A Tale of Two Killies: Keeping and Breeding American-Native Killifish

Presented by Brian J. Torreano

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to the Madison Area
Aquatic Hobbyists club

What is a killifish?

- A killifish is any of various oviparous (egg-laying) cyprinodontiform fish (including families Aplocheilidae, Cyprinodontidae, Fundulidae, Nothobranchiidae, Profundulidae, Rivulidae and Valenciidae). All in all there are some 1270 different species of killifish, the biggest family being Rivulidae, containing more than 320 species. (Wikipedia, 2009a)

What do they look like?

- Their jaws have well-developed teeth, their heads are flattened above, and they have small, more or less dorsal mouths…Killifish possess soft-rayed fins; a single dorsal fin is located posteriorly.” (Becker, 1983)

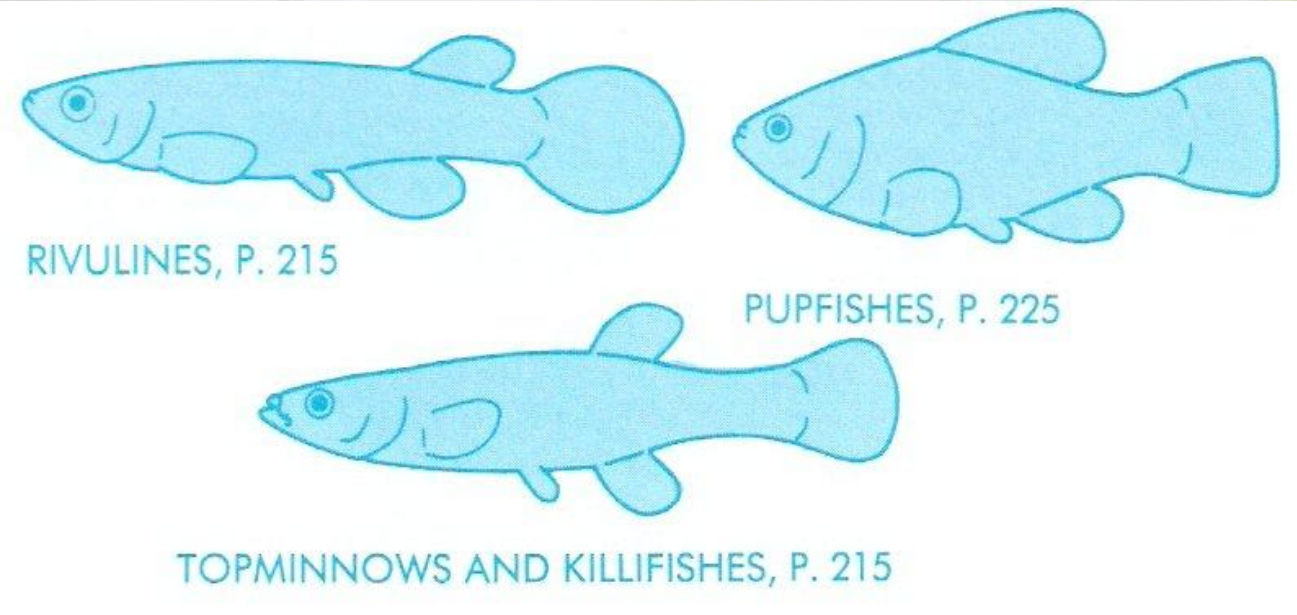


Image from Page and Burr, (1991)

What do they look like?, cont.

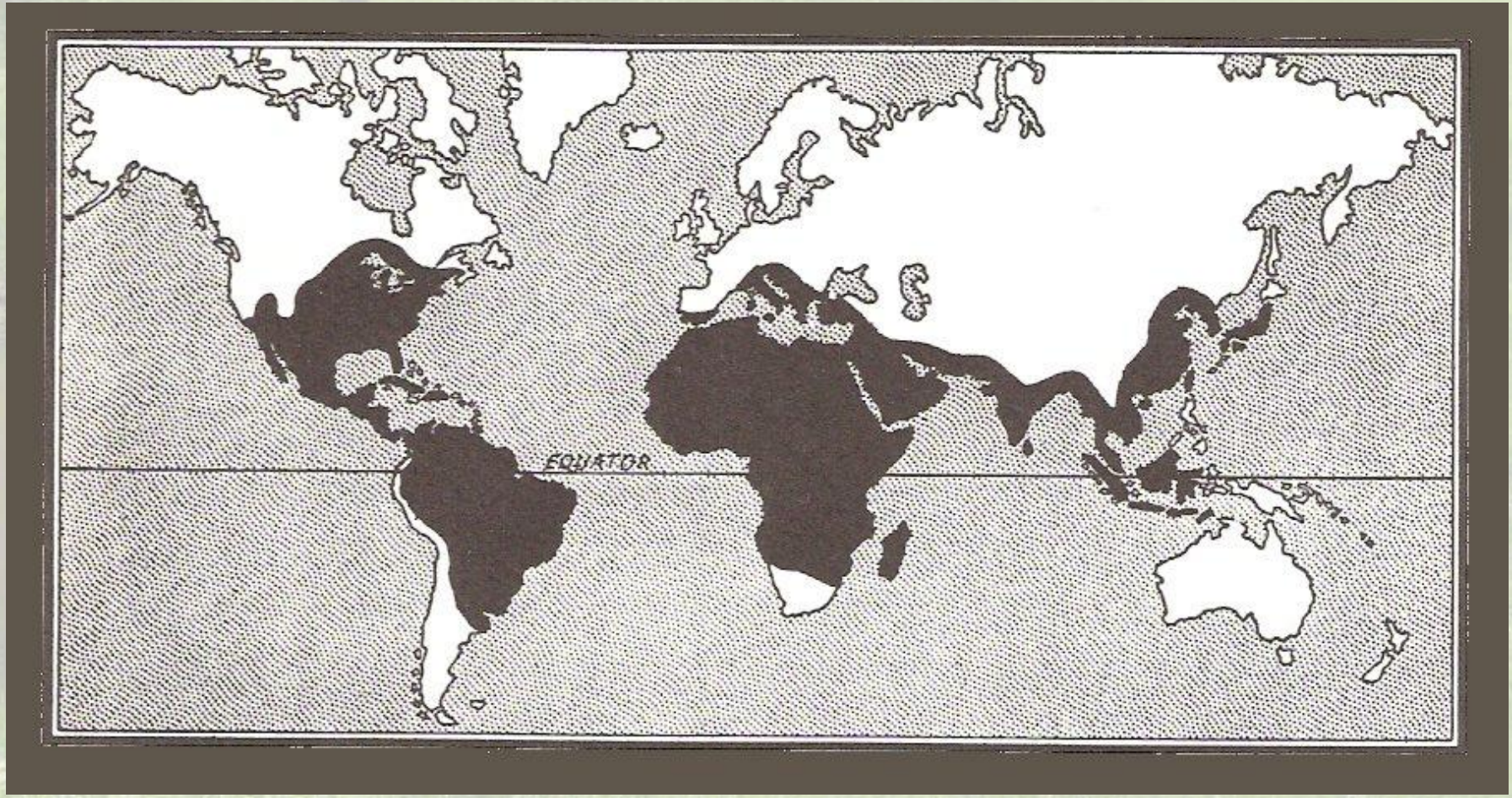
A bluefin notho killifish, *Nothobranchius rachovii*, from East Africa.

Devils Hole pupfish, *Cyprinodon diabolis*, from Death Valley National Park.

Fundulus auroguttatus, a non-annual North American killifish.

All photos from the Wikipedia "Killifish" page, (2009a)

Where are they found?



Map from Innes (1971)

In what types of habitat are they found?

- The majority of killifish are found in permanent streams, rivers, and lakes. (Wikipedia, 2009a)
- They are generally found in shallow waters and are adapted to surface feeding. (Becker, 1983)
- They are found in fresh, brackish, and salt water. (Page and Burr, 1991)

Tell Me About Killifish in North America

- “The family Cyprinodontidae is represented by 48 species in 10 genera in the United States and Canada, a number of which are both marine and freshwater in habit (Robins et al. 1980). The family indudes the Devils Hole pupfish, Owens River pupfish, Comanche Springs pupfish, and Pahrump killifish of the southwest, all of which are endangered and have been the subjects of congressional conservation measures.” (Becker, 1983)

What killifish will I be talking about?

- Bluefin Killifish (*Lucania goodei*)
- Banded Killifish (*Fundulus diaphanus*)

- Both are members of the family Fundulidae
  - The 40 species in this family are found in fresh, brackish, and salt water of North and Middle America (Page and Burr, 1991)

Tell me about the Bluefin Killifish [3]

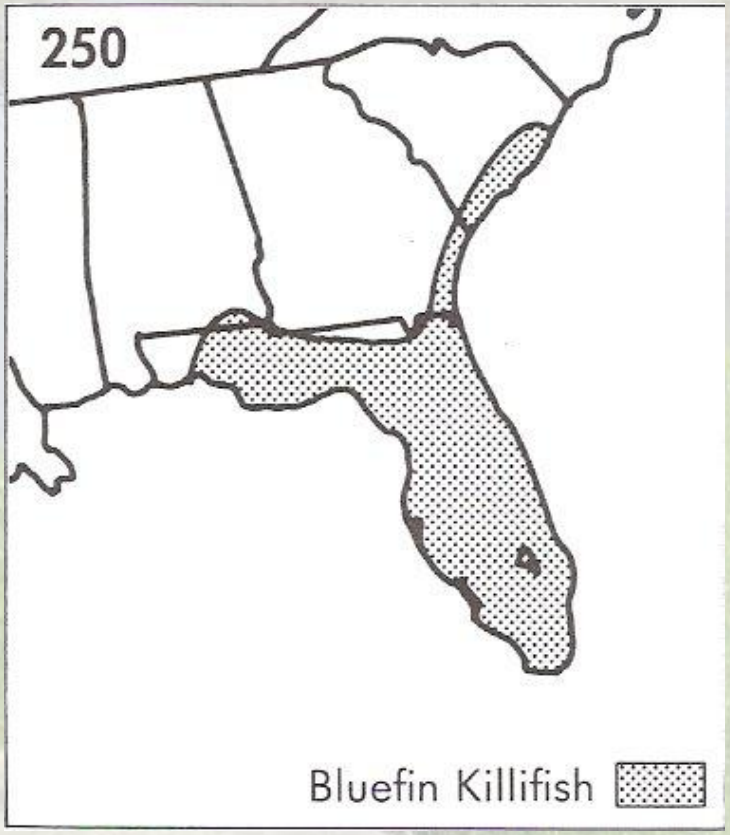
- A silvery fish with a bold black horizontal stripe along the flank. The nuptial male has a red blotch at the base of the pink tail fin and iridescent blue dorsal and anal fins; the fins are colorless in the female.
- The Bluefin spawns among vegetation in clear ponds and backwaters of spring-fed streams.
- It feeds on invertebrates among the plants and grazes on epiphytic algae.

Tell me more...

- It can survive waters of low dissolved oxygen concentrations by using its small, upturned mouth to capture the oxygen layer adjacent to the surface water. (Goldstein, 2000)
- In the aquarium, they take flake food, live blackworms, live or frozen daphnia, live or frozen adult brine shrimp, mosquito larvae, tubificid worms, and possibly fruit flies.

Bluefin Killifish in North America

- To my knowledge, there are no described subspecies. There are known to be color variations, though.



Range map from Page and Burr (1991)

Bluefin Killifish, cont.

- Assume it's status is abundant or at least “secure” due to the fact that it is not listed as a protected species on the North American Native Fishes Associations' website. (NANFA, 2009)

Bluefin Killifish

Lucania goodei – Photo Copyright © Brian J. Torreano, 2009

Why did I want to breed them?

- To learn how to breed a fish that is not common in the aquatic hobby.
- To learn how to breed a fish that is native to America.
- To gain experience breeding fish, in general.
- To perpetuate the species.

Obtaining the Fish

- Bought the fish as Ghost Shrimp “strays” over the course of several months.

Image from Aquatics Unlimited website (2009)

When I got the fish home.

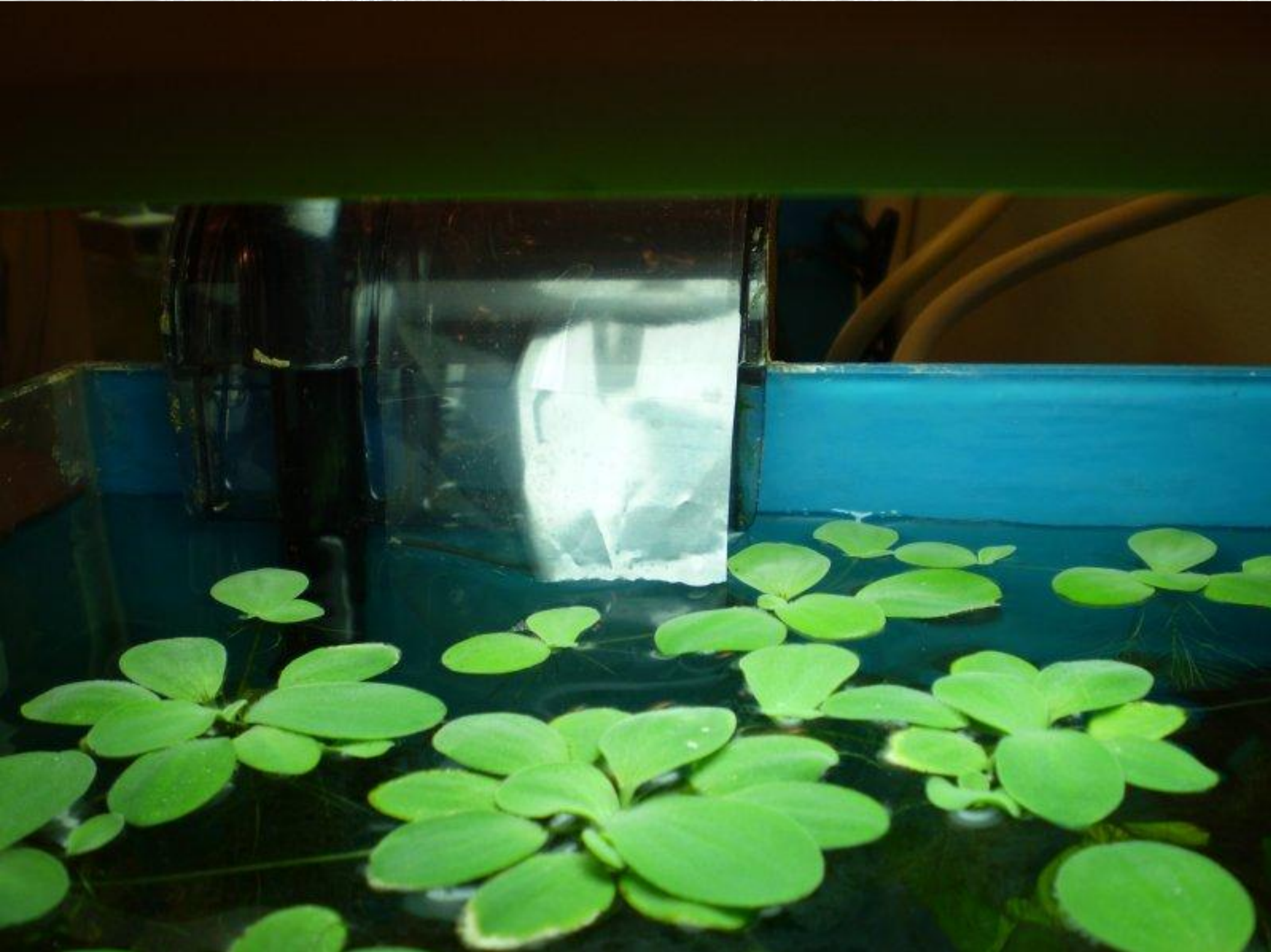
- Put them in their own tank.
- Started with more fish, but at the time of spawning, only had one male and one female.

The Tank

- 4-gallon Finnex Nano-Tank.
- Finnex Compact Fluor. 13 Watt, 7100K fixture.
- BTDarters' Natural Streambed Enriched Plant Substrate.
- Shiruba Nano-filter.
- Tetra Set-temp heater.

The Tank, cont.

- Tank water tempertature, 75 – 78*F.
- Dechlorinated/Dechloraminated Lake Michigan tap water.
- 12 to 14 – hour photoperiod.
- *Cryptocorene lutea,* Narrow-leaf Java Fern, *Anubias nana* var. 'petite' and Water Lettuce.
- Flourish Excel™ fertilization daily.
- Filter provided water circulation.
- *Otocinclus* catfish for algae control.



Care

- Fed live blackworms and Tetra Veggie flakes daily. Occasionally offered live brine shrimp.
- 40% water change every 2 weeks.
- Again, Flourish Excel™ fertilization daily.

Setup for Spawning

- Made a spawning “mop” out of nylon yarn.
  - Wrapped the green yarn around a book about 50 times.
  - Tied-off the mop at the top and cut the bottom.
  - Tied a “belt” around the mop at about 1 inch down from the top.
- Hung the mop in a vertical position near the right rear side of the tank.
- Waited.

At first...

- Didn't get eggs.
- Did think that I “sprang a leak” in the tank.
- Cut top string off of mop and let the mop sink a little bit in the tank.
- Plugged-in the heater.
- Male and female started hanging-out in the spawning mop.

Started Harvesting Eggs

- Pulled the mop out every few days and plucked the eggs out with my fingers and a spoon.
  - Eggs were about 1mm clear “spheres”.
  - Tried a few methods of hatching the eggs.
    - Put them in individual plastic containers with shrimp.
    - Put the mop in a tank with shrimp, swapped-out mops
- Took 6 days at 75*F to hatch.
- Methylene blue was used with some eggs to prevent fungusing.

Harvesting Eggs, cont.

- Hatch ratio wasn't great as many eggs fungused.
- Fry that did hatch looked like 3mm “eyes with a tail” and had black speckles.
- Transferred fry to a 2 ½ gallon rearing-tank.
- Rearing tank had cherry shrimp, Malaysian trumpet snails, and a sponge filter.

Didn't Get a Whole Lot of Eggs at First

- Was getting maybe 3 eggs a week.
- After about 2 weeks, the pair started laying more eggs.

Didn't have very good luck with fry

- Of the 50 eggs, maybe 10% hatched.
- Fed fry crushed flake and Cyclop-eeze.
  - They didn't seem to last long, though.
  - Was one of my first experiences raising fry.
- The fish laid eggs for about a month.
- Had 1 or two fry in the fry tank for about a month after after hatching.

Not a total failure, though!

- After a few weeks I noticed a fry in the tank with the spawning pair.
  - Fry was a lot larger than the fry I had been trying to raise in the fry tank.
  - Don't know what he had been eating.
  - Parents didn't eat him, though.
  - Must have hatched from an egg that fell off of the mop.

As of Now...

- Several months later..
  - Male passed-away.
  - Female and fry remain.
  - Remaining fry appears to be a male.
  - Will try to spawn the fish again when the fry gets bigger.
- Pictures of what the fry looks like.

Next...

- The Banded Killifish (*Fundulus diaphanus*)

Tell me about the Banded Killifish[2]

- Again, a member of the family Fundulidae.
- 3 Species native to Wisconsin:
  - Banded Killifish (*Fundulus diaphanus*)
  - Blackstripe Topminnow (*Fundulus notatus*)
  - Northern Starhead Topminnow (*Fundulus dispar*)

Tell me more...[3]

- *Fundulus* (in the wild) feed on insects, crustaceans, and snails, usually at the surface of quiet waters with dense vegetation.
- In the aquarium, they take flake food, live blackworms, live or frozen daphnia, live or frozen adult brine shrimp, mosquito larvae, tubificid worms, and vestigal-winged fruit flies.

Banded Killifish in Wisconsin

- The subspecies found in Wisconsin is the Western Banded Killifish (*Fundulus diaphanus menona*).

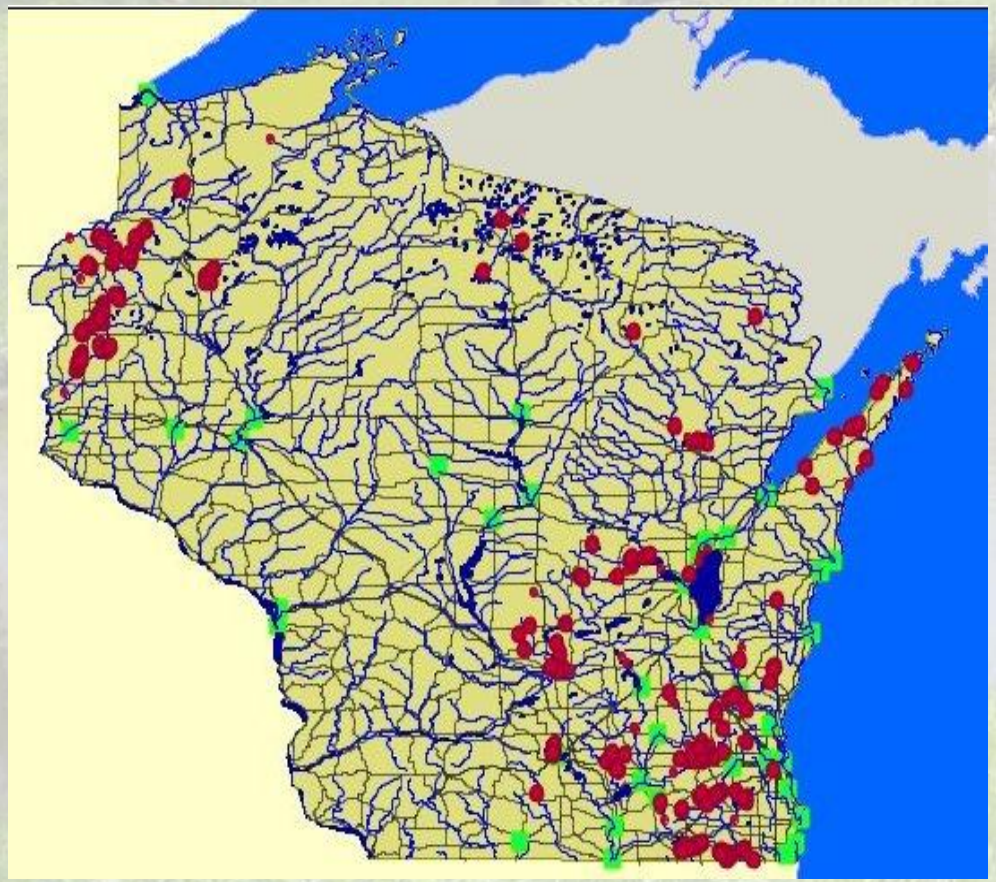
Range of both subspecies of Banded Killifish. Map from Becker (1983)

Banded Killifish, cont.[2]

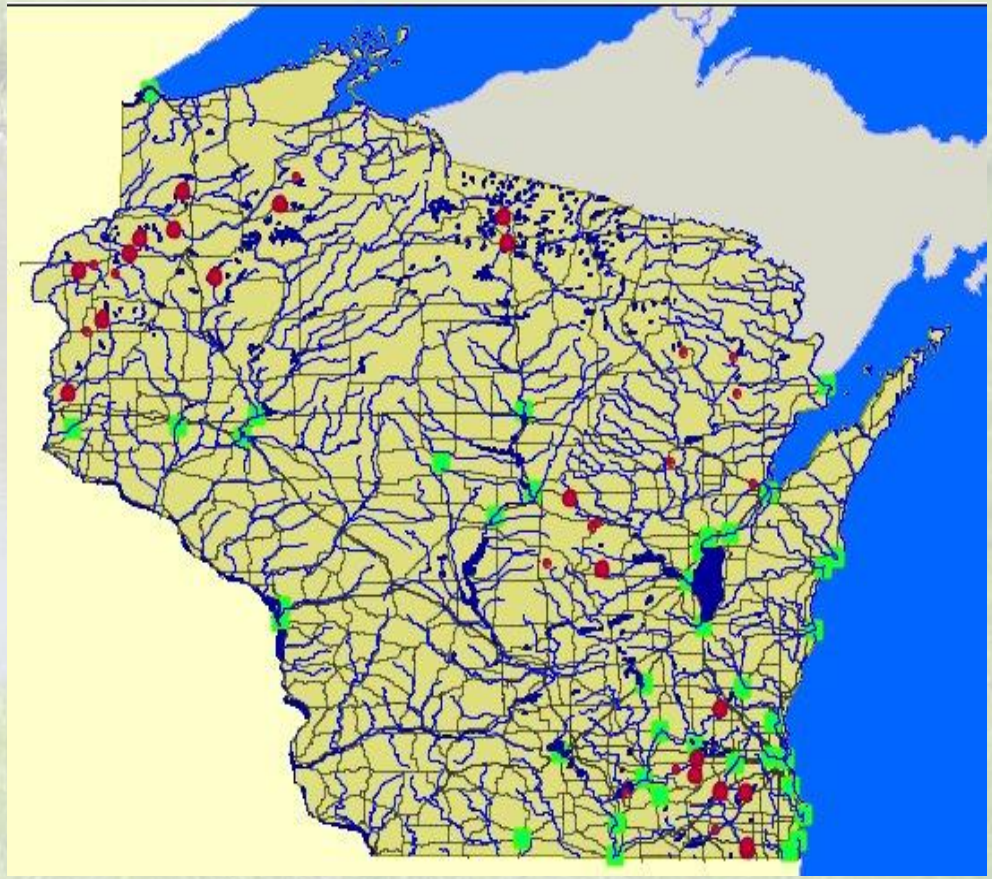
- Becker (1983) listed species as common to abundant in lakes in southeastern Wisconsin.
- Currently listed by the state DNR as a species of “Special Concern”.
  - “Special Concern” species are those species about which some problem of abundance or distribution is suspected but not yet proved. The main purpose of this category is to focus attention on certain species before they become threatened or endangered.

Why are they a “Special Concern” species?

Pre-2000



Post-2000



Maps from the DNR GAP mapping application (WDNR, 2009b)

What does a “Special Concern” listing mean for us?

- Wisconsin has 5 SC listings, from fully protected to unprotected.
- Banded Killifish specific listing is “SC/N”.
  - no laws regulating use
  - CAN be kept in the aquarium.
- However, BTDarters will not sell *any* SC fish, except ones collected in states where their status is secure, OR fish that are the offspring of captive-bred individuals.

Tell me more about Banded Killies[2]

- Inhabits shoal waters and estuaries of large lakes, and the quiet backwaters and sections of slow current in medium- to large-sized streams.
- Strong preference for broad, sandy shallows in the open or in the presence of sparse vegetation.
- Vegetation spawner.
- Adult size: 3 inches.

Tell me more, cont.[2]

- Appearance: Body light olive on back and sides, yellow-white on lower half, including belly. Usually 12-20 narrow, vertical bars on sides. Dorsal and caudal fins lightly pigmented; ventral fins lightly pigmented or clear.
- A schooling fish that feeds as a member of a school.
- Feeds effectively at all water depths.
- Preferred position is the top of the water, although this is the least “topwater” of Wisconsin killifish.

Banded Killifish

Fundulus diaphanus – Photo Copyright © Brian J. Torreano, 2009

Why did I want to breed them?

- To learn how to breed a fish whose abundance is declining in the state, in hopes that my experiences will be useful in possible future breeding or reintroduction efforts.
- To gain experience breeding fish, in general.
- To perpetuate the species.

Collecting the Fish

- Researched and found a lake in Southeastern Wisconsin where the fish were known to occur.
- Went out collecting at the lake in mid-May, 2009, with a friend.
- Collected at a weedy beach with a 10-foot seine, and at a boat landing with the same seine.

Success! Collected 6 Adults.

When I got the fish home.

- Sorted-out the fish.
- Found that I had 2 males and 4 females.
- Set them up in their own tank.

The Tank

The Tank

- 26-gallon Aqueon bow-front tank with simulated rock- and wood-work.
  - Effective measured water volume = 20 gallons
- Finnex Compact Fluor. 13 Watt, 7100K fixture.
- ESU Reptile Fluor. 15 Watt, T8 fixture.
- BTDarters' Natural Streambed Enriched Plant Substrate.
- Zoo-Med 501 Repti-filter.
- Lee's Large Feeding Cone

The Tank, cont.

- Tank water tempertature, 75 – 78*F, Room temp.
- Dechlorinated/Dechloraminated Lake Michigan tap water.
- 12 to 14 – hour photoperiod.
- *Sagittaria* and *Echinodorus sp.* plants.
- Flourish Excel™ fertilization daily.
- Air bubble-disk for water circulation.
- *Otocinclus* catfish for algae control.

Fish in the Tank

Fish in the Tank

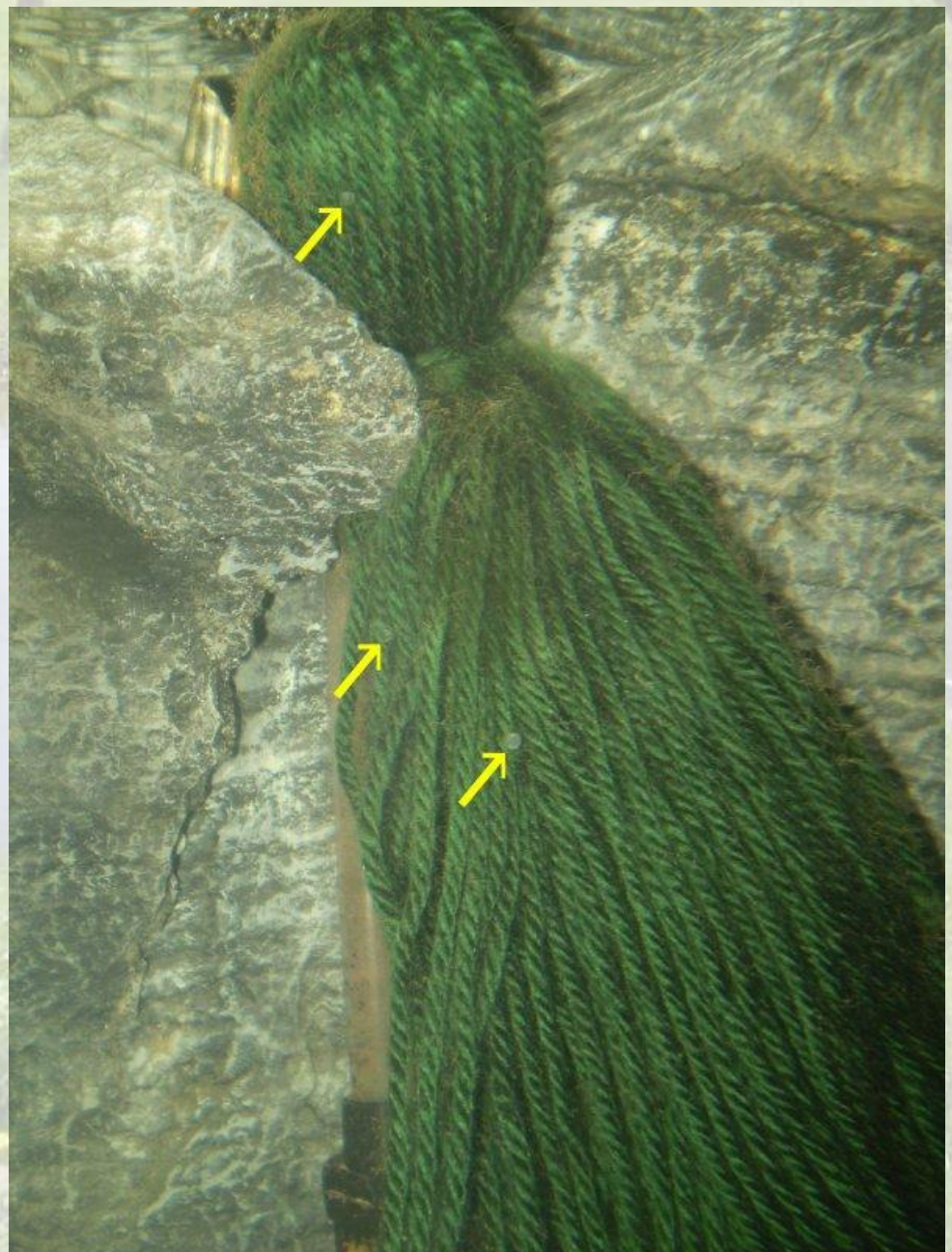
Care

- Fed live blackworms and Tetra Veggie flakes daily. Occasionally offered live brine shrimp.
- 40% water change every 2 weeks.
- Again, Flourish Excel™ fertilization daily.

Setup for Spawning

- Made a spawning “mop” out of nylon yarn.
  - Wrapped the green yarn around a book about 100 times.
  - Tied-off the mop at the top and cut the bottom.
  - Tied a “belt” around the mop at about 1 inch down from the top.
- Wedged the mop in a vertical position near the filter intake.
- Waited.

The Mop



Started Harvesting Eggs

- Pulled the mop out weekly and plucked the eggs out with my fingers and a spoon.
  - Eggs were about 3mm clear “spheres”.
  - Tried a few methods of hatching the eggs.
    - Put them in individual plastic containers with shrimp.
    - Put the mop in a tank with shrimp, swapped-out mops
- Took 11 days at 75*F to hatch.
- Methylene blue was used with some eggs to prevent fungusing.

Harvesting Eggs, cont.

- Hatch ratio wasn't great as many eggs fungused.
- Fry that did hatch looked like 5mm “eyes with a tail” and had black speckles.
- Transferred fry to a 2 ½ gallon rearing-tank.
- Rearing tank had cherry shrimp, Malaysian trumpet snails, and a sponge filter.

Fry

Didn't Get a Whole Lot of Eggs at First

- Was getting maybe 5 eggs a week with mop in vertical position.
- Switched the mop to a horizontal position wedged in between pieces of “wood” near the airstone.
  - Got about 30 eggs a week.

Some of the fish passed-along

- Slowly lost some of the adults.
  - Perhaps senescence? Or spawned-out?
- Over the course of a month, lost all but one male and one female.
  - They were still spawning, though.

Finally Lost Last Female

- Over the course of about a month, collected 100 eggs.
- Only one male remained.
- Didn't check the mop for eggs after the last female passed.

Didn't have very good luck with fry

- Of the 100 eggs, maybe 10% hatched.
- Fed fry crushed flake and Cyclop-eeze.
  - They didn't seem to last long, though.
  - Was one of my first experiences raising fry.
- After a few weeks of female passing, had lost all of the fry.

Then Something Magical Happened!

- After a few weeks I noticed some fry in the tank with the remaining male.
  - Fry were a lot larger than the fry I had been trying to raise in the fry tank.
  - Don't know what they had been eating.
  - Male didn't eat them, though.
  - Must have hatched from eggs remaining on the mop from just before the last female died.

As of Now...

- Several months later..
  - Have about 15 fry.
  - Are almost as big as the male now!
  - One “slider”, though.
- Overall, I'd say, “Success!”.

Fry – About ¾ Size of the Male

Fry

Questions?

- Contact Brian @
  - Phone: (262) 268-7489
  - Email: info@btdarters.com
  - Snail mail:
    - Brian J. Torreano
    - 1414 W. Sunset Rd., #102
    - Port Washington, WI 53074

References

1)Aquatics Unlimited, 2009. Aquatics Unlimited pet store website. 23 Oct., 2009. < http://www.bestfish.com/>.

2)Becker, G. C. 1983. Fishes of Wisconsin. University of Wisconsin Press, Madison, Wisconsin.

3)Goldstein, R.J. 2000. American Aquarium Fishes. Texas A&M University Press, College Station, Texas.

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7)WDNR, 2009a. Wisconsin Department of Natural Resources website. Wisconsin Natural Heritage Working List. 12 Oct., 2009. < http://dnr.wi.gov/org/land/er/wlist/>.

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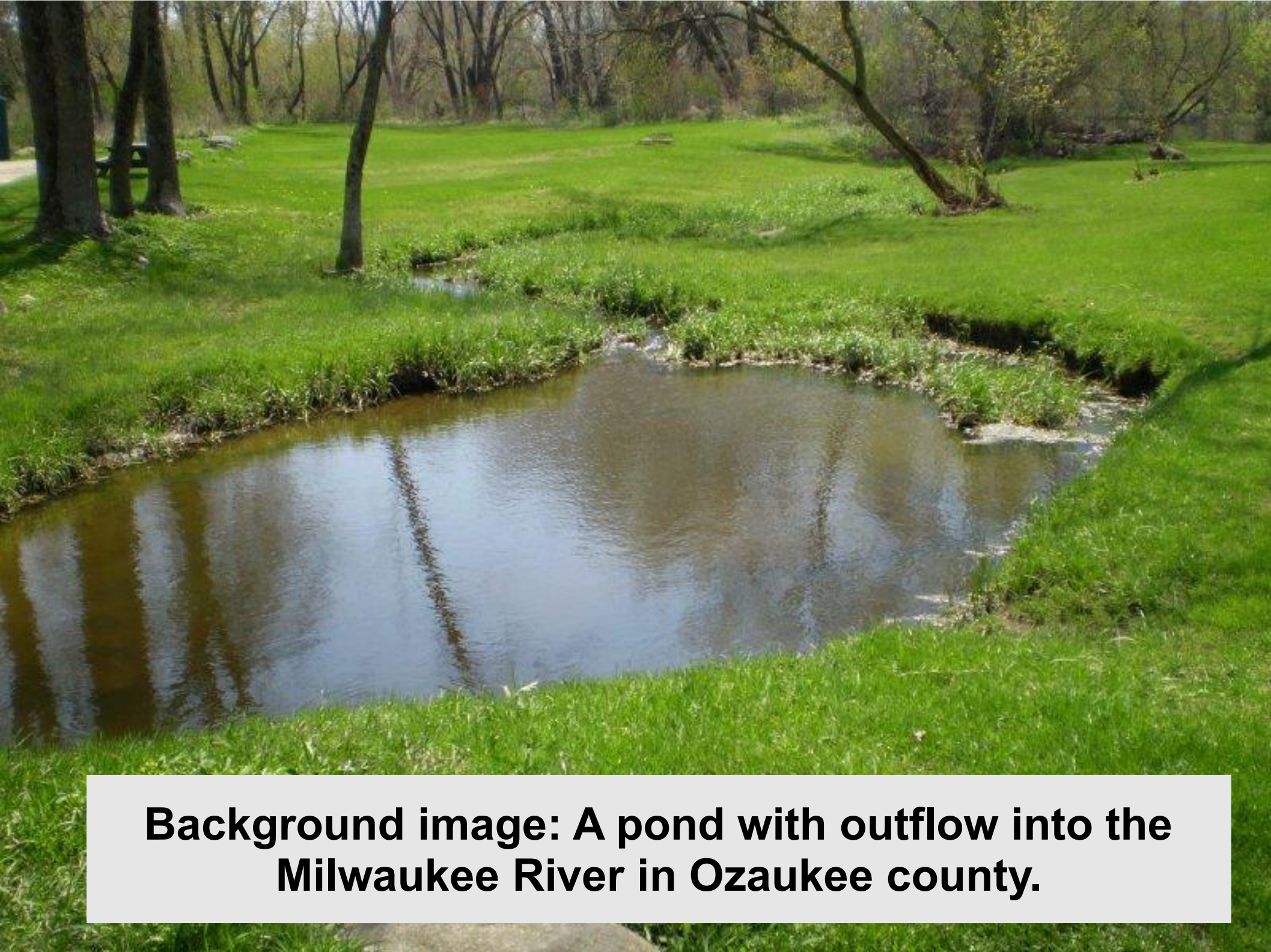

Background image: A pond with outflow into the Milwaukee River in Ozaukee county.