

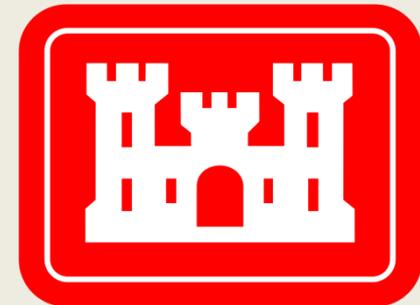
Raystown Lake Channel Catfish Spawning Study (2013-14)

Juniata College

PA Fish and Boat Commission (PFBC)

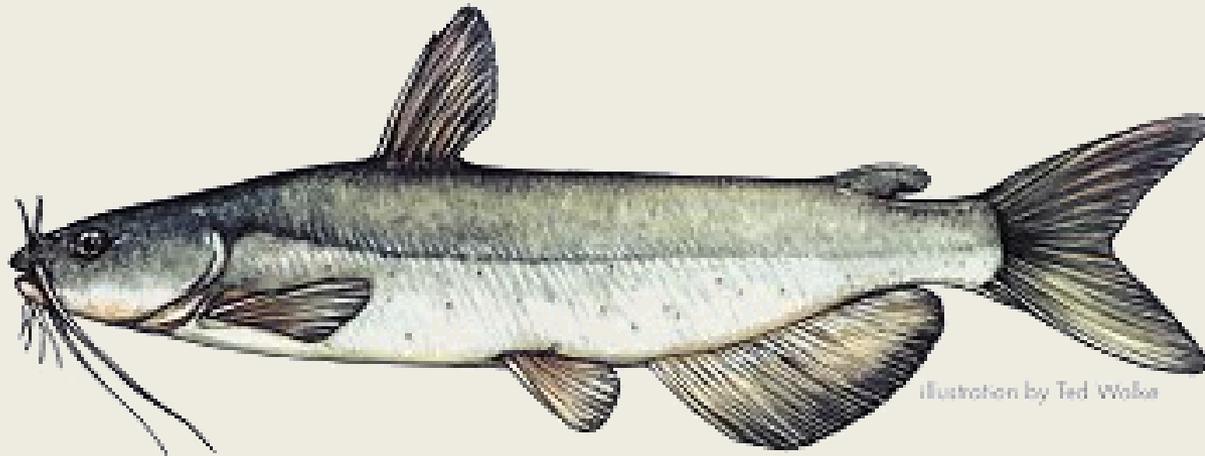
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Background- Channel Catfish

- Found in all US states except Alaska
- Rely heavily on fingerling stocking programs
- Latitude dependent timing and duration of spawning
- Optimal water temperatures for spawning range from 21-31°C



Monetary Impact

- Commercially and recreationally valuable
 - 2nd largest Aquaculture sales in US (**341 mil USD-2012**)
 - 4th most popular rec. fish species (excluding great lakes taxa)
 - 7 million anglers spending 95 million days targeting

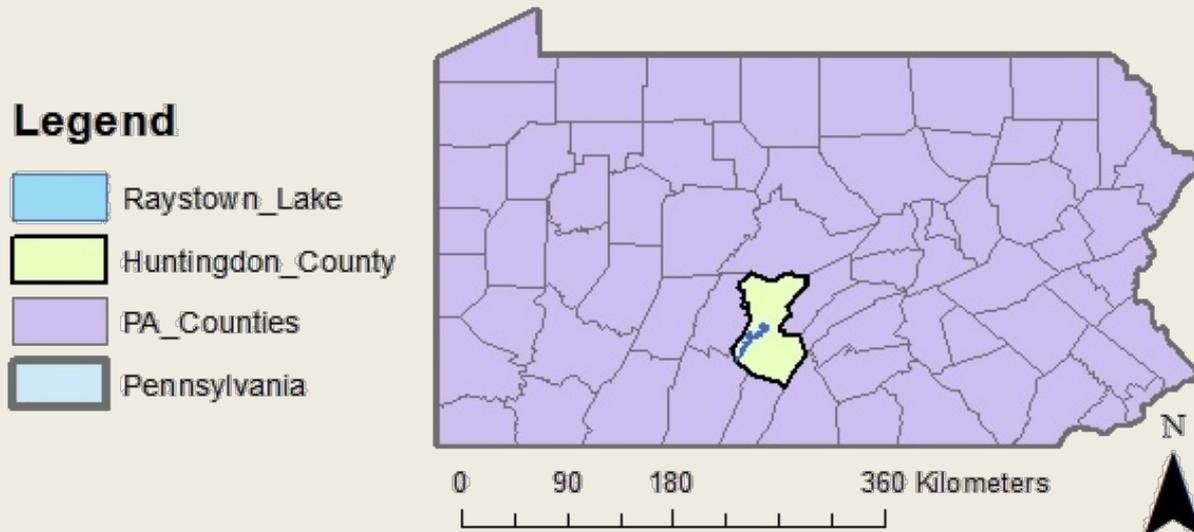


Channel Catfish Spawning

- Prefer cavities in submerged logs, tree roots associated with undercut banks and ledges in near-shore, shallow areas.
- Location is selected by the male
- Female releases a pheromone attracting mates
- Spawning lasts 4-6 hrs
- Male chases female away and guards eggs

Study Site: Raystown Lake

- A 33 km² surface mesotrophic reservoir located in Huntingdon County, Pennsylvania
- Created for flood control and hydroelectric power generation
- Managed by Army Corps of Engineers
- Large ecotourism value



Catfish Management in PA

- Based on two primary lake-by-lake criteria:
 - extent of potential suitable foraging and nesting habitat
 - the composition of ichthyofauna
- Inability to establish robust post-stocking populations is attributed to absence of preferred spawning microhabitats
- Stocking programs not sustaining populations



Artificial Structures

- PFBC devised a protocol that relies on the introduction of man-made spawning structures designed to replicate optimal nesting sites
- Placing wooden rectangular boxes made of hemlock into shallow areas of reservoirs



Catfish Boxes

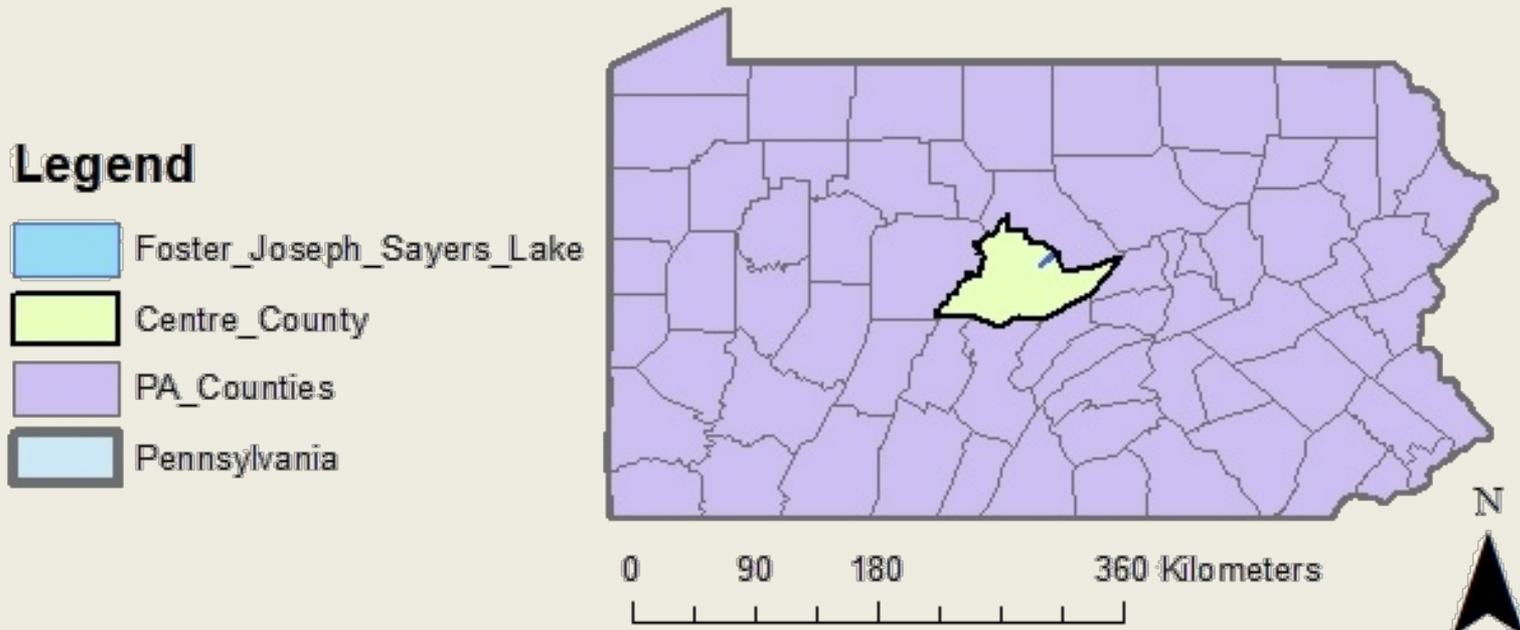
- Approximately 1.0-m length X 0.8-m width X 0.4-m height
- Has a single opening on one end (0.3-m)
- Concrete slab attached to base as an anchor
- Has 2 rope handles that allow for movement of structure
- Top of the box is constructed of two hinged panels that allow the structure to be opened to establish if fish are present

Catfish Boxes



Past Studies

- Spawning box data from Foster Joseph Sayers Lake (Centre County, Pennsylvania) indicated that the structures facilitated Channel Catfish reproduction throughout the breeding season



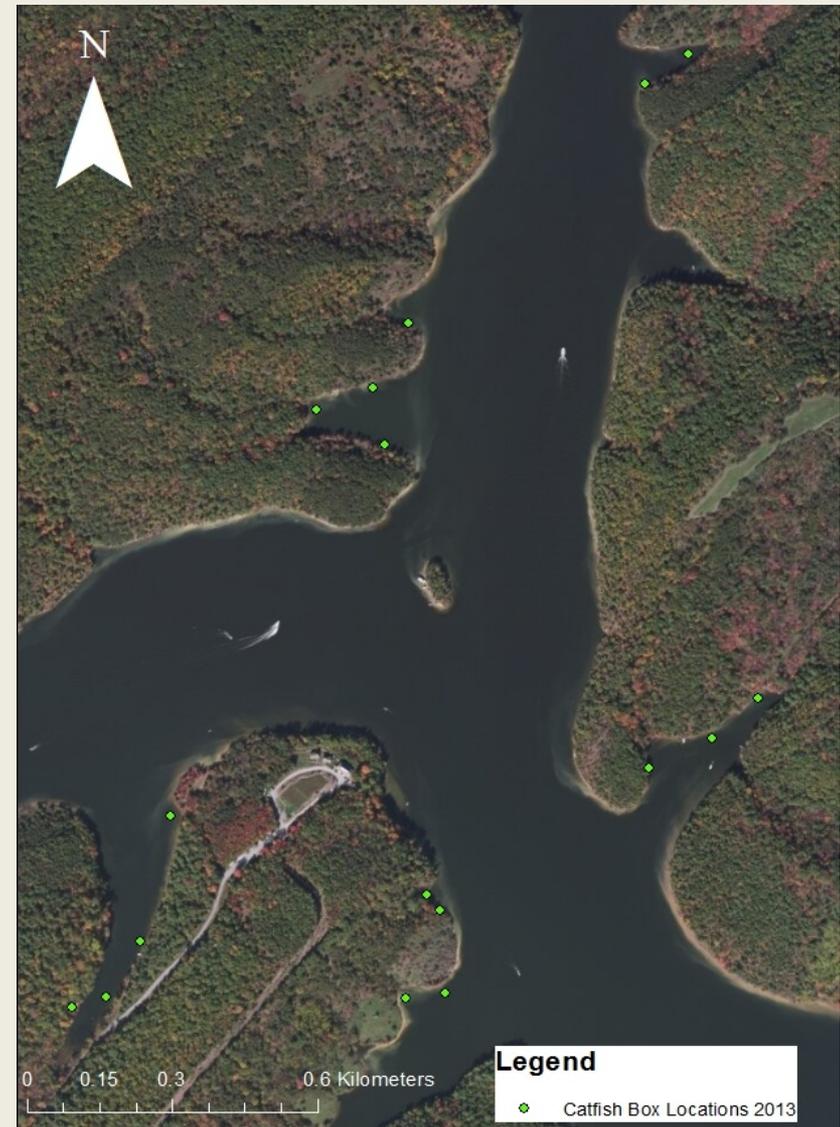
Catfish Boxes

- PFBC biologists believe that the boxes could become an important management tool to enhance reproduction and improve young-of-the-year (YOY) survivorship in lakes lacking suitable nesting habitats



2013 Catfish Study

- 17 boxes placed in mid May in nearshore areas typically < 2.0 -m in depth
- From 3 June—6 August each site was examined every 72-96 hrs



Sampling Protocols- 2013

- Sampling sites were approached from shore, the frontal opening was covered, and then moved to shallow water where hinged top was opened to see if box was utilized for spawning
- Physicochemical measurements were taken at every sample site on each date

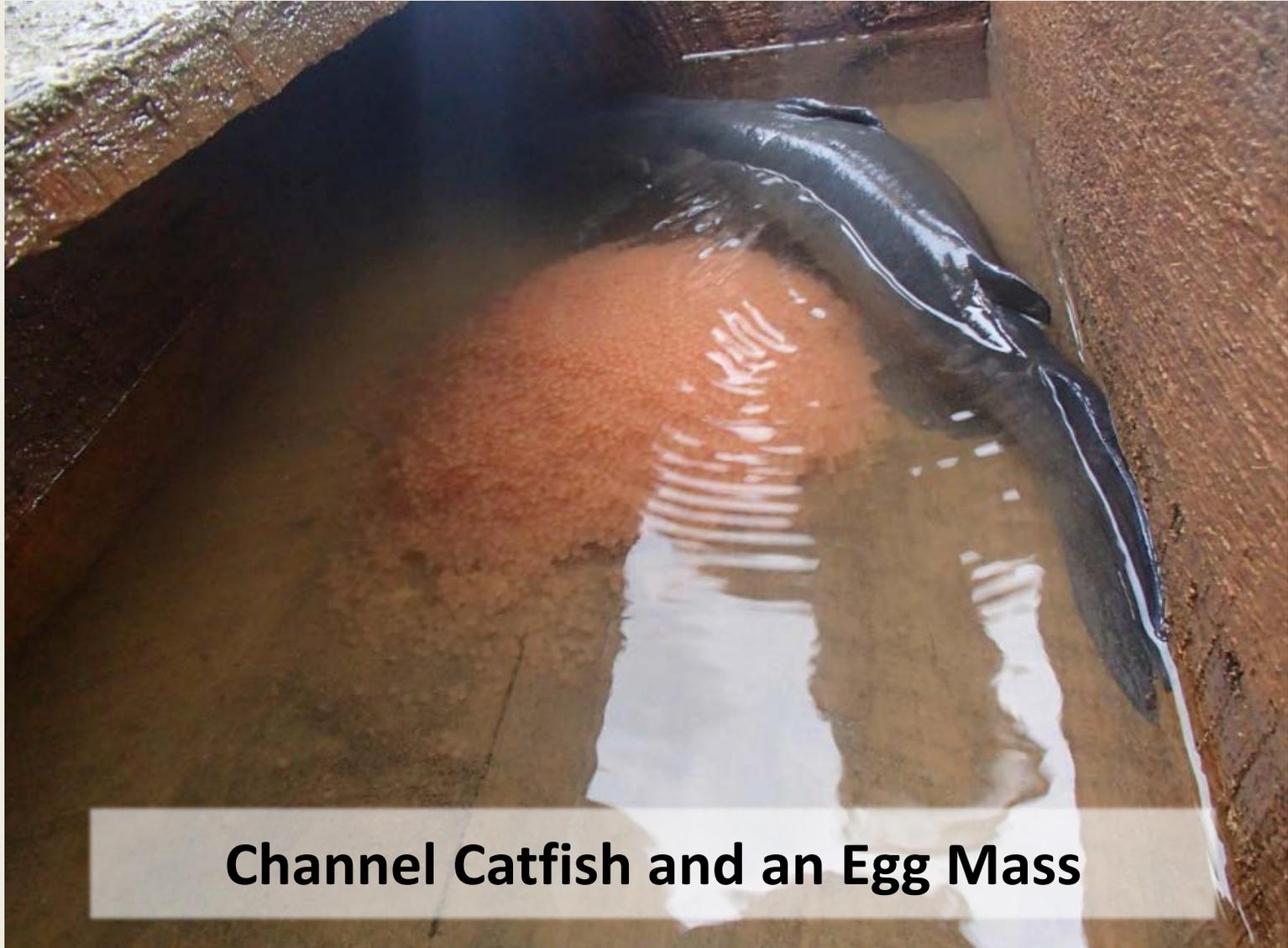


Observations- 2013



Egg Mass

Observations- 2013



Channel Catfish and an Egg Mass

Observations- 2013

Channel Catfish Fry



Observations- 2013

Channel Catfish, no Egg Mass



Observations (adults)- 2013

- From 3 June—15 July at least one box was occupied with an adult Channel Catfish
- Across all sample dates, 11% of the boxes contained adults with the highest occupancy rate (30%) occurring on 28 June
- A spawning peak lasted 17 June—9 July coinciding with water temperatures reaching 25°C
- Starting 15 July there was a rapid sustained decline in adults using structures as water temperatures exceeded 30°C
- Typically, once fertilized eggs were observed an adult was present

Observations (eggs) - 2013

- Found evidence of continuous spawning for six straight weeks once water temperatures exceeded 22°C
- Starting 11 June and continuing 4 weeks, at least one structure contained eggs on each sample date
- Highest incidence peaked 28 June and lasted for almost two weeks (~ 18% of the boxes contained eggs)
- On two occasions fertilized eggs were found but no adult was observed in the structure

Observations (fry)- 2013

- First hatchlings were observed on 17 June and at least one structure contained fry during the next four weeks
- By 9 July 35% of the structures had either eggs or ichthyoplankton
- Fry tended to remain in the boxes < 96 hours
- Eggs were usually always observed at a box prior to documenting fry

Conclusions- 2013

- Our results suggest that catfish boxes can influence reproductive success of Channel Catfish in large lotic systems.
- The consistent number of structures that contained either adults or fry indicates that the **structures appear to offer Channel Catfish optimal reproductive and grow-out microhabitats.**
- The spawning peak occurring near water temperatures of 25°C and lack of Channel Catfish in structures after 30°C was exceeded suggests a **temperature-mediated reproductive response.**
- Data suggests that eggs took approximately 4-7 days to hatch

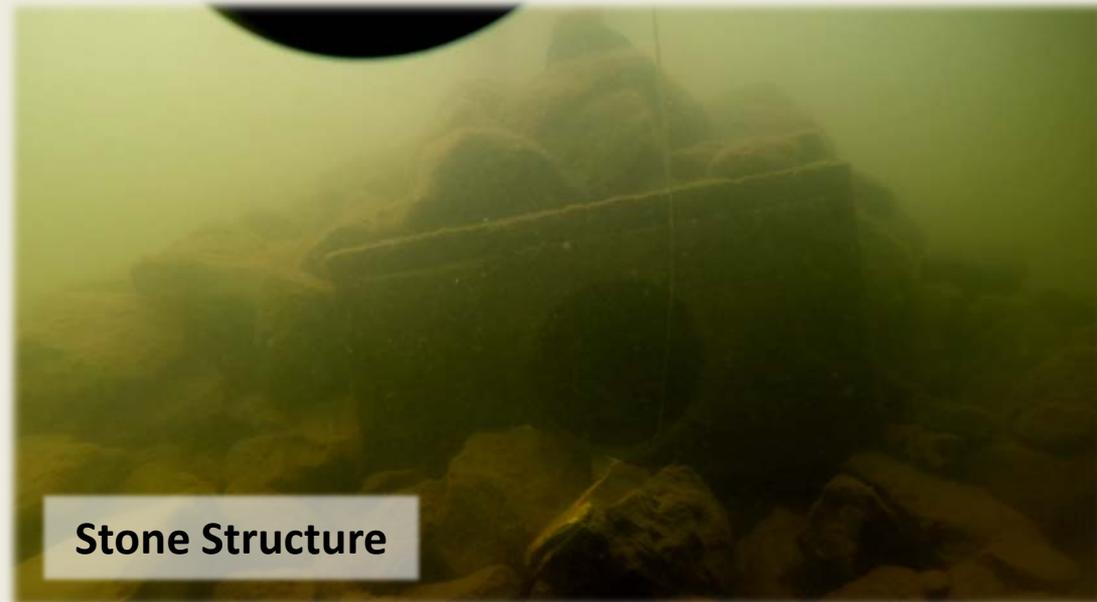
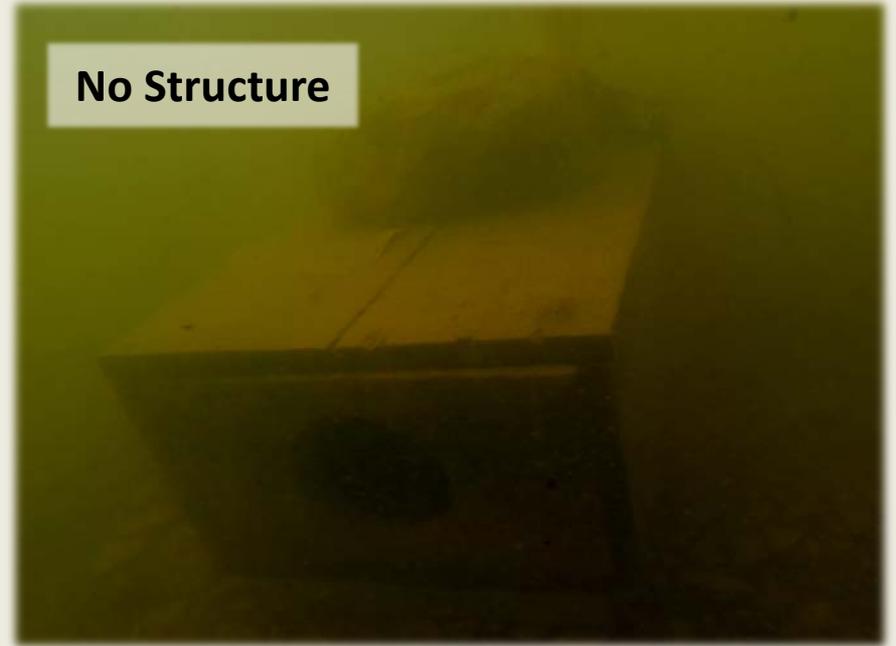
Habitat Preference?

- Following the 2013 catfish study on Raystown Lake:
 - Researchers questioned fry survival rate once leaving catfish boxes due to lacking cover in which fry could hide
 - Therefore, the question arose to test if adult Channel Catfish would selectively choose boxes that provided protective cover for fry once leaving the artificial structure?
 - In turn, providing PFBC with information on how to improve the placement of catfish boxes in future catfish restoration and management projects across the state

Background-2014 study

- 2013 study established:
 - There is a reproducing Channel Catfish population in Raystown Lake
 - Channel Catfish are utilizing spawning structures
- Goals of 2014 study:
 - Determine if catfish boxes placed near certain habitat types are occupied more often than other habitat types
 - Test a new method of checking catfish boxes utilizing a GoPro camera

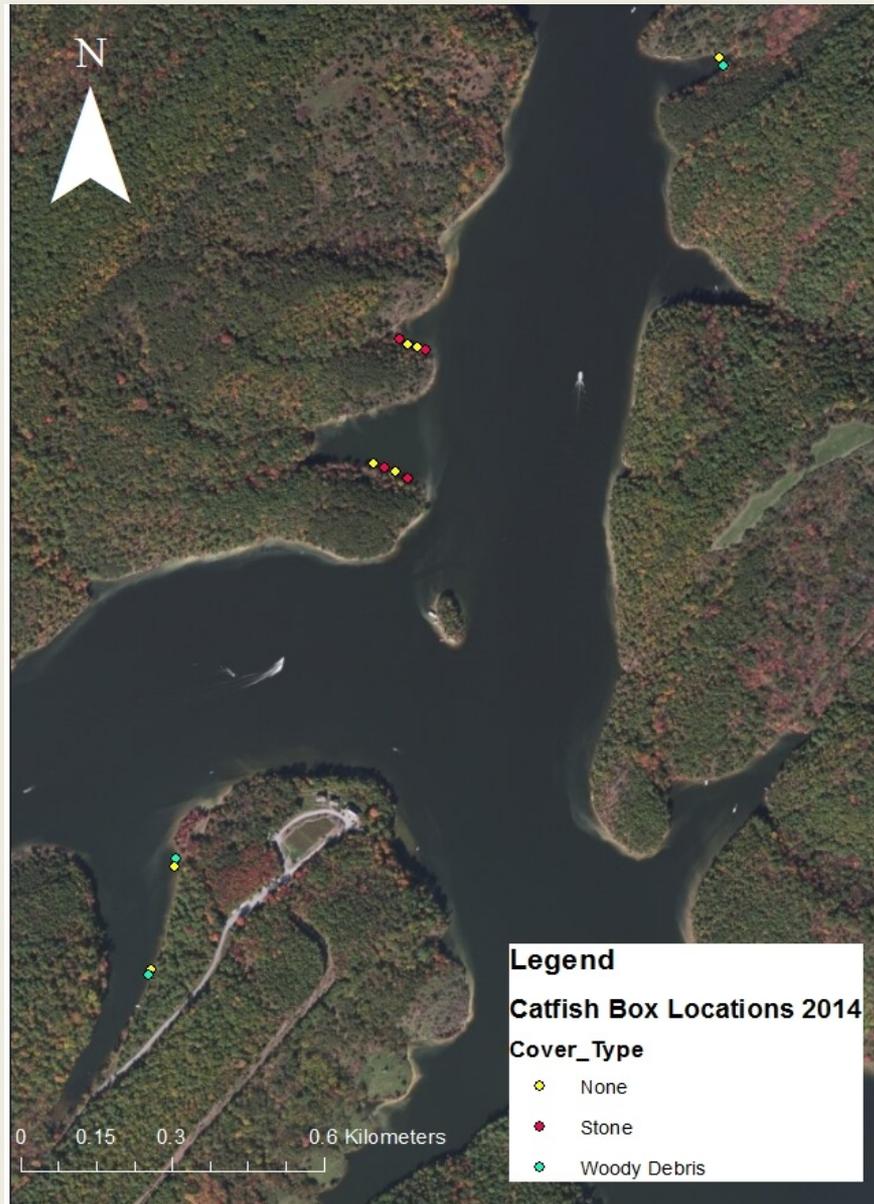
Habitat Types



Sampling Protocol- 2014

- 14 boxes deployed at the end of May in near-shore areas typically < 2.0 -m in depth
 - Boxes placed in groups of 2 or 4 in close proximity (separated by about 10-15 meters)
 - Near Woody Debris (3), with stone pile (4) or with no cover (7)
- From 5 June—23 July each site was examined every 6-7 days
- Physicochemical measurements were taken at every sample site on each date

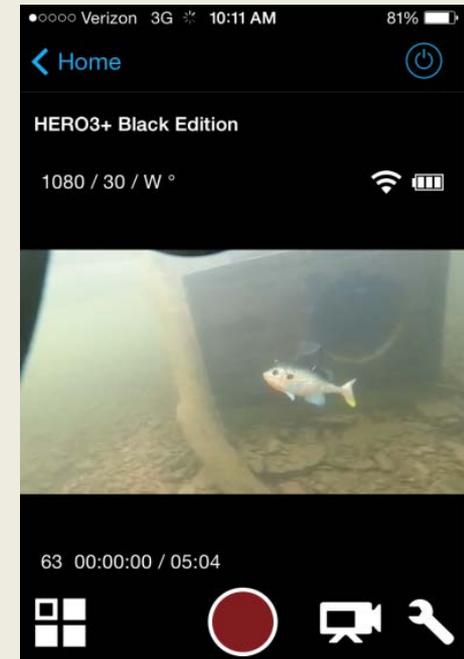
Catfish Box Locations- 2014



Sampling Protocol- 2014

- Boxes were approached from shore
- A GoPro camera was mounted to a PVC pole with two dive lights.
 - GoPro HERO 3+ Black Edition
 - BigBlue Underwater 350 Lumen LED light system
- A researcher would enter the water, stand on top of the catfish box and direct the camera and lights into the opening of the box
- A researcher on the boat watched a live feed of what the GoPro camera was seeing (sent via wifi) with an iphone and was able to control the camera's settings and recordings (GoPro app)
- If a catfish/egg mass/fry were present a video clip was recorded.

Camera Setup



GoPro App



Sampling Protocol- 2014

**Standing on box,
recording video**



**Directing Camera
into Catfish Box**



Observations- 2014

A photograph showing the interior of a catfish box. The scene is dimly lit, with a bright yellow light source illuminating the bottom and sides of the box. The water is dark and contains many small, white, suspended particles, likely catfish eggs or larvae. The top of the box is dark, and the overall appearance is that of a clean, empty container.

Interior of catfish box- no occupancy

Observations- 2014

1 Channel Catfish , no Egg Mass

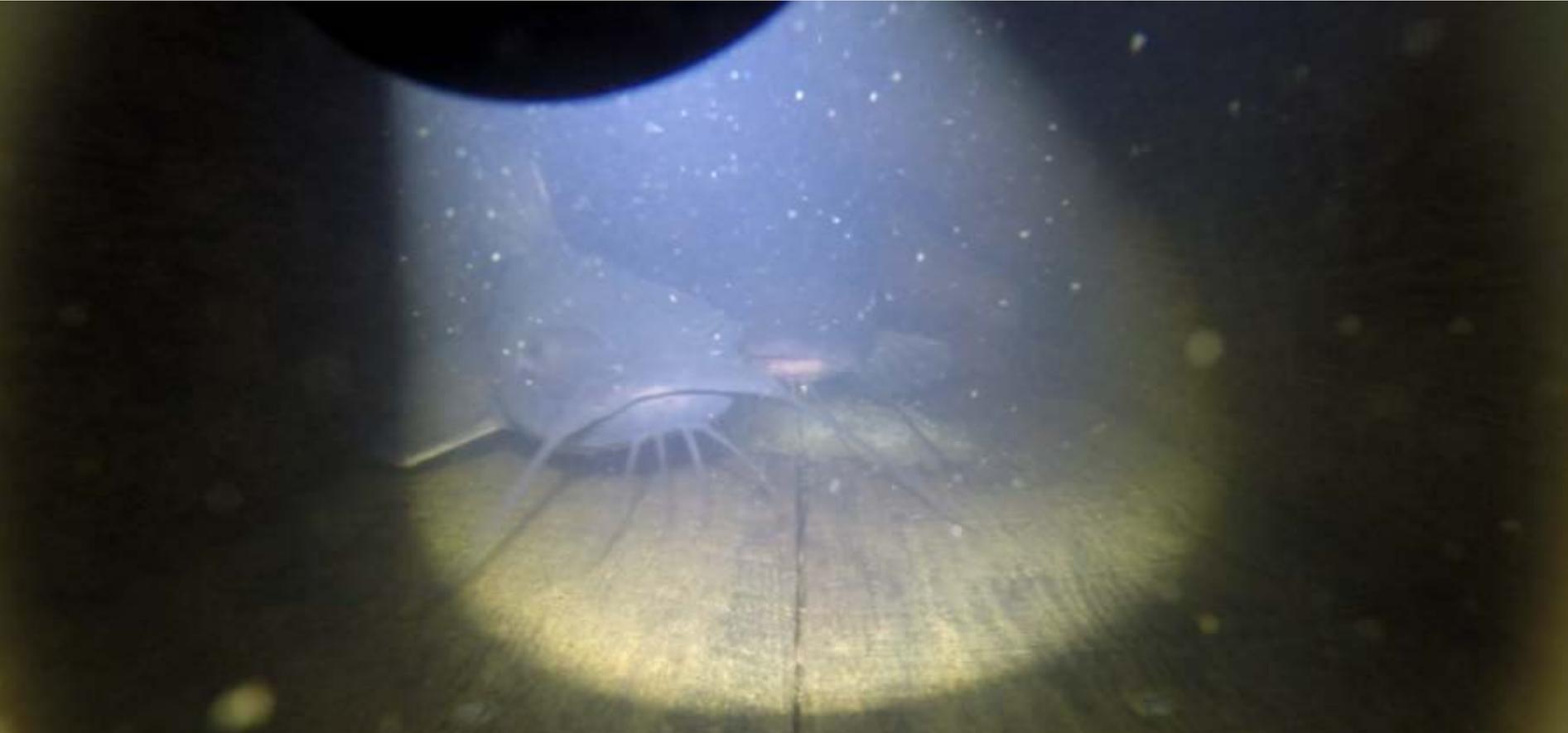


Observations- 2014

1 Channel Catfish and an Egg Mass



Observations- 2014

An underwater night photograph showing two channel catfish and an egg mass. The scene is illuminated by a blue light source, likely a flashlight, creating a bright blue glow around the fish and a yellowish-green glow on the sandy bottom. The catfish are positioned in the center, facing each other, with their whiskers clearly visible. The egg mass is located between them. The background is dark, with some small white specks, possibly bubbles or debris.

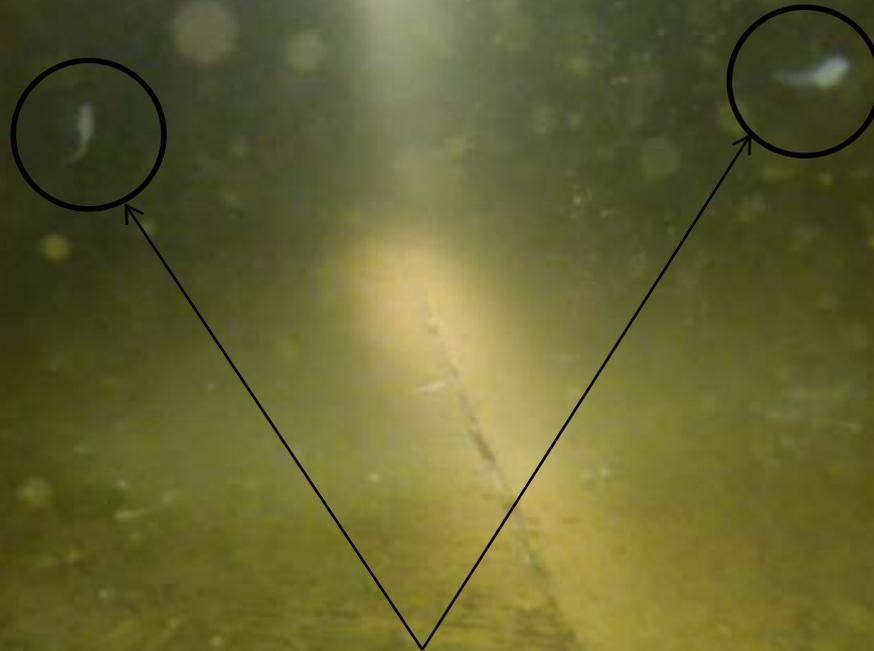
2 Channel Catfish and an Egg Mass

Observations- 2014

An underwater photograph showing a bright yellow, glowing egg mass in a dark, murky environment. The background is dark green and blue, with many small, white, speckled particles floating around. The egg mass is a large, bright yellow, glowing shape in the lower center of the frame.

Egg Mass, no Catfish

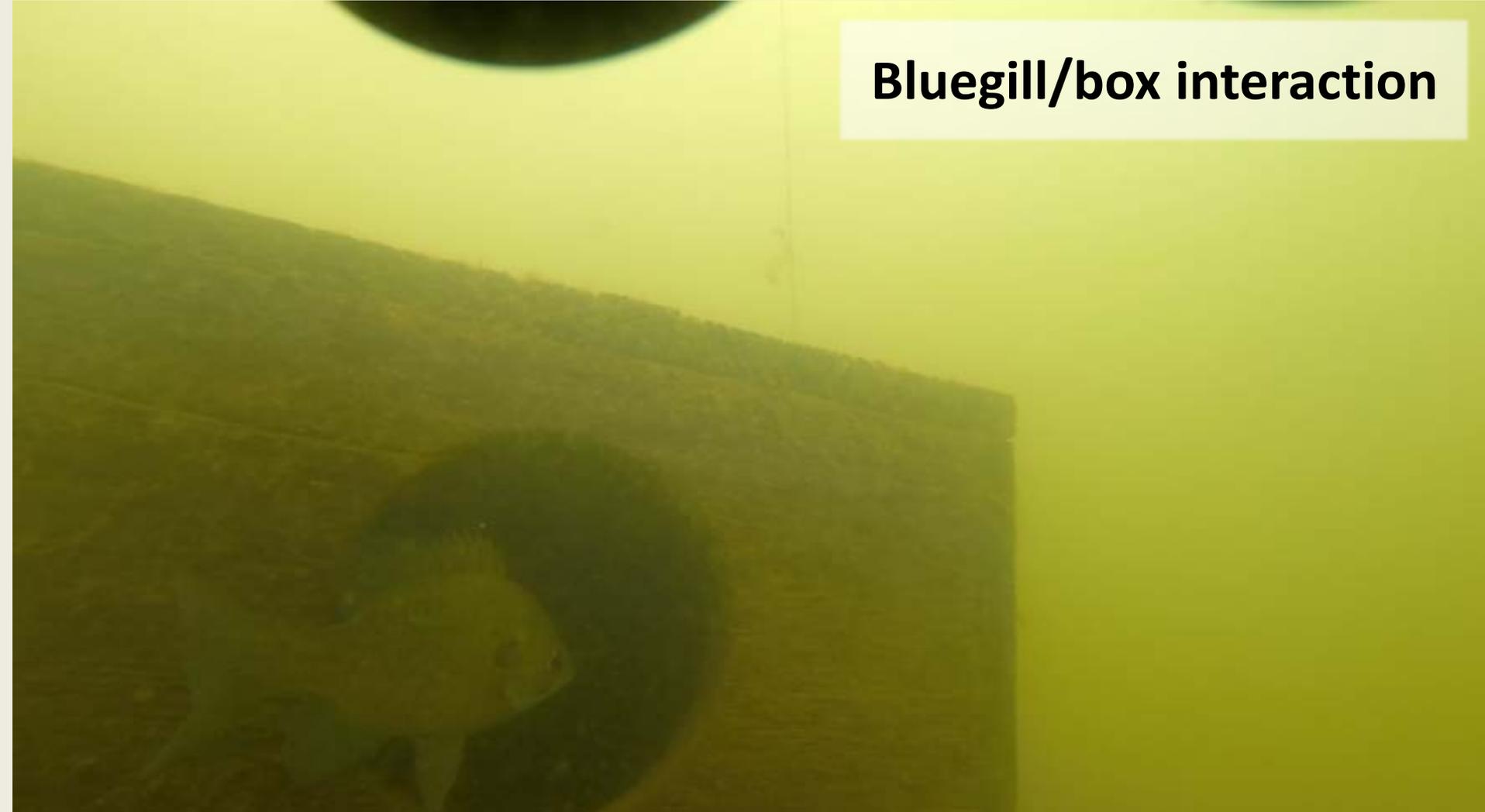
Observations- 2014



Channel Catfish Fry

Observations- 2014

Bluegill/box interaction



Observations (adults)- 2014

- From 12 June—23 July at least one box was occupied with an adult Channel Catfish
- Across all sample dates, 25% of the boxes contained adults with the highest occupancy rate (57%) occurring on 18 June
- A spawning peak lasted 12 June—2 July coinciding with water temperatures reaching 24°C
- Starting 9 July there was a rapid sustained decline in adults using structures

Observations (eggs+ fry)- 2014

- Found almost continuous evidence of spawning for six straight weeks once water temperatures exceeded 24°C
- Starting 12 June and continuing 6 weeks, at least one structure contained eggs on each sample date
- Highest incidence peaked 18 June and lasted for almost two weeks (~ 48% of the boxes contained eggs)
- On multiple occasions fertilized eggs were found but no adult was observed in the structure
- Catfish fry were observed in one box throughout all sample dates on 16 July

Observations (habitat preference)- 2014

- Woody Debris

- Throughout all sample dates, 26% of structures were occupied by adults/eggs/fry or a combination (i.e. adults and eggs together)
- During spawning peak (12 June- 2 July), 33% were occupied by adults/eggs/fry or a combination
- Also observed high numbers of *lepomis* (sunfishes) spp. in close proximity to submerged woody debris

Observations (habitat preference)- 2014

- No Cover

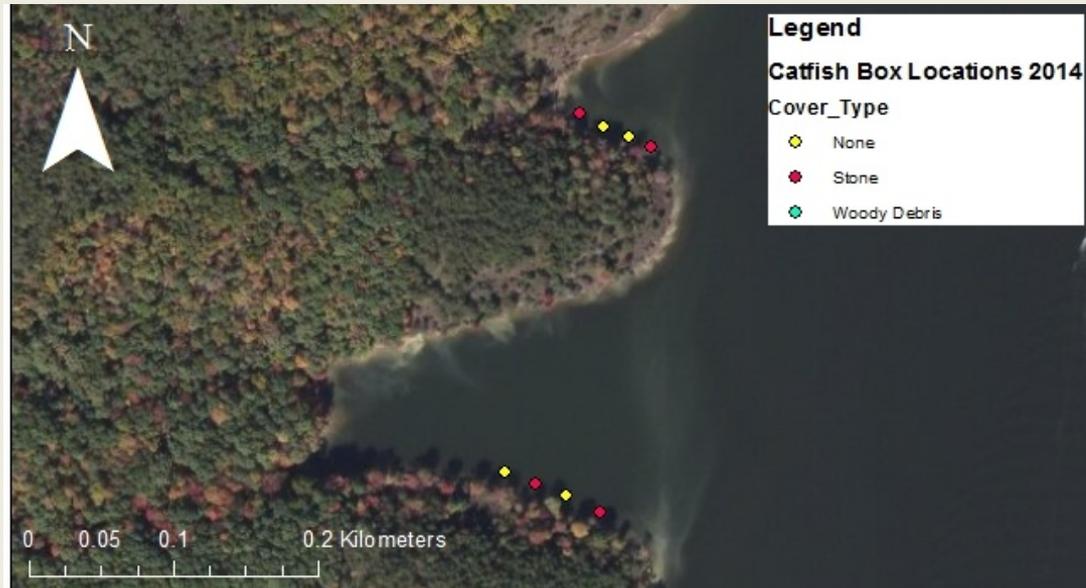
- Throughout all sample dates, 38% of structures were occupied by adults/eggs/fry or a combination (i.e. adults and eggs together)
- During spawning peak (12 June- 2 July), 61% were occupied by adults/eggs/fry or a combination
- Observed fewer *lepomis* spp. near boxes with no cover

Observations (habitat preference)- 2014

- Stone Piles
 - Throughout all sample dates, 50% of structures were occupied by adults/eggs/fry or a combination (i.e. adults and eggs together)
 - During spawning peak (12 June- 2 July), 88% were occupied by adults/eggs/fry or a combination
 - Observed fewer *lepomis* spp. near boxes covered in stone piles

Observations (habitat preference)- 2014

- Grouped boxes of alternating stone and no cover
 - Throughout all sample dates, 36% of no cover structures were occupied by adults/eggs/fry or a combination (i.e. adults and eggs together) while 50% of stone pile structures were occupied
 - During spawning peak (12 June- 2 July), 50% of no cover structures were occupied by adults/eggs/fry or a combination while 88% of stone pile structures were occupied
 - During the peak spawning period it was 38% more likely that a catfish would occupy a box covered in stone to a box with no cover



Conclusions- 2014

- Continue to suggest that these structures appear to offer Channel Catfish the preferred spawning microhabitats.
 - However some habitat types increase/decrease box usage
- Catfish boxes near woody debris were **occupied most infrequently**
- Catfish Boxes with no cover were **occupied at an intermediate rate**
- Catfish Boxes with a stone pile were **occupied most frequently**
- Channel Catfish appeared to prefer boxes covered in stone when grouped together with boxes with no cover
 - 38 % higher occupancy rate during peak spawning period

Conclusions- 2014

- We speculate that boxes:
 - Near woody debris were used **least** because more lepomis spp. were observed in close proximity, they are known to feed on the catfish fry, so when they leave the box there is a high chance they will be consumed.
 - With no cover were used at an intermediate rate because there were fewer lepomis spp. nearby, but then leaving catfish fry vulnerable because there was no cover for them nearby to hide in.

Conclusions- 2014

- We speculate that boxes:
 - With a stone pile on top were occupied **most** often because fewer *lepomis* spp. were observed nearby and catfish fry upon leaving the box could then hide in the crevices created by the rock pile to avoid predation.
 - We also perceived a structure with a stone pile to appear more “natural” than a catfish box on its own

Management Implications

- Overall our research suggests:
 - Catfish boxes can influence reproductive success of Channel Catfish in large lotic systems such as Raystown Lake
 - By providing structures that appear to offer Channel Catfish the preferred spawning microhabitats
 - Catfish boxes covered with stone piles have the highest frequency of occupancy when compared to those with no cover and those near woody debris
 - Future installments of catfish spawning boxes to other PA lakes should consider adding stone piles on top of placed boxes as well as not deploying boxes near submerged woody debris

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