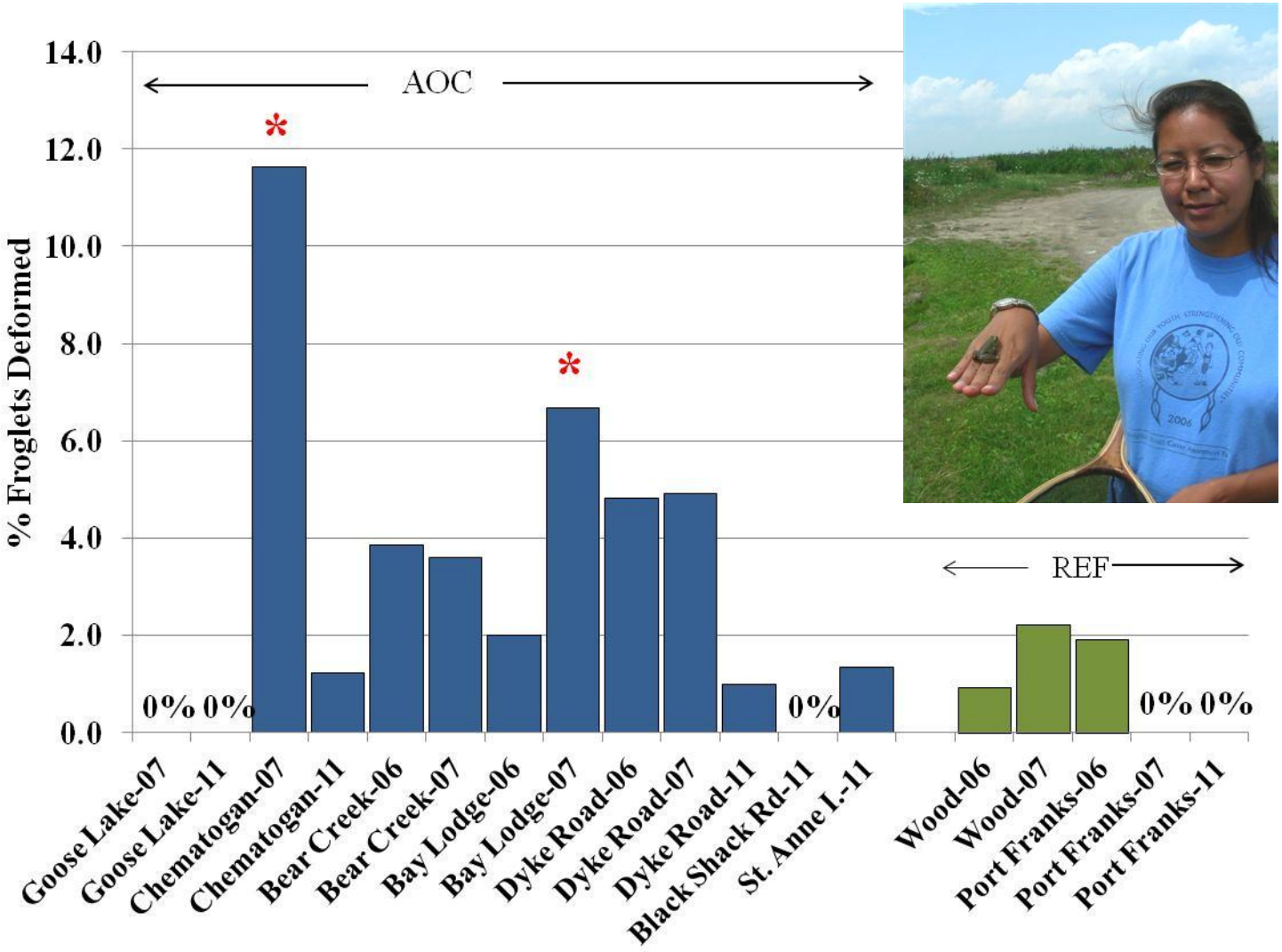
- Examine for evidence of intersex condition in male frogs and measure contaminant burdens

Northern Leopard Frogs
Survey Sites in the St. Clair River AOC

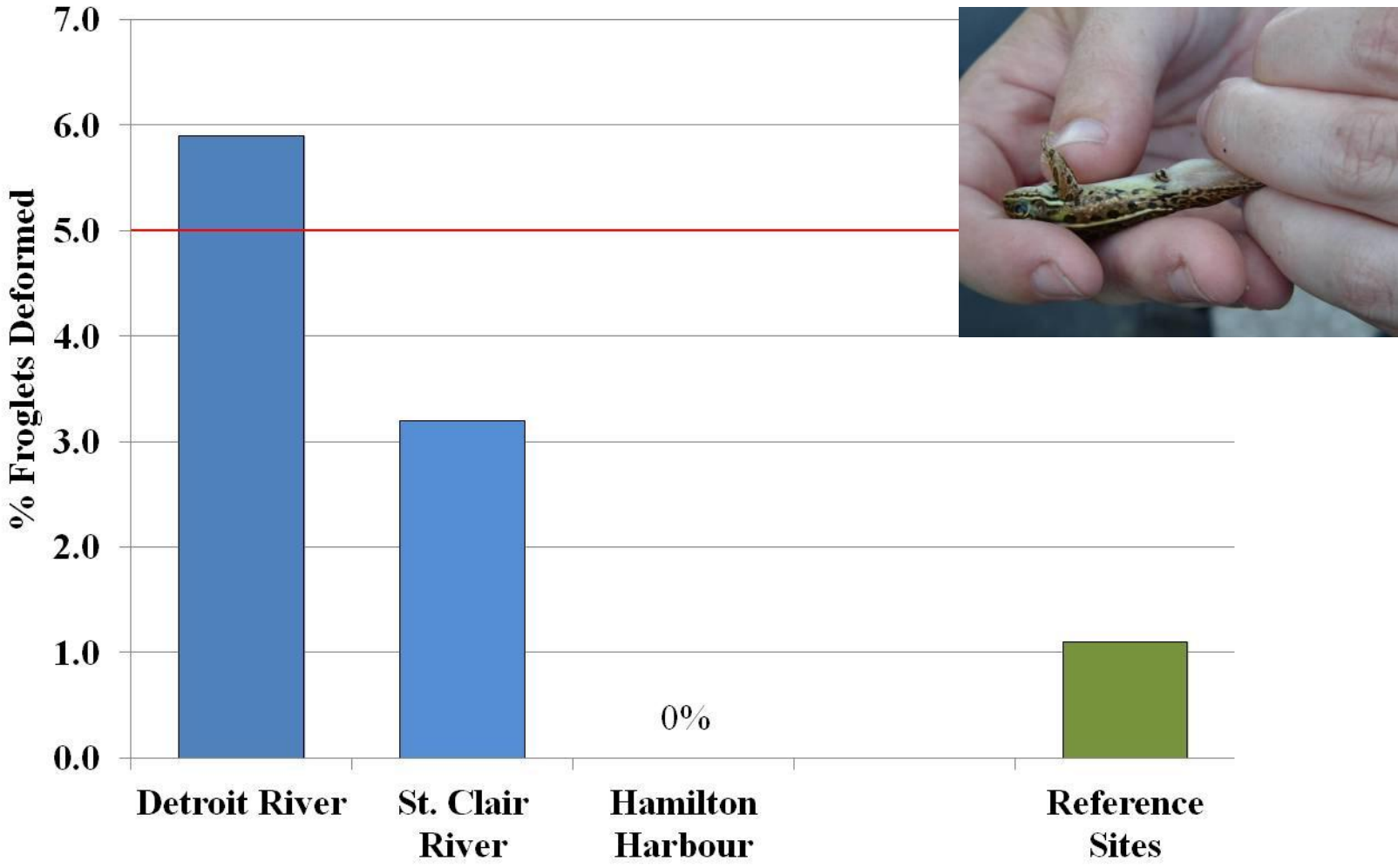


Deformities in Wild Populations of Newly Transformed Froglets

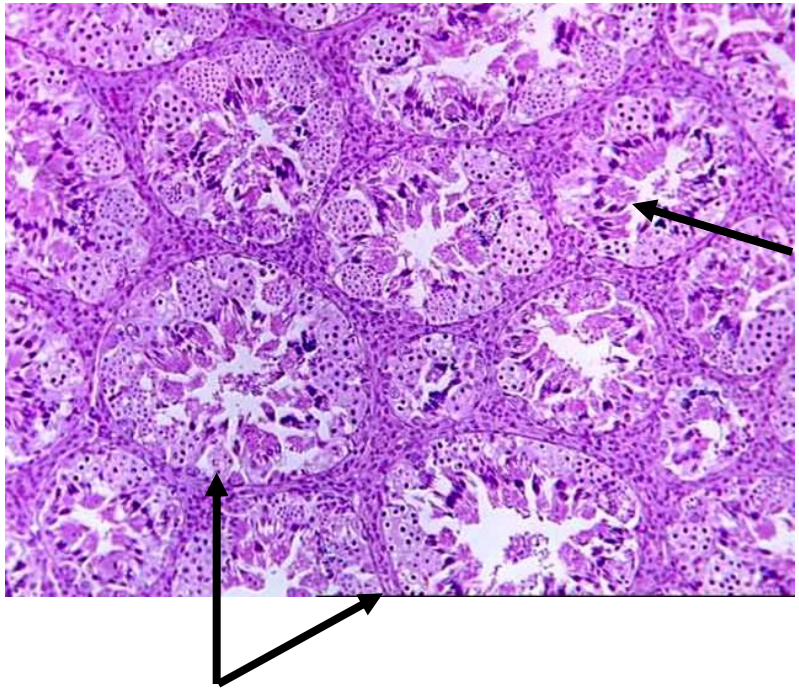
Incidence of Deformities in Newly Transformed Froglets



Incidence of Deformities at other Great Lakes Sites, 2006-2012



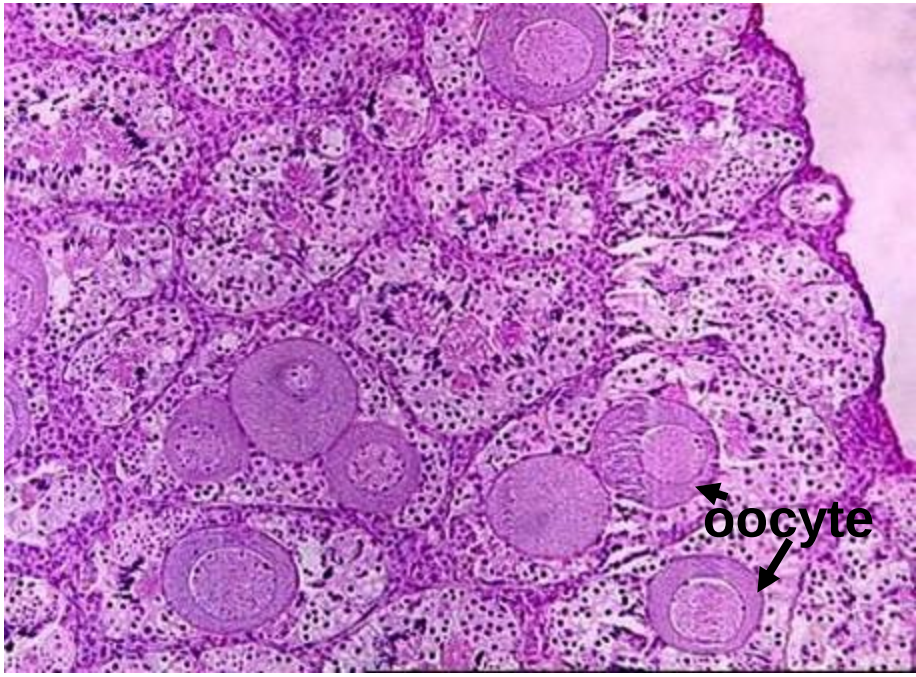
Intersex in Pre-hibernation Young of Year Male Leopard Frogs



Developing sperm

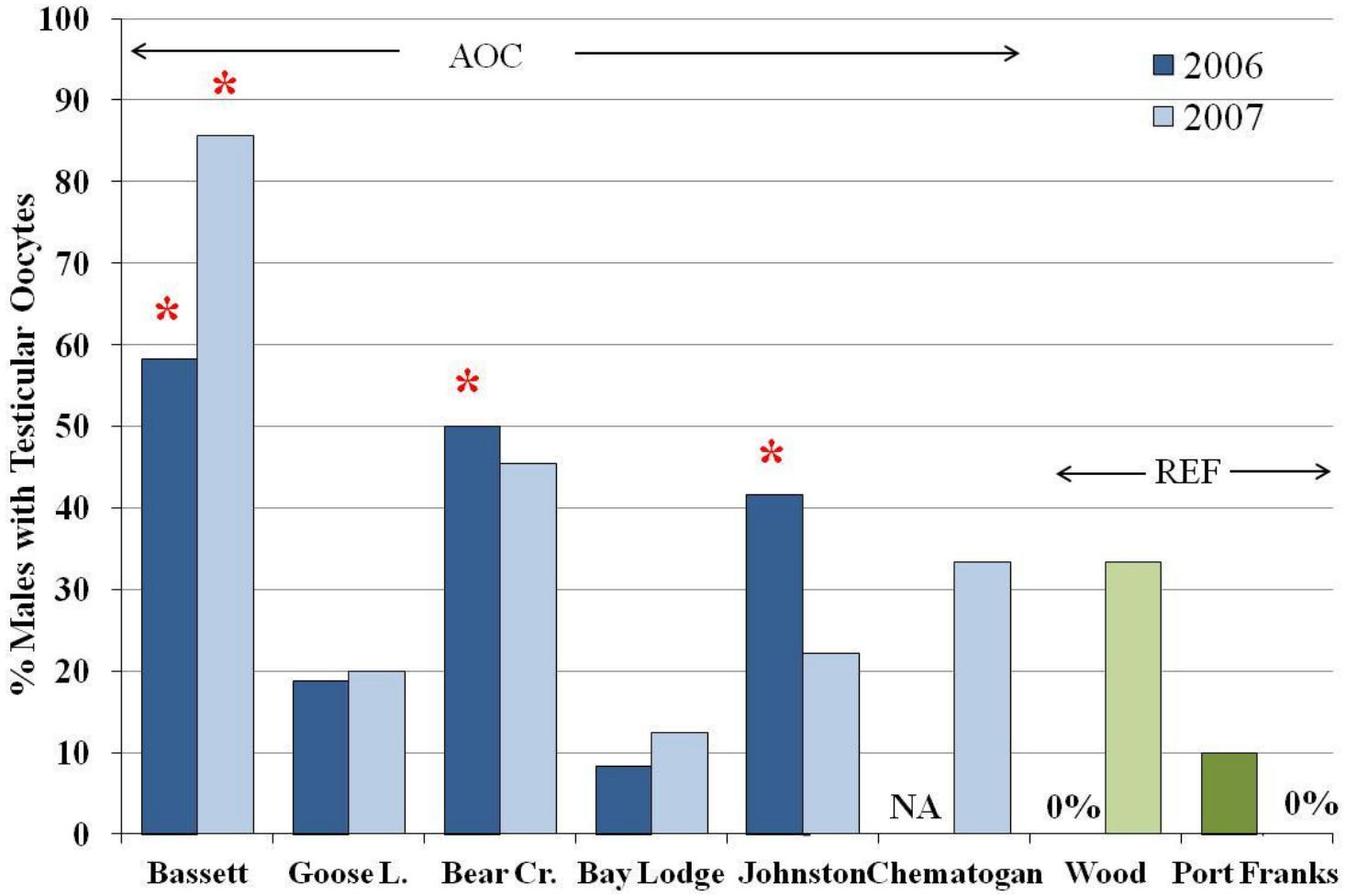
Seminiferous tubules

Normal Testes

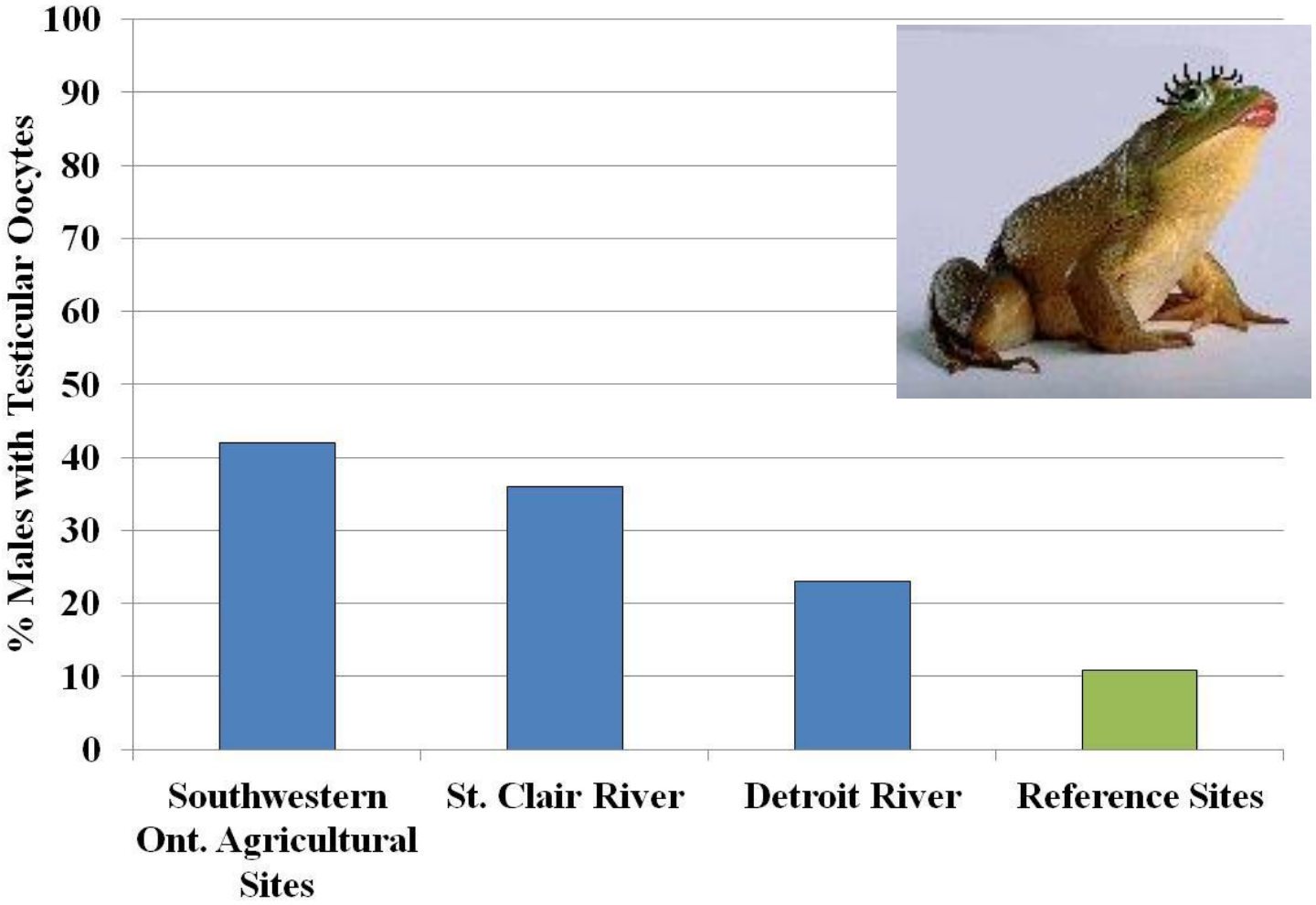


Testes with Testicular Oocytes

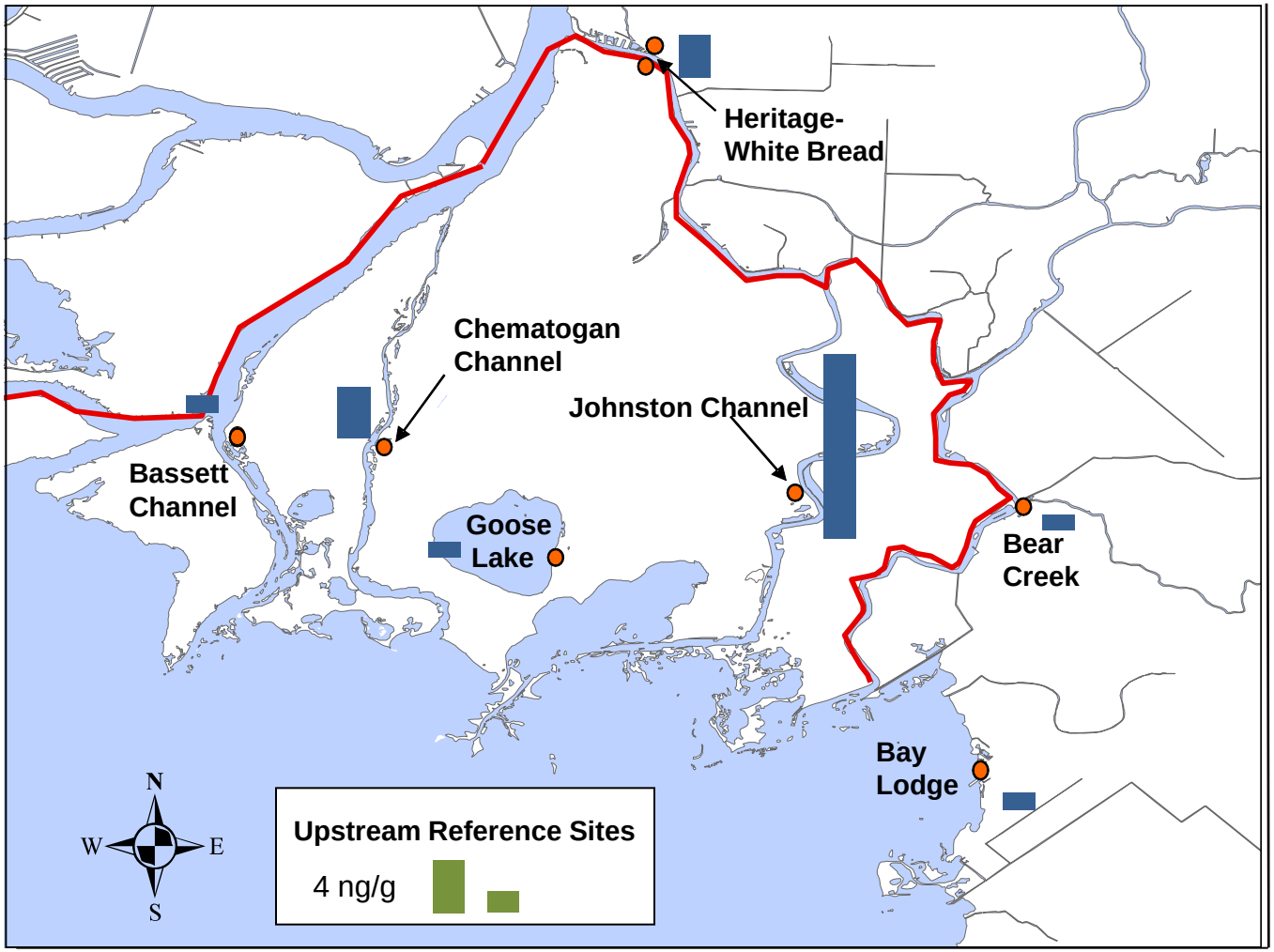
Intersex in Male Leopard Frogs from the St. Clair River AOC



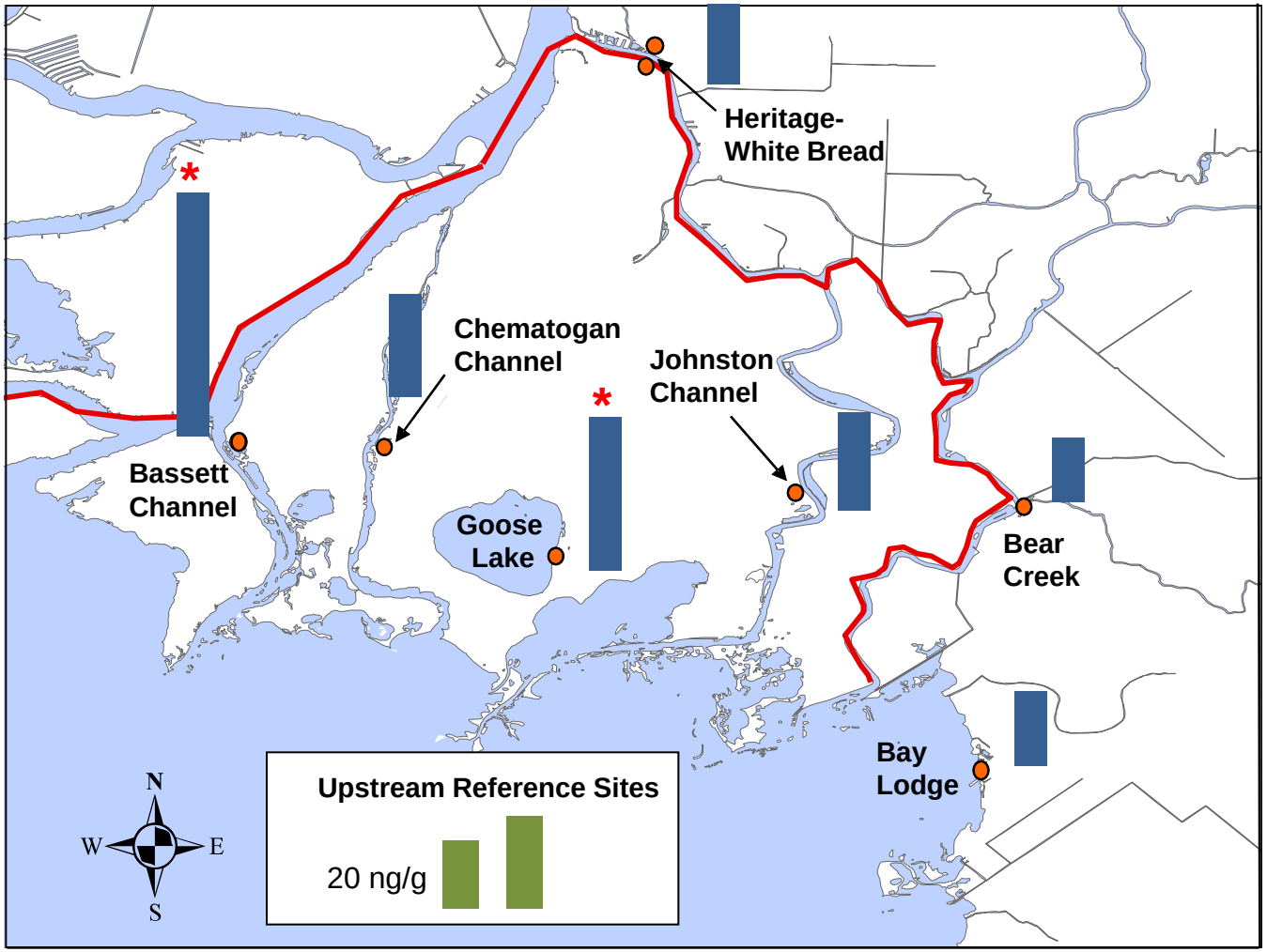
Intersex in Male Frogs at Other Ontario Sites, 2003-2008



Total DDT in Frogs

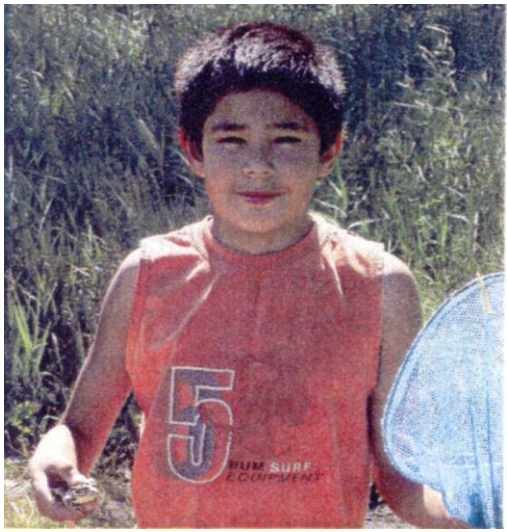


Total Mercury in Frogs



Summary - Leopard Frogs

- High hatchability and low incidence of deformities found in frog embryos
- 2 of 13 surveys in AOC exceeded the 5% threshold of deformities in new froglets
- Elevated rate of intersex testes in male frogs 4 of 11 surveys but overall similar or lower than other southwestern Ontario agricultural sites
- Low and variable concentrations of mercury
- Very low concentrations of other other legacy contaminants



Snapping Turtles

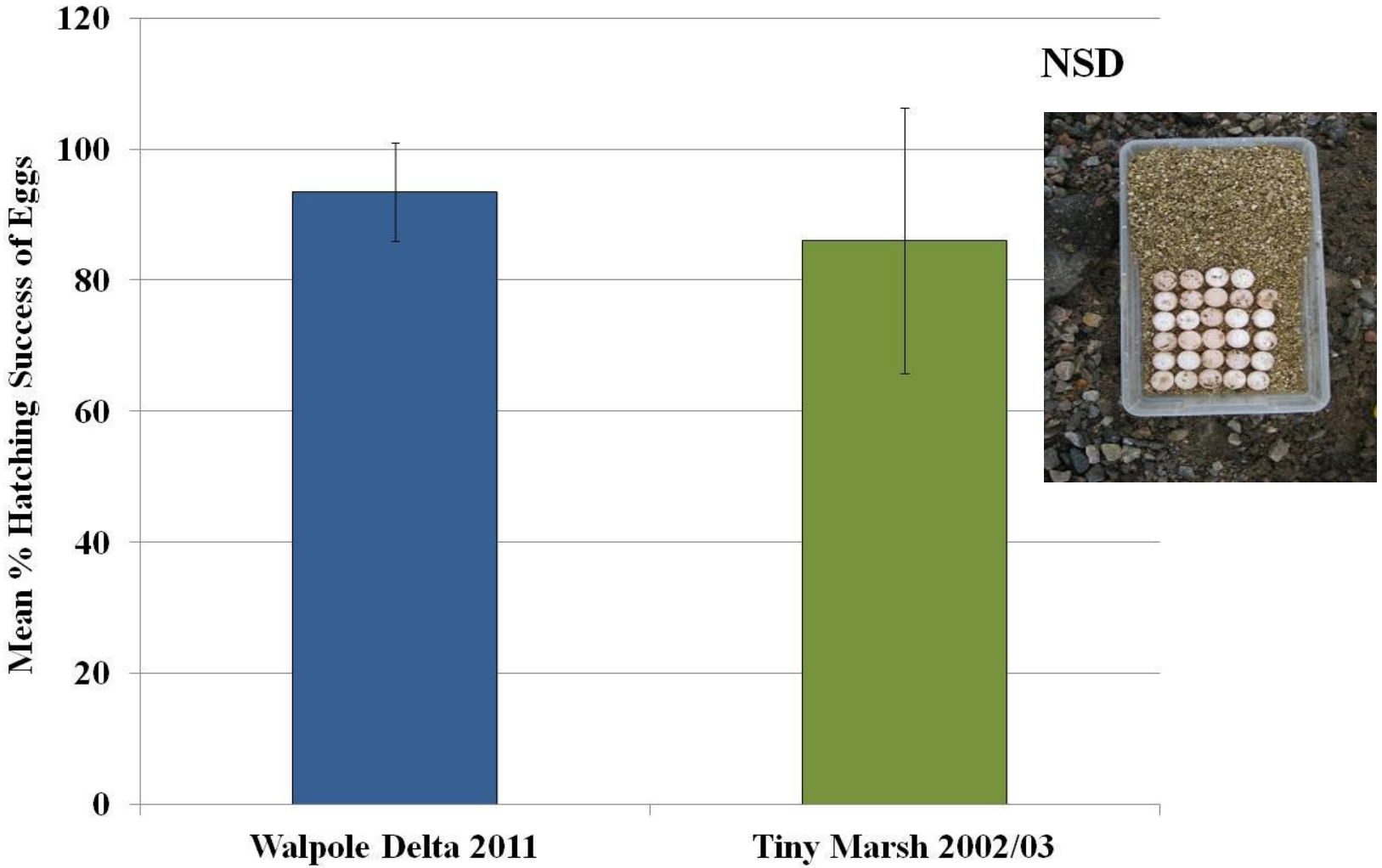
Artificially incubated eggs collected from multiple AOC sites in Walpole Delta (2011) to assess:

- hatching success
- hatchling deformities
- eggs for contaminants

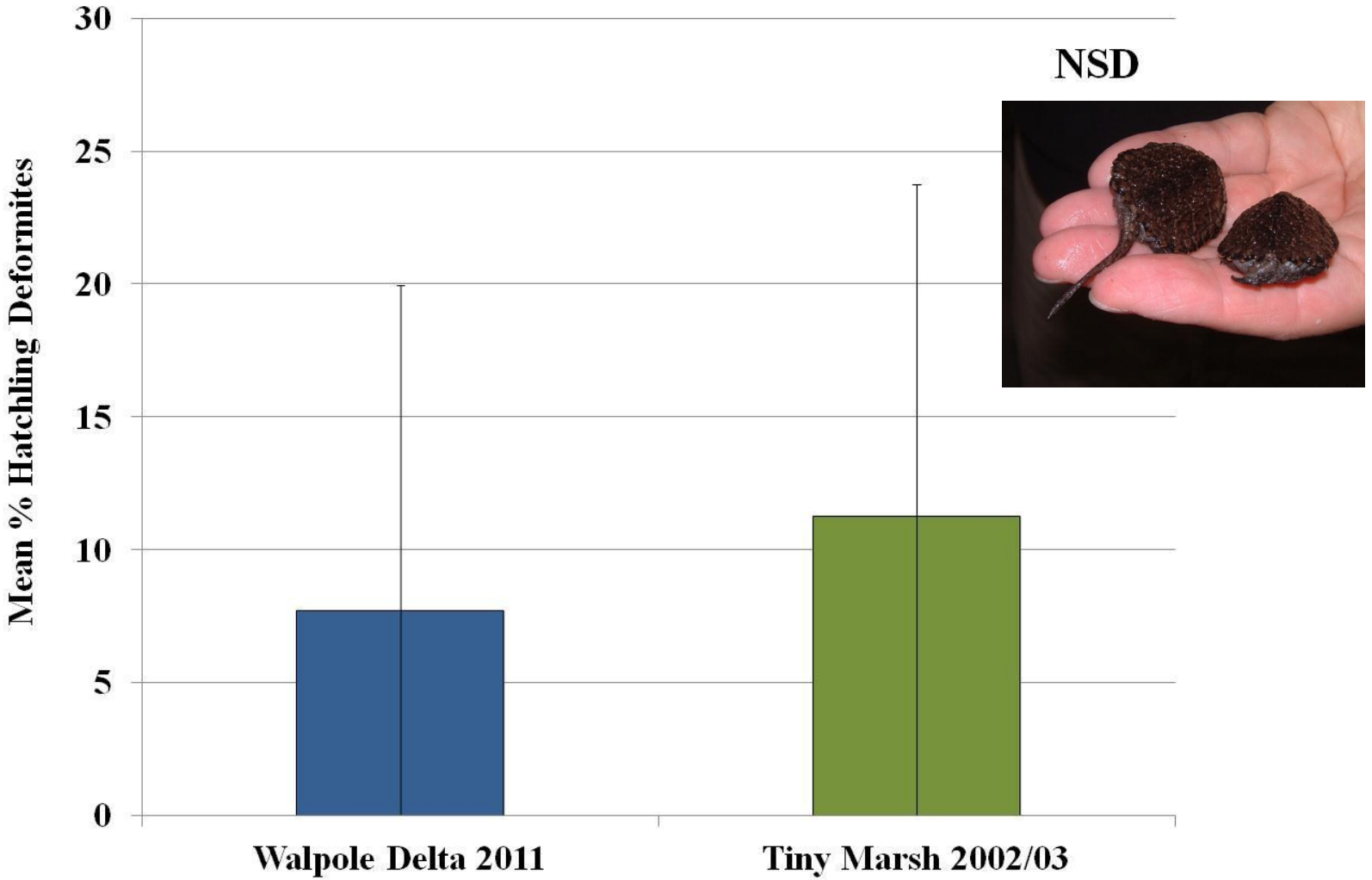
Tiny Marsh used as reference site

Snapping Turtles
Clutch Collection Locations (41)

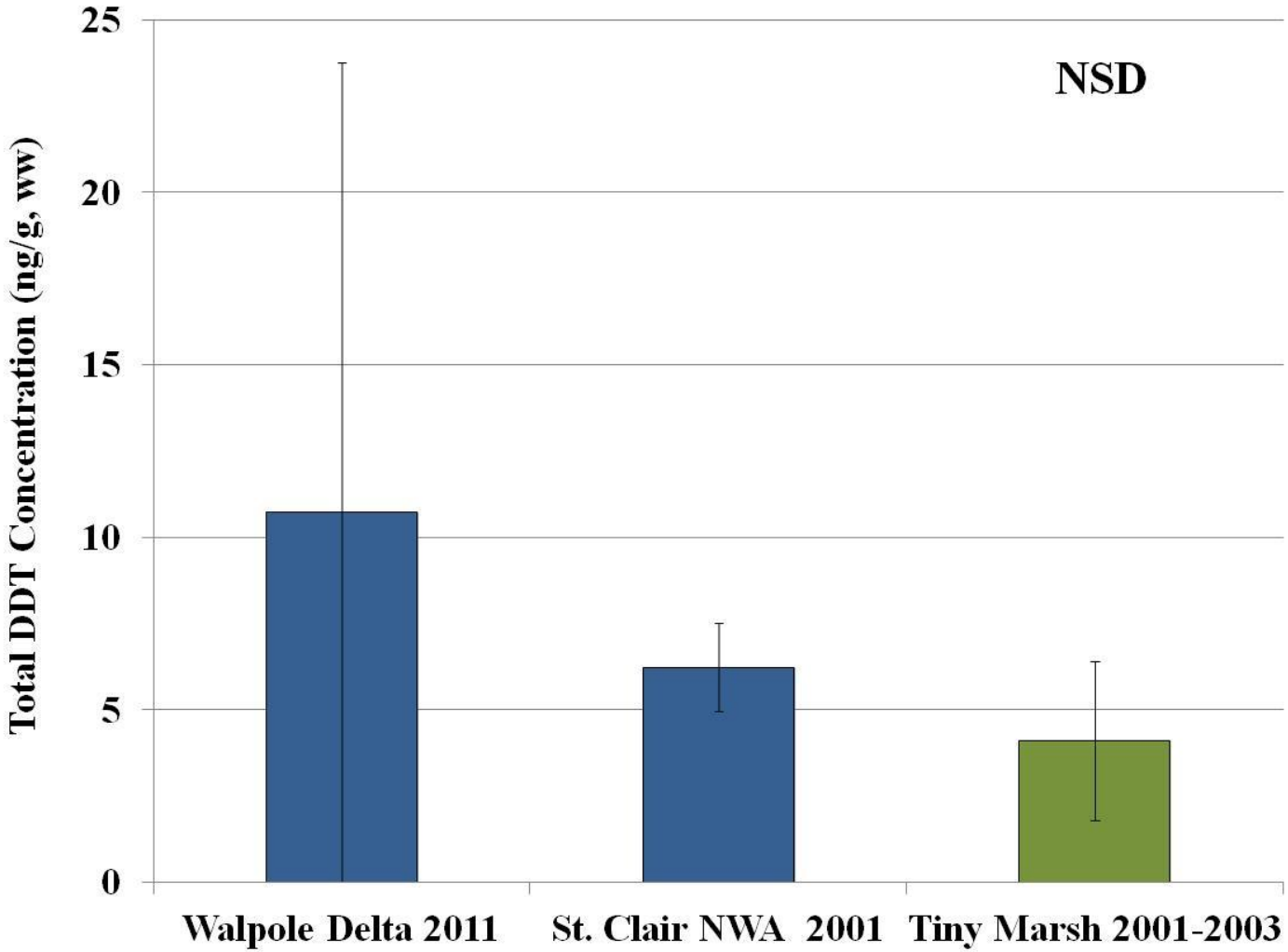
Snapping Turtles Hatching Success



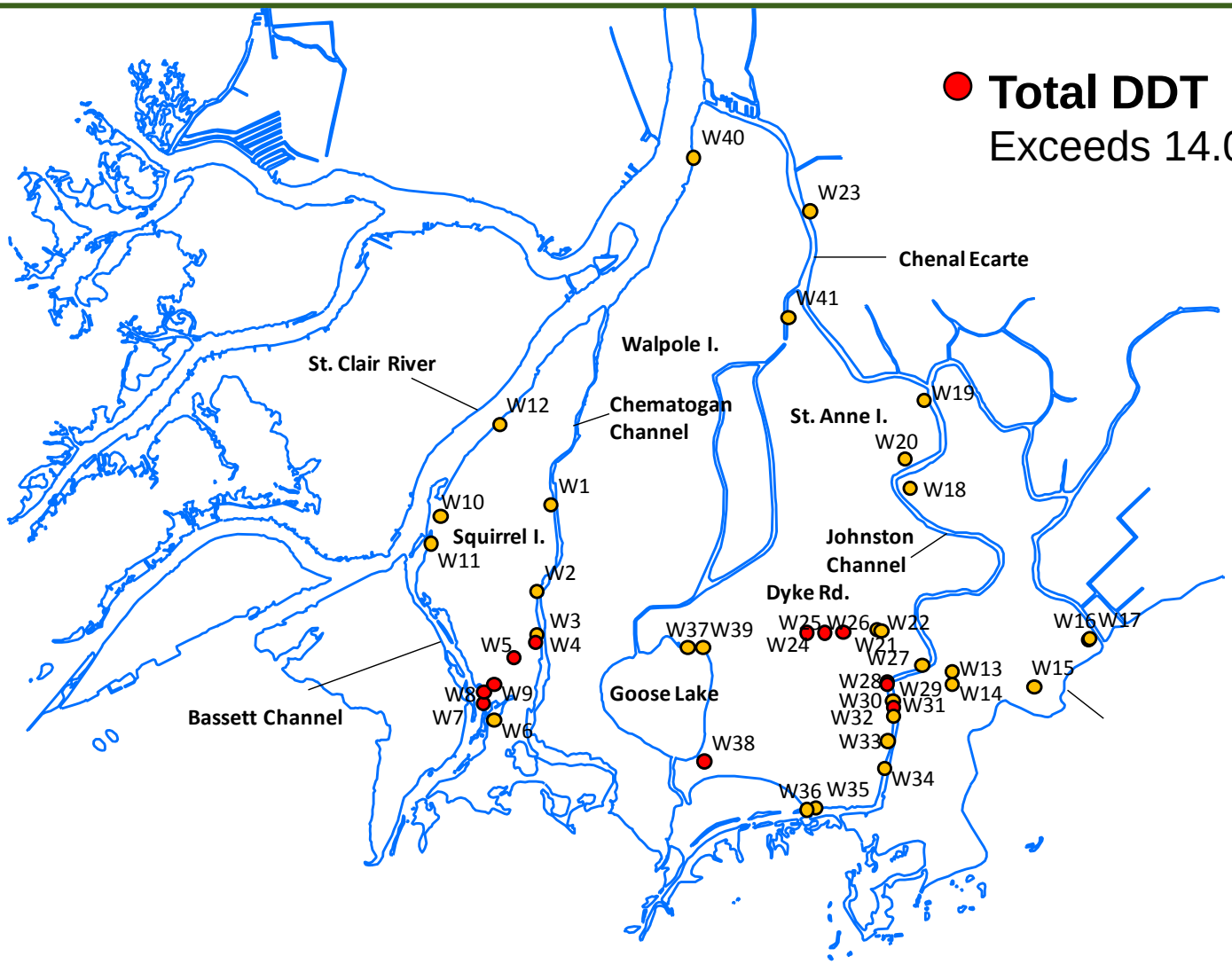
Snapping Turtles
Hatchling Deformities



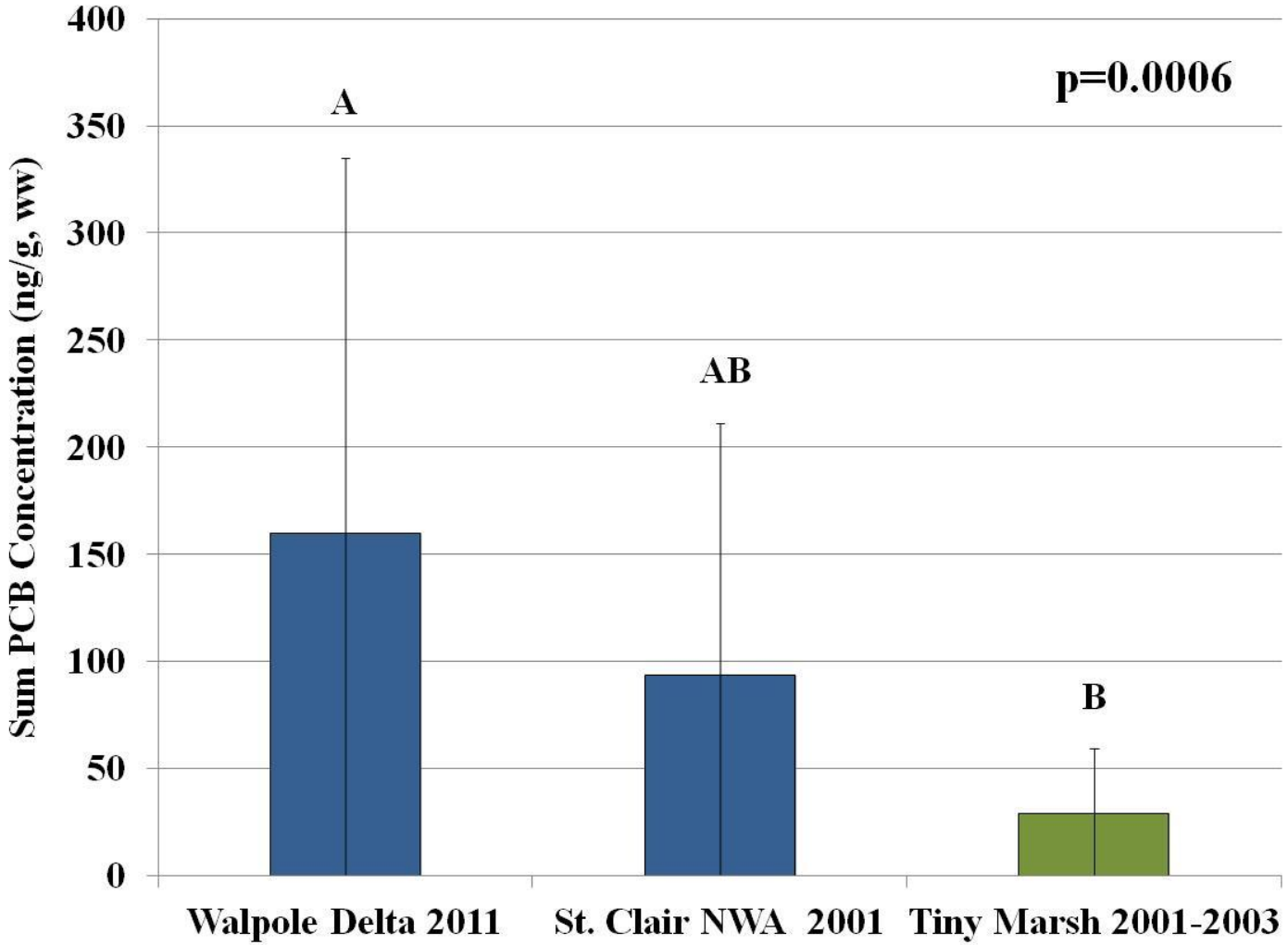
Snapping Turtle Eggs
Total DDT



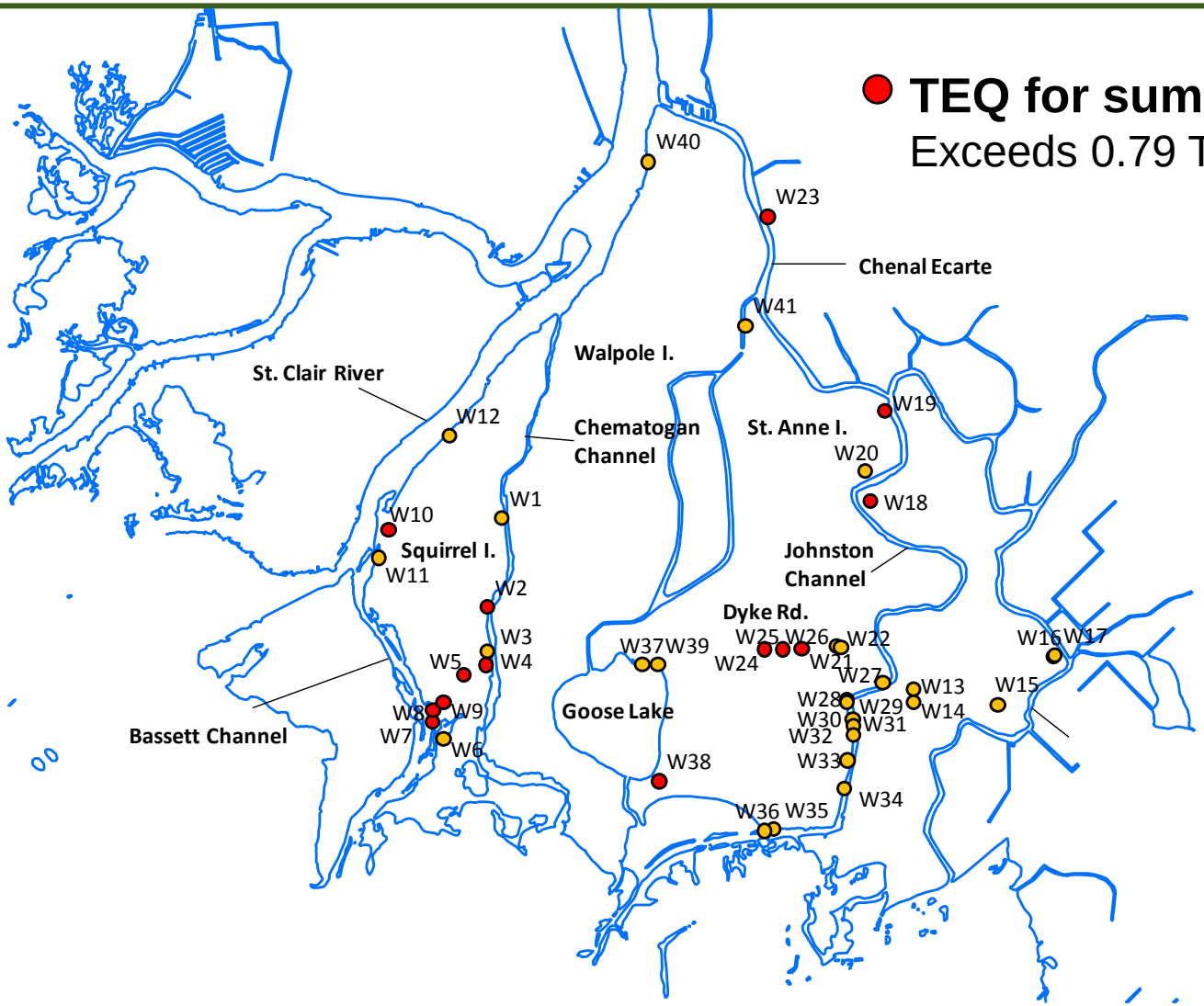
CCME Guideline for Protection of Wildlife Consumers – Total DDT



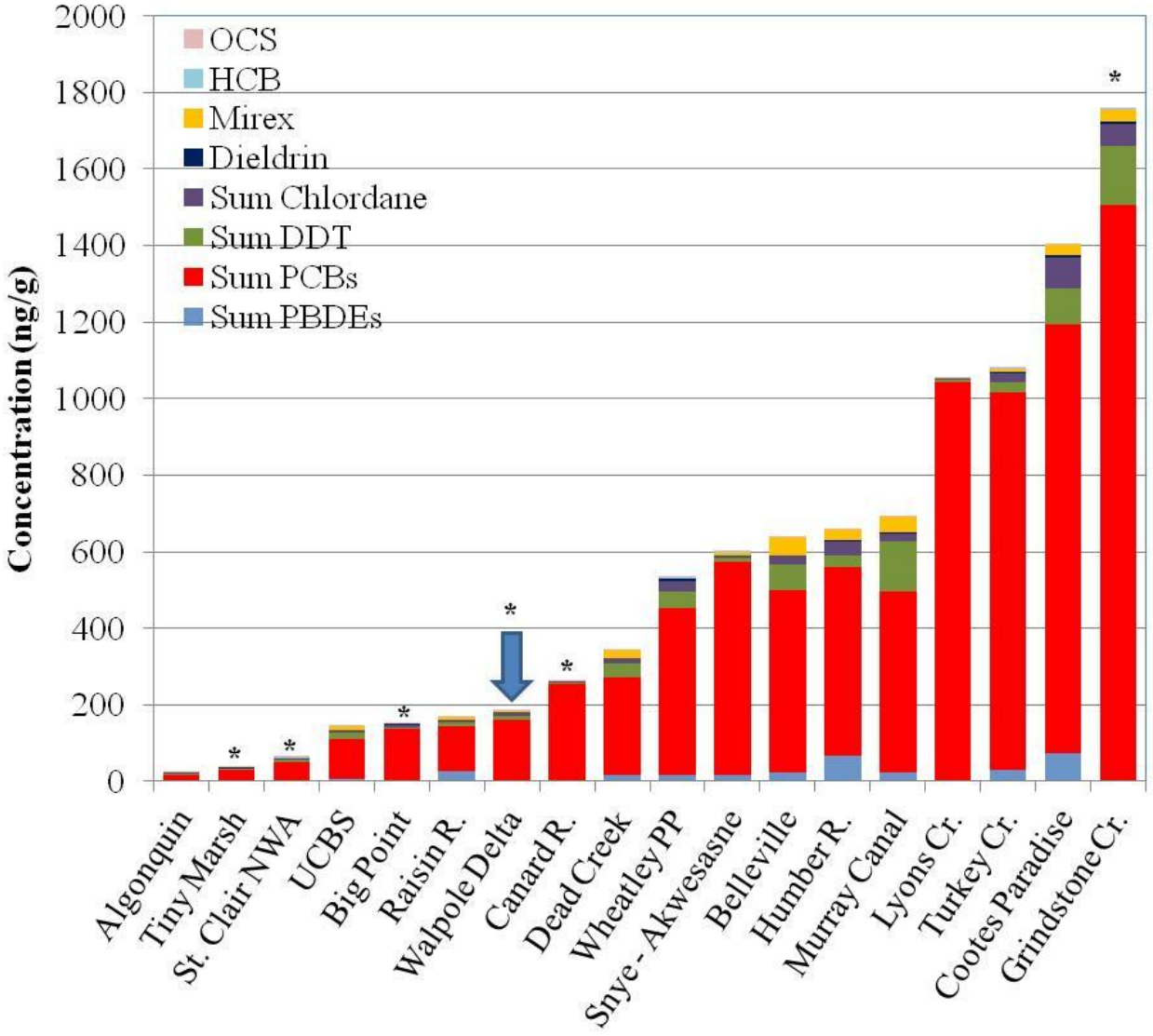
Snapping Turtle Eggs
Sum PCBs



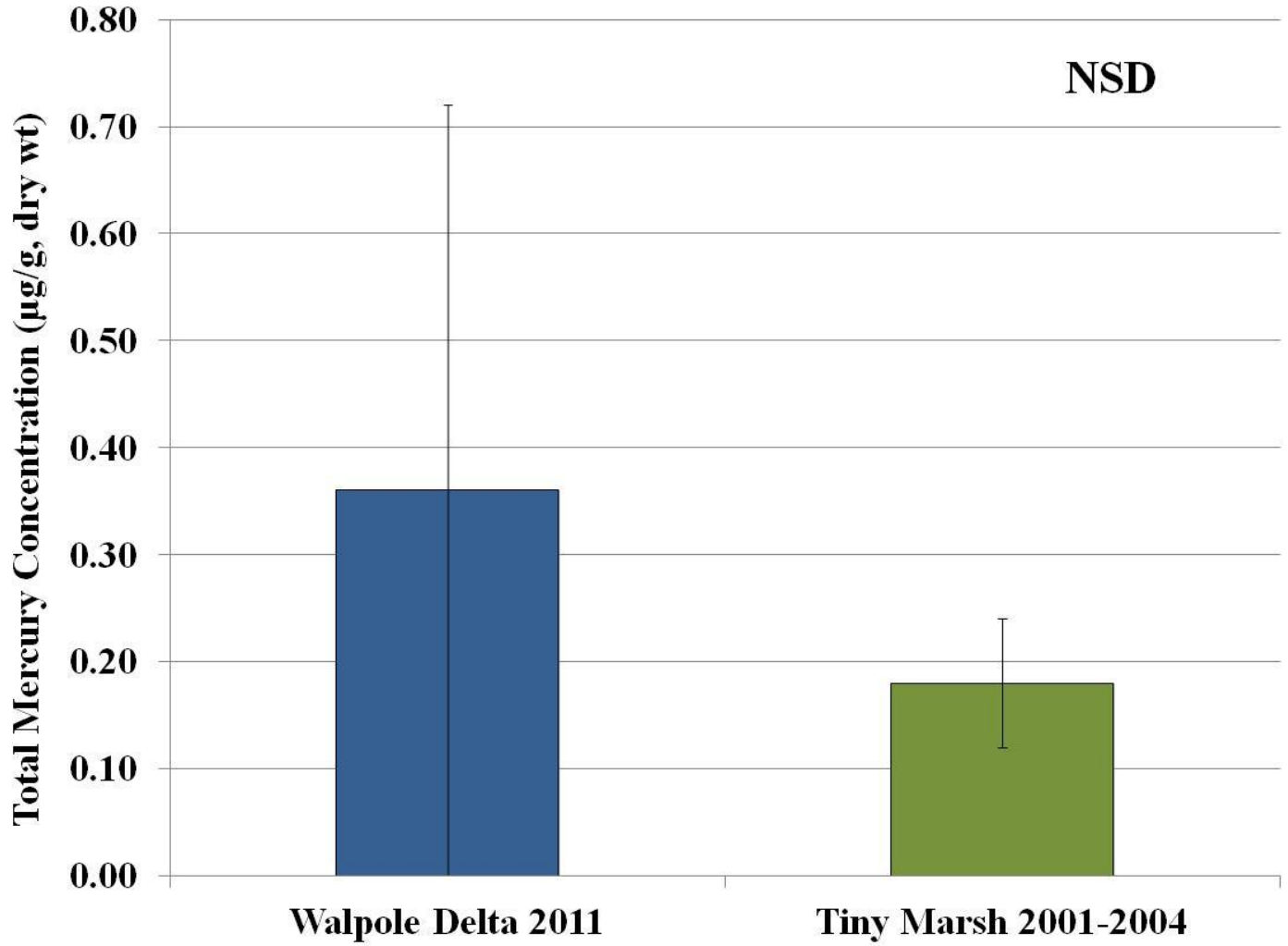
CCME Guideline for Protection of Wildlife Consumers – PCBs



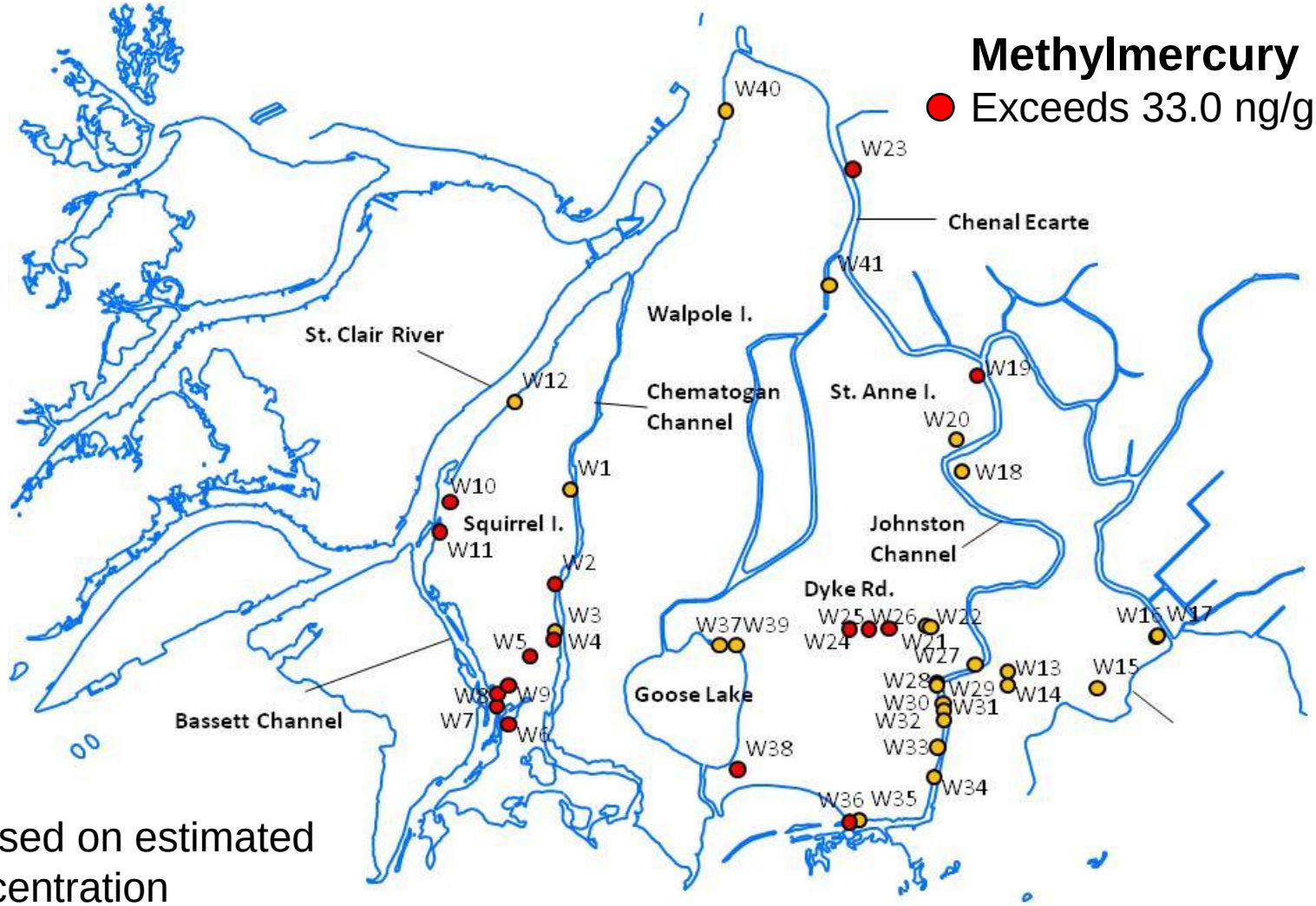
Cumulative Totals of Contaminants in Turtles from Great Lakes



Snapping Turtle Eggs
Total Mercury

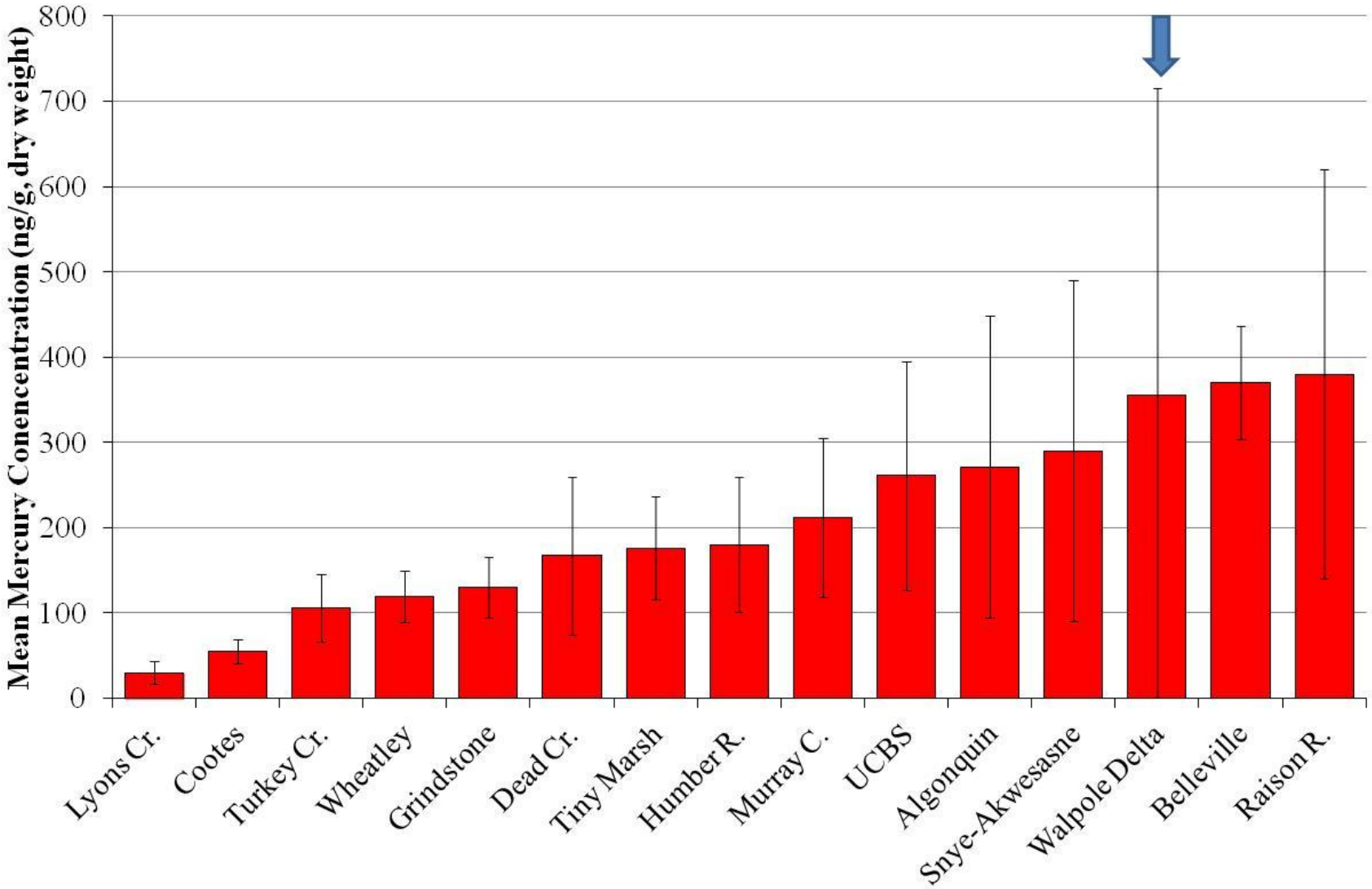


CCME Guideline for Protection of Wildlife Consumers – Methylmercury*



* Based on estimated concentration

Mercury in Turtles from Great Lakes



Summary - Turtles

- High hatching success and low hatchling deformities
- Low levels of PCBs and DDT and other contaminants in eggs relative to other Great Lakes sites
- Variable mercury levels in eggs around AOC and higher relative to other Great Lakes sites
- While no effects were found here, no thresholds are available to assess potential effects on reproduction and development in turtles
- Guidelines for PCBs, DDT and methylmercury (estimated) exceeded for wildlife consumers of eggs
- Evidence indicates few temporal changes in PCBs or pesticides from 1995-2011.

Wildlife Reproduction & Deformities in St. Clair River AOC

Evidence <u>against</u> impairment:

- No effects on reproduction and deformities in turtles
- No effects on hatching and tadpole deformities in frogs in lab study
- Low levels of PCBs and DDT
- Mercury levels likely lower than possible effects

Wildlife Reproduction & Deformities in St. Clair River AOC

Evidence <u>for</u> impairment:

- Deformities in frogs above 5% threshold in 2/13 surveys
- Intersex in male frogs from AOC greater than reference at 4 of 11 surveys

- However…
  - Deformities in frogs inconsistent among sites & years
  - Intersex also evident outside of AOC in region
  - There is no causal linkage between legacy contaminants measured with the intersex condition.

Where Do We Go From Here?

Do we have enough information to assess wildlife reproduction and deformities in AOC?

- Turtle results clear – no impact
- Frogs – less clear

What additional information would clarify?

Would a 4th year of frog deformity data help us clarify?

…or do we just accept that periodically there will be a few locations where deformities exceed normal thresholds for some unknown cause.

Where Do We Go From Here?

If we were to go back, here are some suggestions:

Turtles

- Since turtles exceeded consumption thresholds for protection of wildlife, it would be useful to periodically monitor levels of contaminants at some AOC sites in Walpole Delta (e.g., Bassett Channel).
- Analyze 2011 turtle eggs for methylmercury since levels were estimated for comparison to threshold.

Frogs – Chematogan Channel, Bay Lodge and Dyke Road areas are the most questionable and prone to higher deformities where relatively higher levels of contaminants were also found.

Thanks!

- The authors thank the many volunteers that helped with frog surveys, water and sediment collections including Naomi Williams and our collaborators from the Walpole Heritage Centre, Ken Drouillard from GLIER and many student interns, contractors and colleagues from EC.