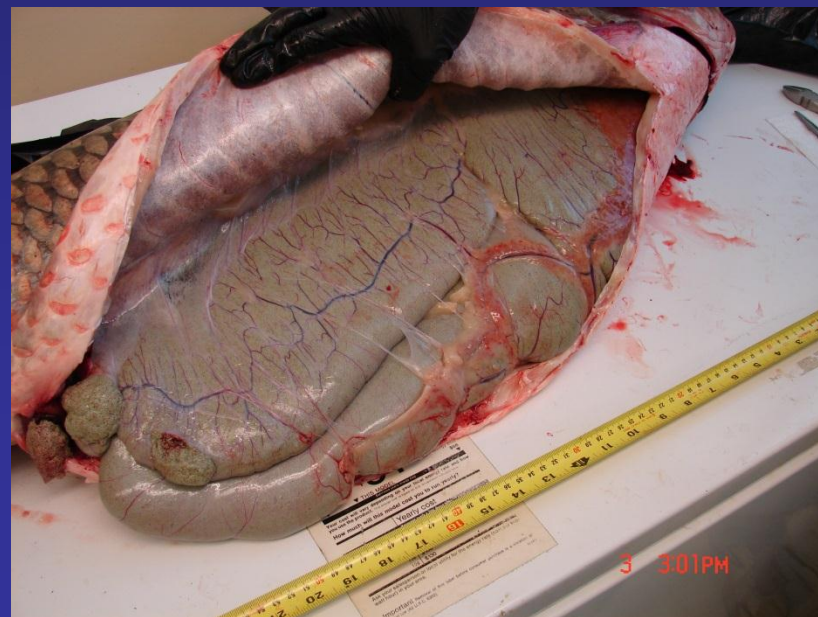


USGS Grass Carp Research in the Sandusky River and Western Lake Erie



~28 kg mature, diploid female grass Carp
Lake Erie north of Cedar Point, 6-2014

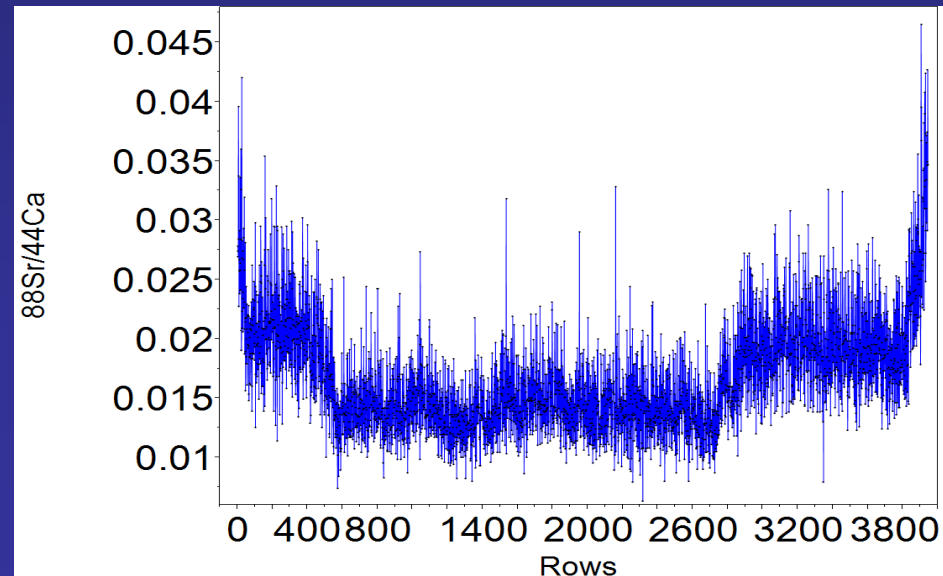
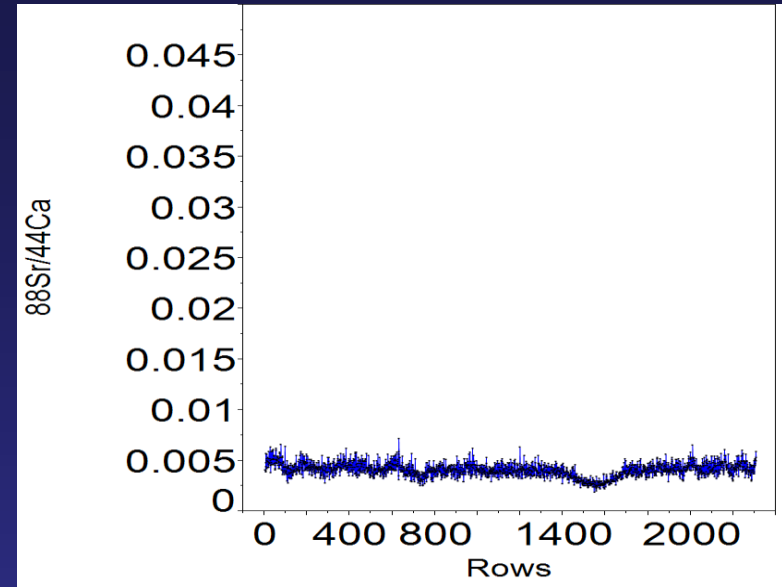
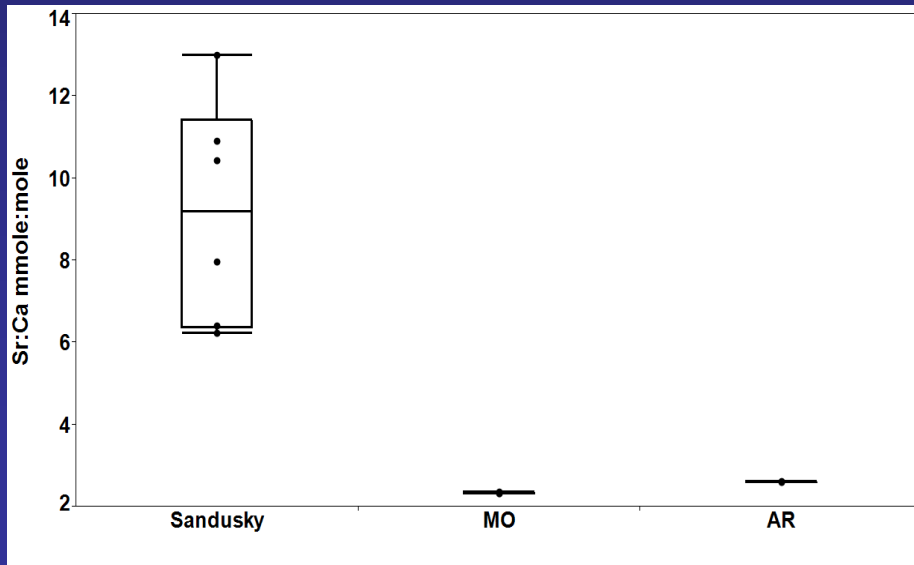
4.5 kg eggs (GSI ~16%)



Grass Carp spawning potential in GL tributaries

What we know:

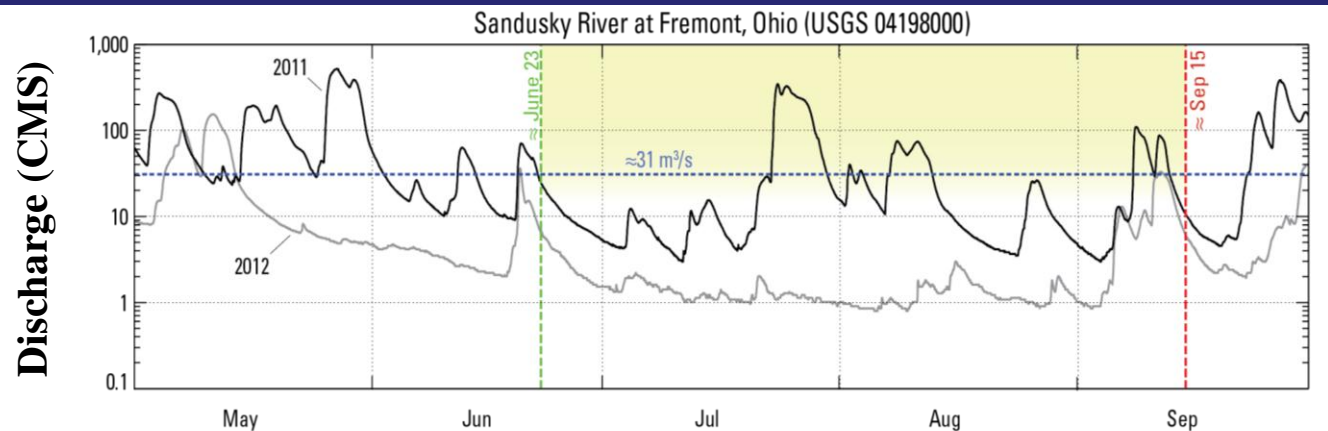
- Six age-1+ diploid GC (451-514 mm TL) captured in Sandusky River in 2012
- Otolith microchemistry consistent with Sandusky River origin



Grass Carp spawning potential in GL tributaries

What we know:

- USGS modeling work confirmed reach below Ballville Dam of suitable length for incubation
- Suitable flood event occurred in 2011



EXPLANATION

- Range of potential spawning discharge with observed hydraulics capable of egg transport (lower boundary uncertain) (Murphy and Jackson, 2013)
- Discharge, in 2011
- Discharge, in 2012
- Maturation date (≈ June 23) from Kocovsky et al. (2012)
- Estimated date when water temperature is no longer conducive to spawning and egg development (based on 2012 data in the Sandusky River, Murphy and Jackson, 2013)
- Observed discharge at which Asian carp eggs can be successfully transported (Murphy and Jackson, 2013)

Grass Carp spawning potential in GL tributaries

What we want to know:

- Can we find *direct evidence* of spawning?

If so:

- Can we determine where they spawned?
- Can we determine where they are reared?

And ultimately...

- Can we predict/prevent/disrupt spawning?
- Can management options be developed to greatly reduce or eradicate Grass Carp?

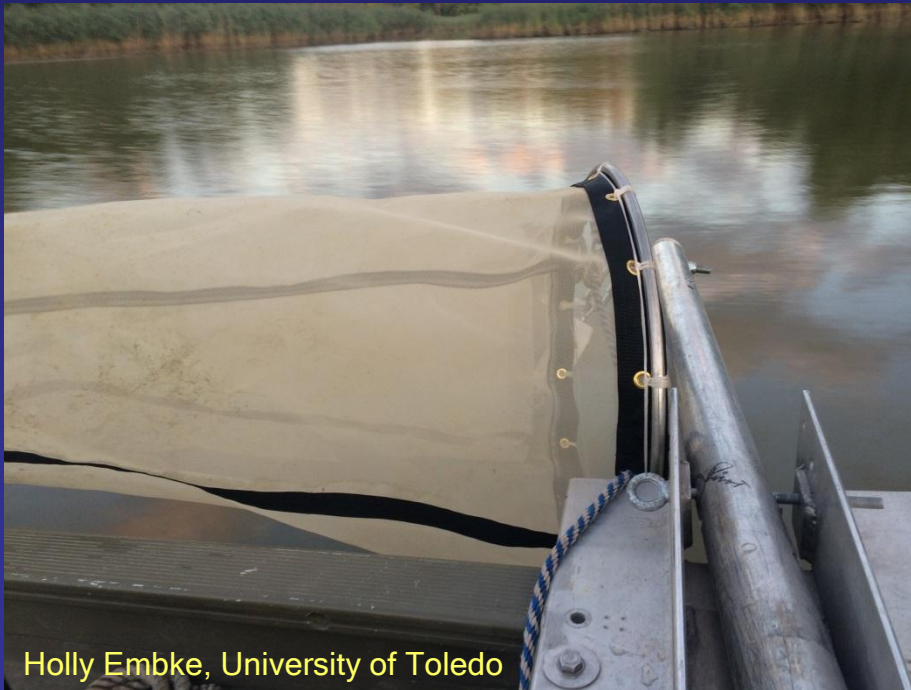


USGS

Assessing Spawning in Lake Erie Tributaries

Sampling for direct evidence of spawning

- Bongo nets weekly and during high-flow events
- Light traps in main channel and backwaters in 3 habitat types (open water, macrophytes, wood debris)
matches protocol used on MO River



Holly Embke, University of Toledo



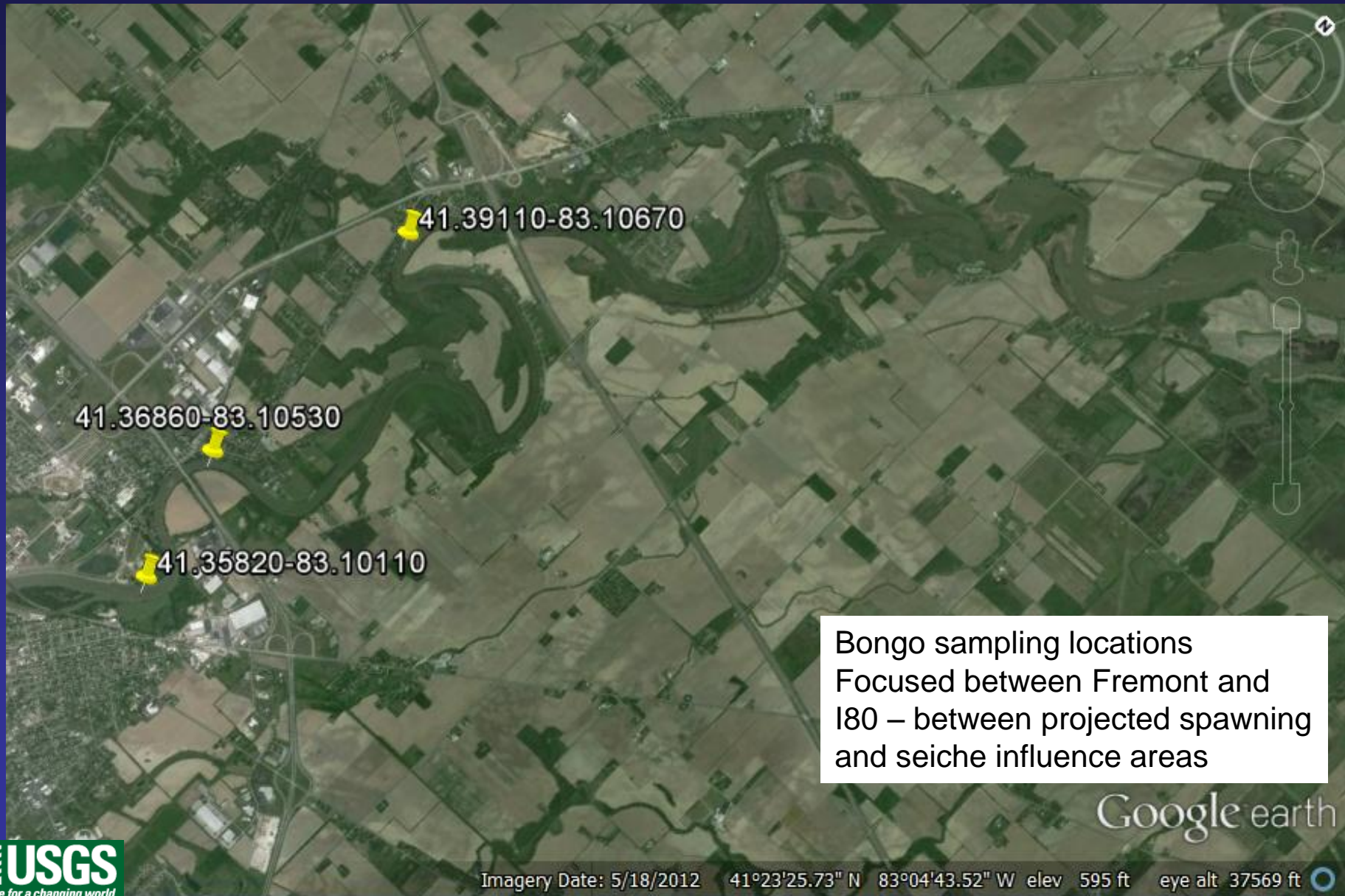
Holly Embke, University of Toledo

Assessing spawning in GL tributaries

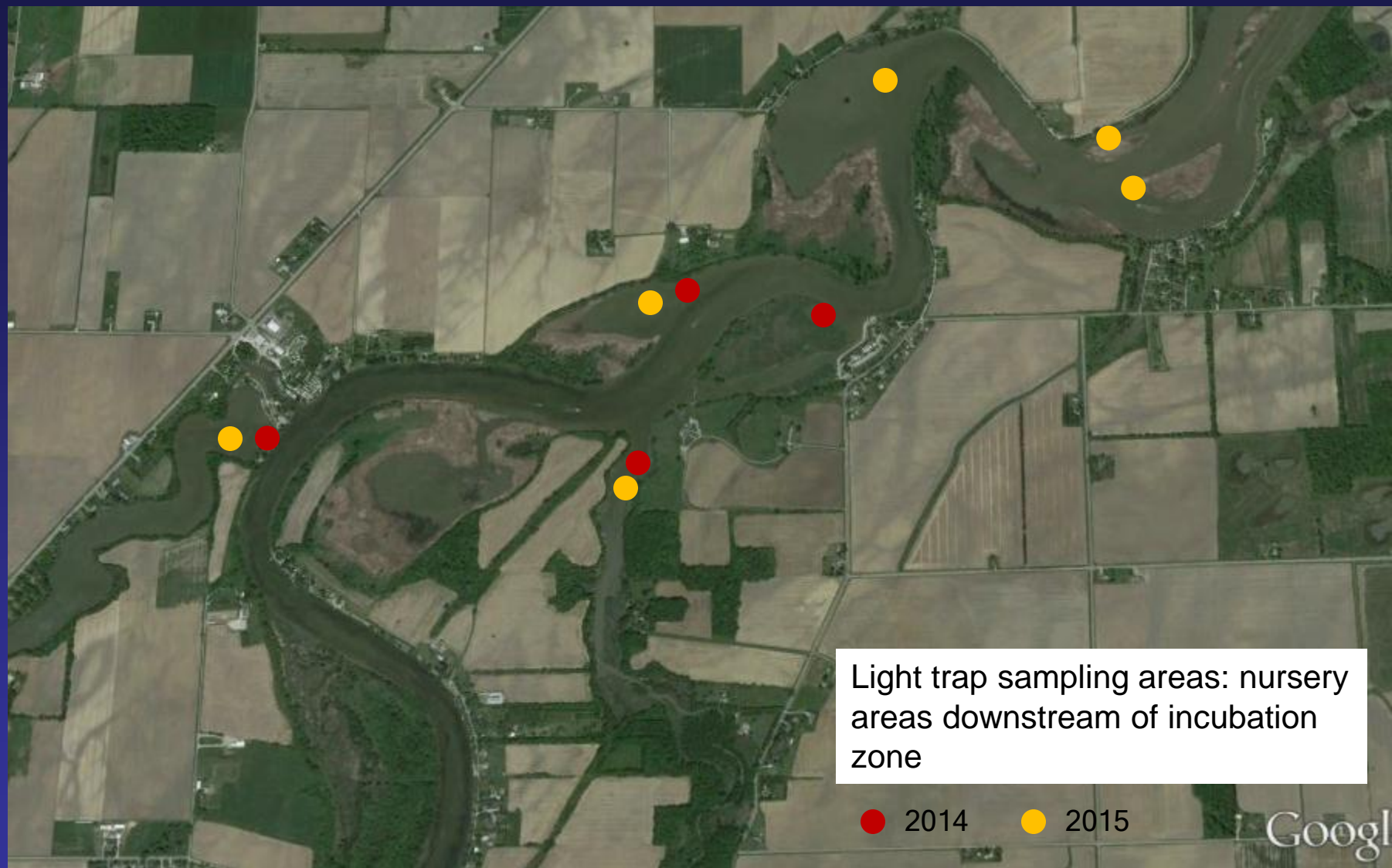
2015 promoted to 2-year project and expanded



Sandusky River



Sandusky River



Google

River Raisin



In collaboration with MIDNR

~33 river km from mouth at
Monroe to Cabela's at Dundee

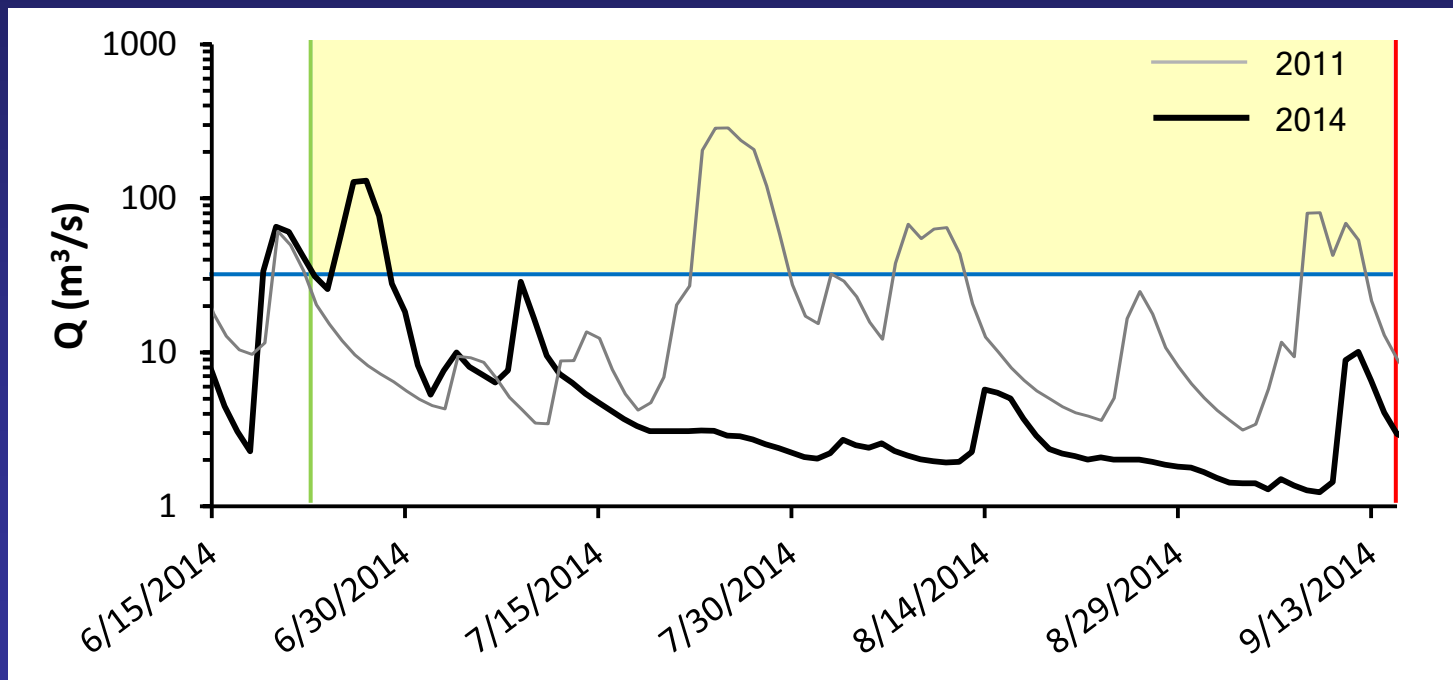
Bongo sampling only a few km
upstream due to poor access

Light traps near “hot ponds”



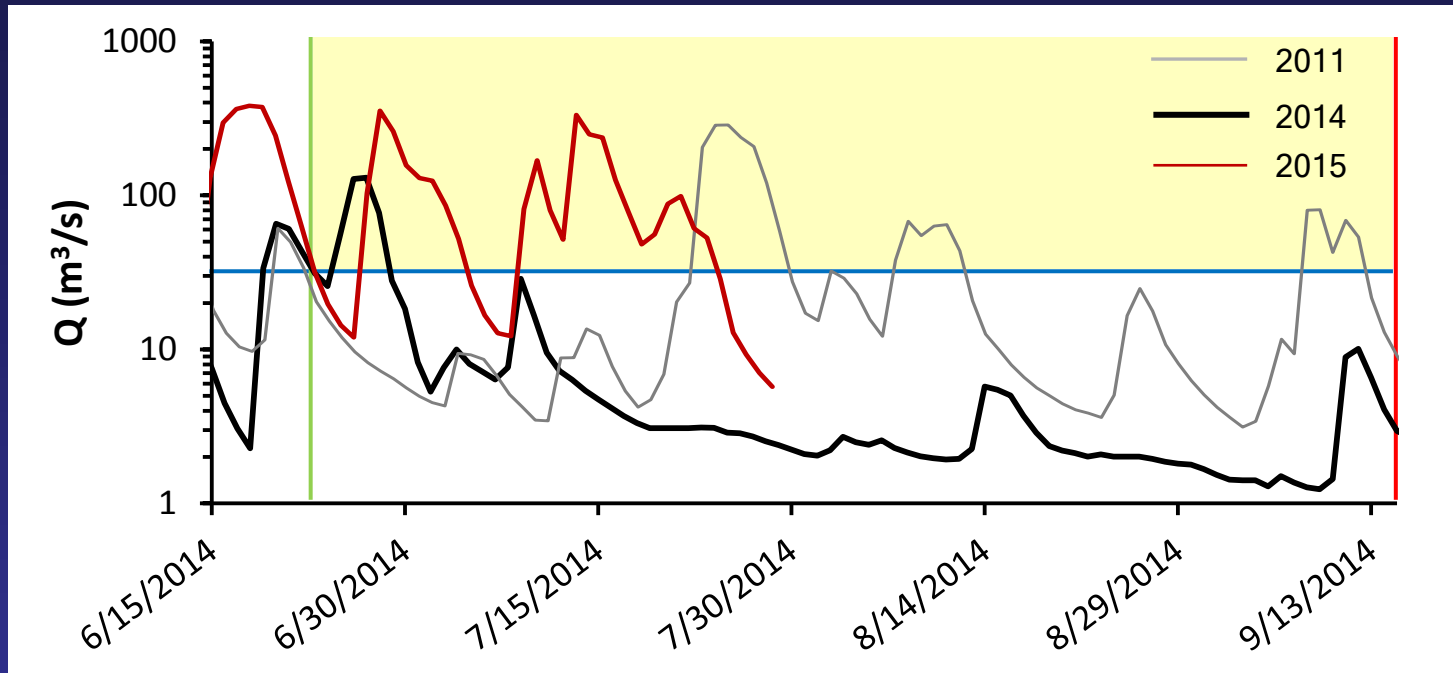
2014 Pilot Year Sampling

- Proof of concept: Sandusky safe to sample during high-flow events
- 10 dates Bongo, 4 dates light traps
- No GC sampled
- Only 1 suitable event within likely spawning period



Late June event of short duration, low % change in discharge

2015 Sampling



Much higher water levels and more high-flow events than 2014 captured late June and Early July events with Bongo nets continue to sample with larval traps

Outcomes for Sandusky River Work

- Catch them in the act?
 - pinpoint location of spawning and strong confirmatory evidence of suitability of conditions
- Establish spawning chronology for Sandusky River: Who and when
 - will inform potential for collateral damage if GC control measures deployed
- Establish sampling protocols for assessing spawning
- Create probabilistic models to assess risk of spawning
 - hydrologic and meteorologic variables in conjunction with USGS FluEgg model
 - primary focus of graduate students thesis work

Models to Assess Spawning Risk

- USGS flow data
 - Minimum required flow
 - Sandusky River water temperatures
 - Determines incubation time
 - Thermal depression with increasing flow
 - Air temperatures
 - To predict water temperatures
 - Rainfall
 - What amount of rain over what period required to produce sufficient flow
-
- Bayesian model to assess what amount of rainfall and what temperature is required to produce a high-flow event suitable for Asian carp spawning
 - Good for the goose, good for the gander: Silver Carp and Bighead carp have similar spawning needs

Potential research 2016-2020+

- IPM: Identify eradication or control methods
- Grass Carp biology and population status
 - Growth, origins, diets, fecundity, age structure, genetics, abundance estimate
 - Will require killing fish for otoliths, gonads, diets
- Tagging and tracking

2015 Pilot vegetation work

- Assessing macrophyte communities and locations in lower Sandusky River

Objectives: Identify existing data sets and gaps

Inventory aquatic vegetation

- embayments, shorelines, connected wetlands
- metrics: species richness, distributions, relative abundances

Faunal species associations/diet preferences

Grass Carp, Tubenose Goby, Rusty Crayfish, Red Swamp Crayfish

Ongoing/terminating USGS Research

- Waterguns: final year
6-gun array with bigger guns
- CO₂ barriers – first year testing
- Complex sound – simulated motor noise





www.google.com, search term: silver carp image

United States Geological Survey