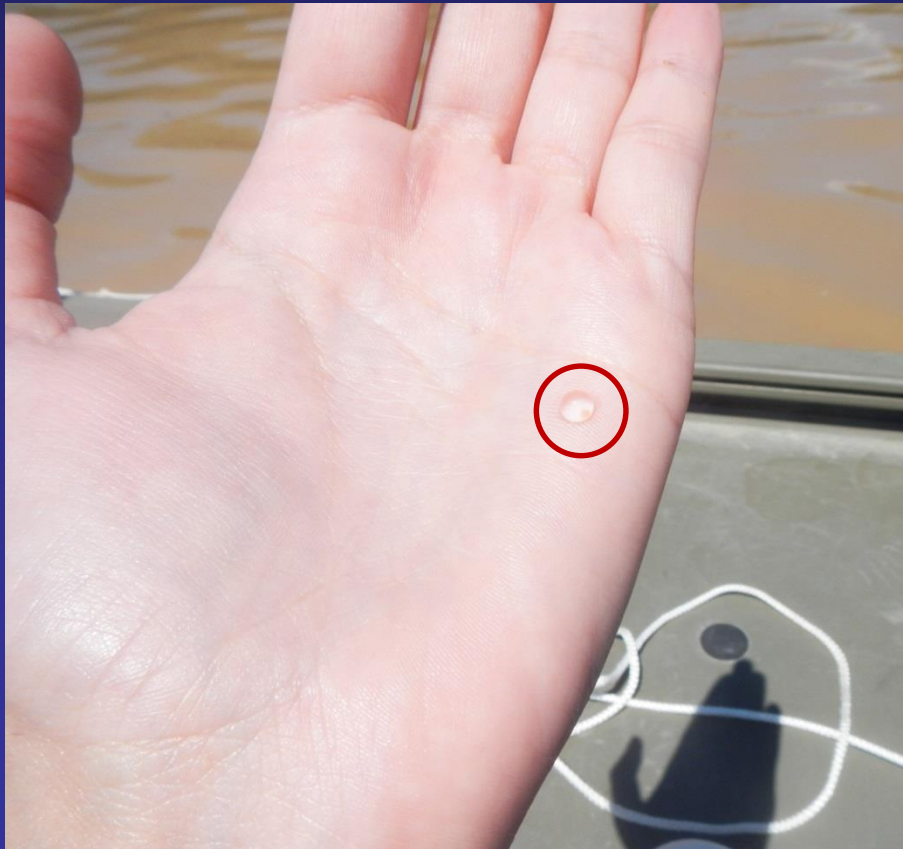


# Reproduction of Grass Carp in Lake Erie Tributaries

Patrick M. Kočovský<sup>1</sup>, Nicole King<sup>2</sup>, Christine Mayer<sup>2</sup>, Song Qian<sup>2</sup>

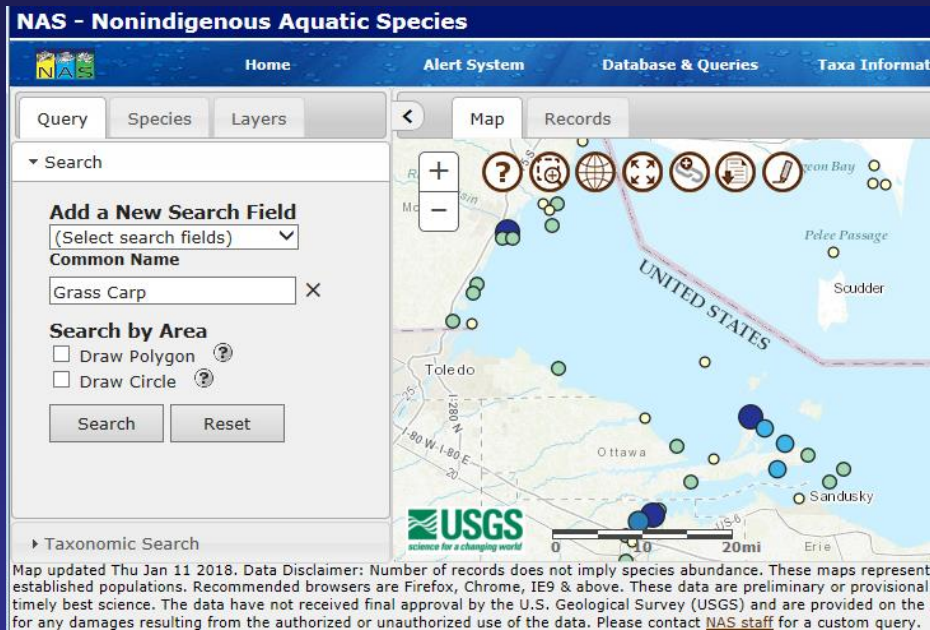
<sup>1</sup> US Geological Survey, Lake Erie Biological Station

<sup>2</sup> University of Toledo



# History of Grass Carp in Lake Erie

- First Grass Carp captured in Lake Erie in 1985



**1986:**  
**OSUM 69227, 845 mm SL**  
**OSUM 65221, 880 mm SL**

- Method for inducing triploidy developed by J.M. Malone and Son in 1983

**First GC captured in Lake Erie were diploid**

# Spawning in Lake Erie tributaries

- **10 captured in the Sandusky River Oct 2012**
  - Age 1+, 4 verified diploid
  - Otoliths: Sandusky spawned
  
- **2015: caught them in the act!**
  - Holly Embke MS work – fertilized eggs
  - Otoliths: Sandusky spawned
  
- **2017: Double-trouble...**
  - Spawned twice in Sandusky
  - First fertilized eggs from Maumee
  
- **Have they spawned before?**
  - Examining evidence of spawning prior to 2011



Grass Carp otolith  
J. Miner

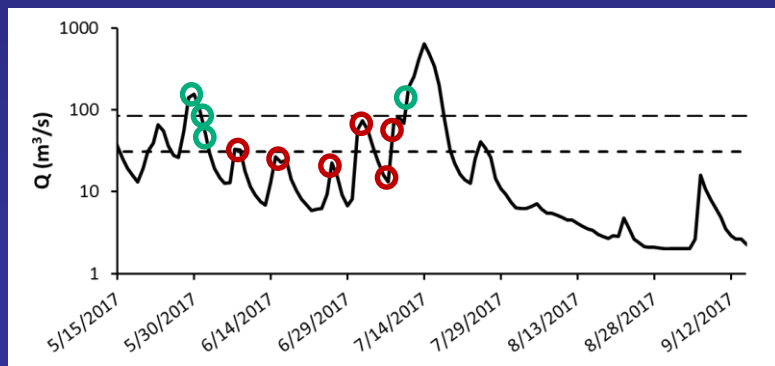
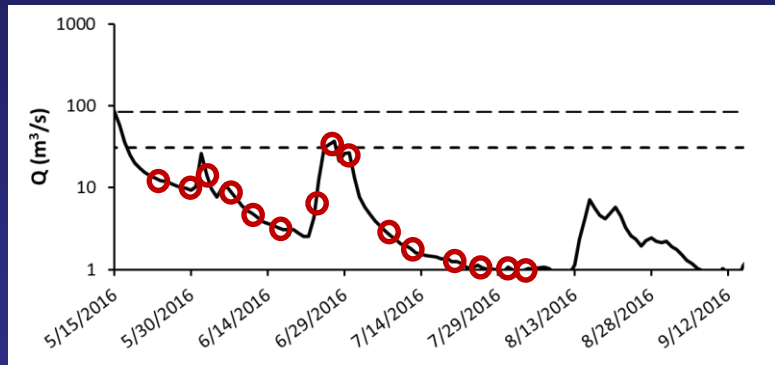
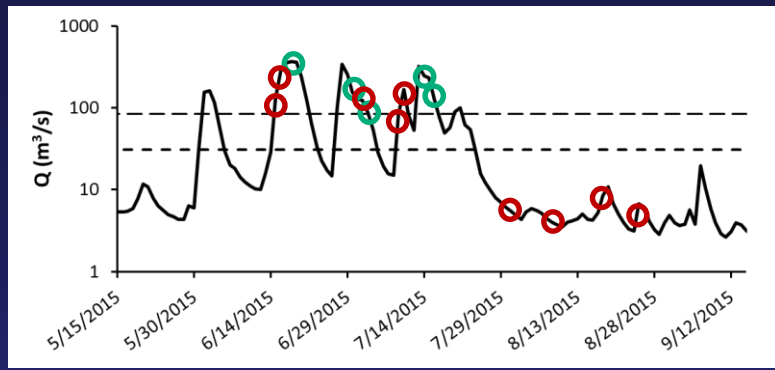


Grass Carp egg, Sandusky 2017  
H. Embke



Grass Carp embryo, Maumee 2017  
M. Tomczak

# When do they spawn?



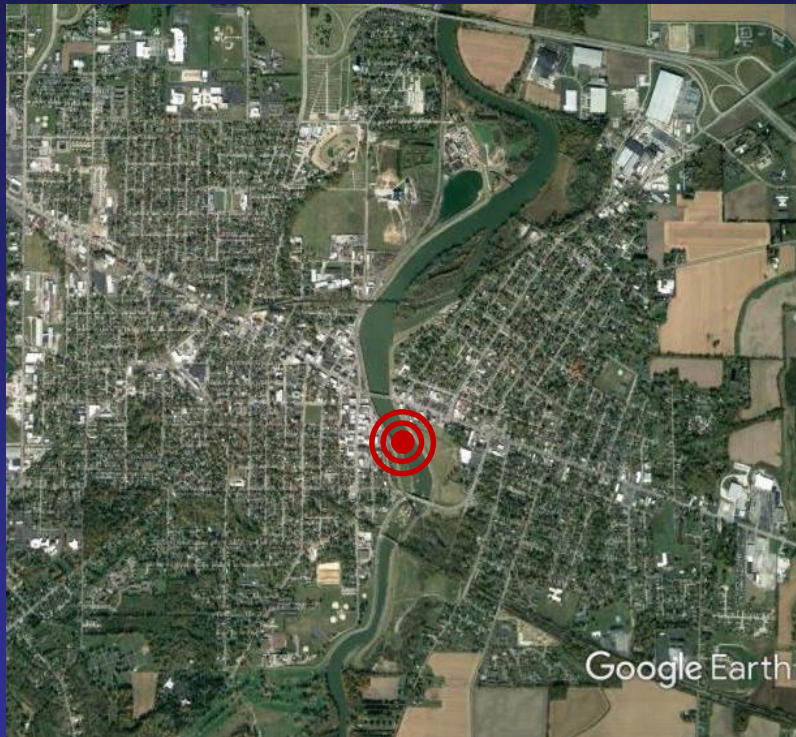
- High flow events, mid-May – Mid July
- Peaks or Descending limbs of hydrographs



- Sampled, collected eggs
- Sampled, did not collect eggs

# Spawning Locations

**Sandusky: Fremont, OH**

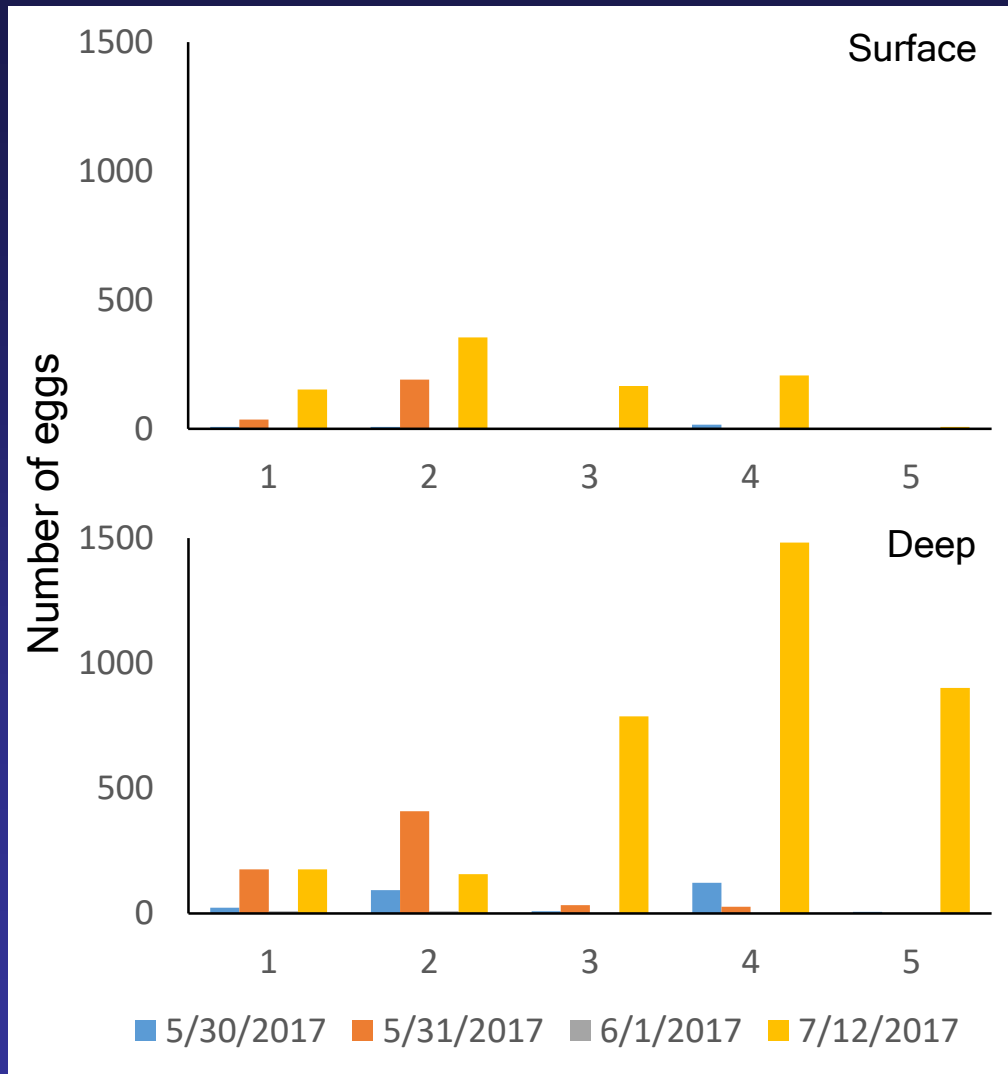


**Maumee: ?**

**- Insufficient hydraulic data**

**Removal of Ballville Dam, no significant barriers on Sandusky opens hundreds of km of potential spawning territory**

# Context: Comparing 2017 to 2015 events

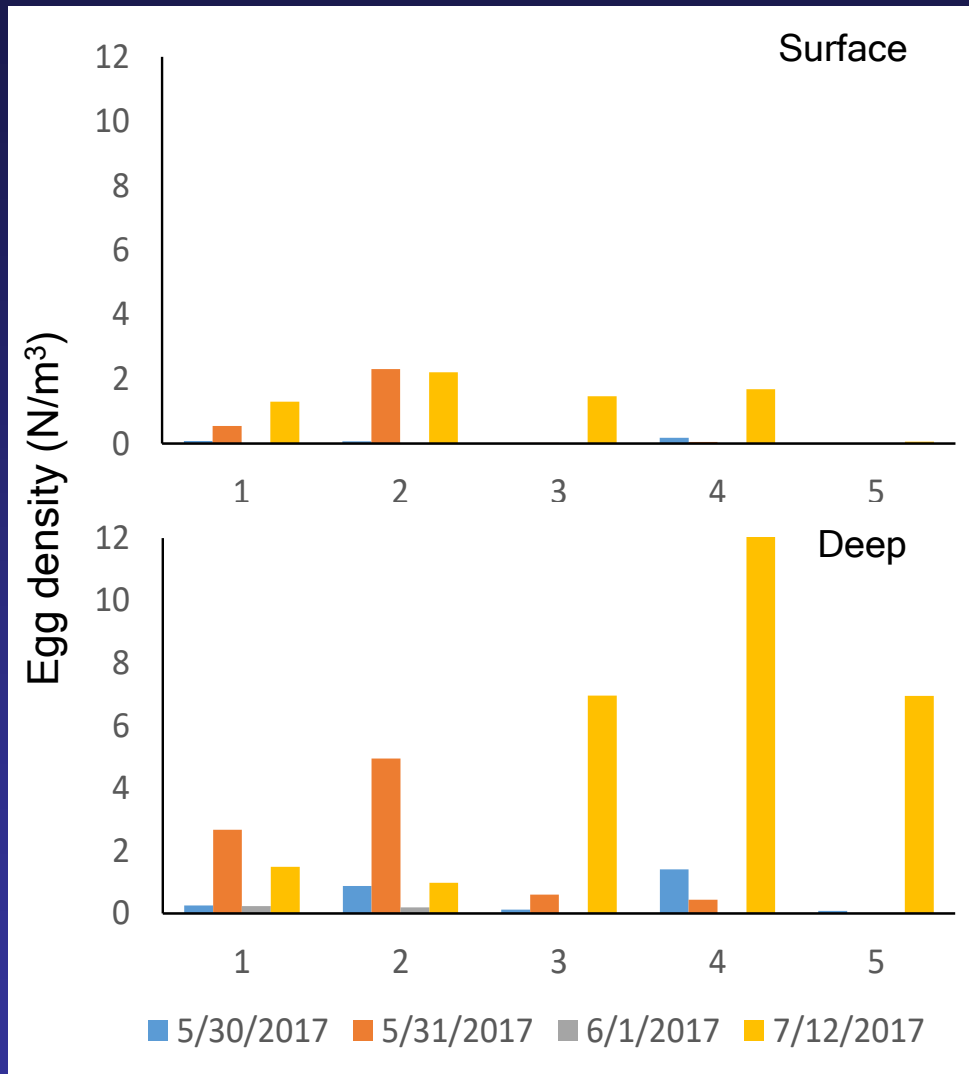


**Numbers:**

**2015: 8 eggs**

**2017: ~7,700**

# Context: Comparing 2017 to 2015 events



**Densities:**

**2015: 0.005 eggs/m<sup>3</sup>**

**2017: 0.609 eggs/m<sup>3</sup>**

**~122 times higher**

## What did we learn from 2017?

- **Spawning occurred ~3 weeks earlier than in 2015**
  - Earlier than Kočovský et al. (2012) hypothesized window
  - Fish are in warmer than average waters
  - Thermal thresholds are wrong (research ongoing)
- **...and at much lower peak flow than previously observed**
  - Peak mean daily Q was < half previous spawning events

**2015: 3 events peaked at 322-362 cms**

**2017: May-June event peaked at 156 cms**

- **Expands range of events on which spawning might occur**
- **...and in two rivers**

## What are we doing about it?

- Egg staging to estimate distributions of spawning times

FluEgg modeling to validate spawning areas and to refine where to look for larvae

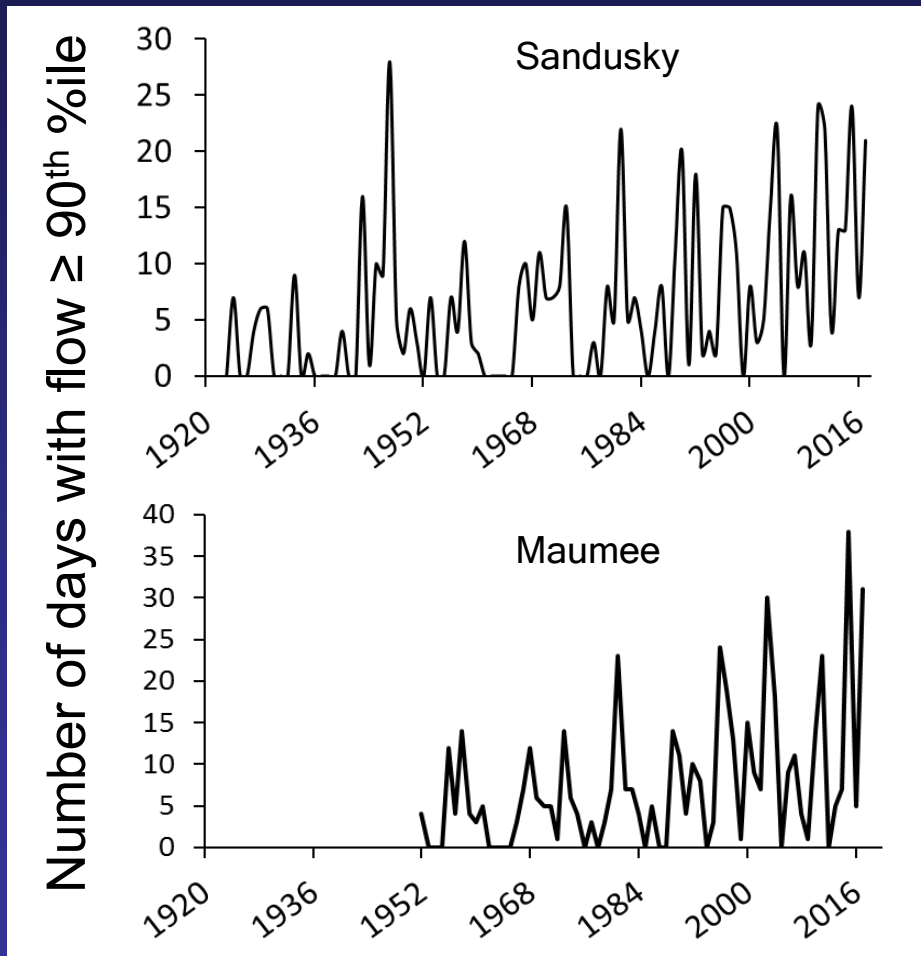
- Larval sampling: DFO, MIDNR, USFWS, U Toledo/USGS in lower Sandusky River and Muddy Creek Bay
  - Sample processing underway (thousands of larvae...)



Holly Embke, U Toledo

# What does the future hold?

## Frequency of high-flow events is increasing



### Likely culprits

- Tiling
- Increased field size
- Separation of storm and sanitary sewers

## What are we doing about it?

- Continuing sampling through 2018 and beyond
- Identify spawning areas in Maumee River
- Prospect sample and use eDNA sampling to identify other potential spawning tributaries
- Determine if sampling occurs upstream of former site of Ballville dam
- Identify **control strategies** and where and when to use them



# Acknowledgments

**UToledo:** Embke, King, Laszlo, Mayer, Mullikin, Qian, Tomczak  
**ODNR:** Weimer, Navarro, Hartman, Carter  
**MIDNR:** Francis, Harris, Herbst  
**FWS:** Thompson, Briggs  
**DFO:** Colm, Cudmore, Marson

**USGS Ecosystems Mission Area, Invasive Species Program  
Great Lakes Restoration Initiative**



Tomczak  
Black Carp

King  
Grass Carp

Mullikin  
Bighead Carp

Laszlo  
Silver Carp