

A Pack of Wild “Dogfish” Aggregation by Adult *Amia calva*

Collin Nienhaus and Clinton Nienhaus
Biology Department
700 Terrace Heights
Saint Mary’s University of Minnesota
Winona, Minnesota 55987



Introduction

The Bowfin (*Amia calva*) is a relatively widespread and common fish endemic to North America. It is found in the eastern and central part of the United States, ranging from the Gulf states in the south to Quebec in the north, and from Texas in the west to the eastern seaboard (Page and Burr 2011). A fish of sluggish waters, the Bowfin inhabits lakes and slow-moving rivers with abundant vegetation (Becker 1983), as well as sloughs and river backwaters. The abundant backwaters of the Upper Mississippi River provide excellent habitat for the fish and support Bowfin populations that appear to be healthy (Koch et al. 2009). With ample aquatic vegetation, these backwaters provide good spawning habitat for Bowfin. These fish construct their nests in aquatic vegetation and may begin spawning in late April or early May in the northern part of their range (Becker 1983). Preferred water temperature for spawning is 16° to 19° C (Becker 1983).

We are not aware of previous records of aggregations

of adult Bowfin. However, in early May of 2012, we observed a large, presumably pre-spawn assembly of adult Bowfin at a culvert connecting two backwater complexes on the Wisconsin side of the main channel of the Mississippi River near Winona, MN. Four visits were made to the site, and observations were compiled and included in this paper.

Study Area

The assemblage was discovered in the Upper Mississippi National Fish and Wildlife Refuge near Bluff Siding, Buffalo County, WI, and visited on May 2nd, 4th, 5th, and 6th. The site was located at the end of the “Ox Bow Dike Trail” at the “River Bottoms Unit” of the refuge, where a culvert runs beneath the Canadian National Railroad near its junction with the Burlington Northern-Santa Fe Railroad (BNSF). On the northwestern side of the culvert is a backwater complex that extends farther to the northwest (Figure 1). On the southeastern side of the culvert is a

relatively small pool connected to another large backwater complex bordered on the south by the BNSF (Figure 2). The area is roughly located at the coordinates 44.054978° N, 91.582117° W.

The culvert had large, square openings and was constructed of concrete. Visibility in the water was estimated at 0.6 – 1 meter (m). Depth was not measured, though it appeared that the areas immediately adjacent to the culvert mouths were quite shallow (less than two m), especially on the southeastern side. The bottom of the culvert was clearly visible and was less than 0.3 m in depth. The predominant substrate nearest the culvert openings was sand, and aquatic vegetation was abundant at both ends of the culvert. There was no flow through the culvert during any of the visits. Water temperature was measured on the second (21.5° C) and fourth visits (16.5° C).



Figure 1. View from the northwest side of culvert.



Figure 2. View from the southeast side of culvert.

Observations

On all four visits, large numbers of Bowfin were observed at both ends of the culvert, especially on the southeastern end. A rough count was taken on the third visit, with an estimated 50 – 70 fish visible at the southeastern end and 10 – 20 fish visible

at the northwestern end (roughly the same number of fish were present on each visit). The groups included adult fish of varying sizes, with the largest individuals estimated at over 4 kg in weight. Other fish species observed within or near the groups of Bowfin included bullhead (*Ameiurus* spp.), Bigmouth Buffalo (*Ictiobus cyprinella*), Common Carp (*Cyprinus carpio*), sunfish (*Lepomis* spp.), and schools of unidentified small fish (most likely cyprinids). Curiously, the baitfish were seen swimming directly through the Bowfin aggregations and experienced no observable harassment from them.

The Bowfin appeared to be in spawning condition with the males sporting vivid green pelvic and pectoral fins. In addition, the caudal spot, or ocellus, was outlined in a bright yellow orange color [see page 17]. The Bowfin were breaking the surface frequently to respire, which is indicative of an exceptionally large biomass of fish in a relatively confined area or a low level of dissolved oxygen. Additionally, the fish appeared docile toward one another, and no clear aggressive behaviors were observed. Many fish had visible injuries and scars, some of which appeared to be recent. This may have been due to the crowded, confined environment or a migration barrier created by a debris dam of branches and wood that had completely blocked the culvert (Figure 3).

This debris dam possibly have been constructed by beavers, which have been observed in the area, or it could have been deposited by high water. As previously mentioned, the Bowfin appeared to be more concentrated at the southeastern end of the culvert where they likely were awaiting an opportunity to attempt to clear the barrier. The fish stacked up within the culvert here were observed splashing wildly and coming out of the water in an attempt to cross over the top of the dam. After the fish successfully crossed over the barrier, they may have dispersed, as evidenced by the lower number of fish observed at the northwestern end. At this end, the fish seemed to be swimming more actively and were observed a greater distance away from the culvert mouth than the other side. Compared to the southeastern end, Bowfin here were not as concentrated near the culvert mouth and few fish were observed actually within the culvert.



Figure 3. Debris dam (in background) within culvert.

It seems most likely that the Bowfin were assembled here because they were migrating into the backwaters to spawn rather than to forage. This is evidenced by the distinctive spawning colorations sported by the males, the suitable water temperature, and an apparent lack of interest by the fish in foraging. Hook-and-line angling with a variety of artificial baits was attempted on the first visit. Only one fish was hooked and landed (a medium-sized male caught after a considerable duration), but the overwhelming majority showed no interest in the lures or the baitfish swimming amongst them.


It did not appear that the Bowfin at the southeastern end of the culvert were preparing to spawn and staking out nest sites either, at least not in that immediate location. Rather, they were simply milling around the culvert mouth. Individuals on the periphery of the aggregations and along the shorelines seemed to be swimming more actively, but they were doing so randomly and did not appear to be foraging or preparing nests. At the northwestern end, however, especially during the third and fourth visits, the fish may have possibly been investigating potential nest sites, as they were often observed at regular intervals along the shoreline. These fish were not permanently staying at these locations, however. The fish seen along the shoreline on both ends of the culvert were neither predominantly male nor predominantly female. On the third visit, one pair of Bowfin was observed in extremely shallow water farther up the shoreline on the northwestern end. However, observational constraints made it difficult to clearly determine the behaviors of these fish. We did not observe any Bowfin clipping or clearing vegetation to construct a nest, nor did we see any pairs clearly engaging in courtship behaviors (circling, nipping, etc.) described by Becker (1983).

There was a small amount of rainfall before both the third and fourth visits. The rainfall before the third visit did not significantly affect the water level, but the rainfall prior to the fourth visit did raise the water level by somewhat less than 5 cm. However, even after the rainfall there was no observable flow through the culvert, and the activity of the Bowfin was not significantly different.

Discussion

We hope that these observations inspire new questions about Bowfin biology. This aggregation of presumably pre-spawn fish at a barrier that was apparently blocking their movement from one backwater complex into another suggests questions concerning the details of their movements. Based on these observations, we think that the Bowfin may have been migrating into a backwater to spawn. Future studies of Bowfin could focus on their pre-spawn movements and their preferred spawning areas. Do they make significant annual or even occasional spawning migrations? If so, what factors (temperature, dissolved oxygen, water level, etc.) cause them to make these movements? Furthermore, Bowfin are able to survive in highly fluctuating habitats, but it seems logical that they would still select the best possible conditions to ensure reproductive success. Might the size of the water body, then, affect where Bowfin choose to spawn? It is conceivable that Bowfin may seek extremely confined and shallow areas uninhabitable by many other species, “nurseries” so to speak, to rear their offspring successfully. In the backwater areas that the Bowfin were apparently trying to move into, we have observed spawning Bigmouth Buf-

falo and Northern Pike (*Esox lucius*), species that are both known to migrate into areas like this to spawn (Becker 1983). These two species are not as well adapted as the Bowfin to survive in these places, which is most likely why they migrate to spawn. Bowfin are adapted to live in these places, though, and we have frequently observed resident adult Bowfin (at least in the spring through fall) here. Why, then, would large numbers of fish be migrating into this area if it already supports a resident population? It may be possible that Bowfin have distinctively different winter and summer habitats, and summer residents may make seasonal movements out of and back into these shallow areas to avoid being trapped under the ice in poorly-oxygenated water.

Also, it is interesting to note that they were moving from one backwater complex to another. What distinguished the backwater they were trying to move into from the one that they were moving from? If one area had better spawning habitat, then this might mean that there are certain “high value” spawning areas that large numbers of Bowfin seek, areas that would be crucial for successful reproduction in any given year and relevant to future conservation of the species. 

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References

- Becker, G.C. 1983. Fishes of Wisconsin. University of Wisconsin Press. 1052 pp.
- Davis, J.G. 2006. Reproductive biology, life history and population structure of a Bowfin *Amia calva* population in southeastern Louisiana. Nicholls State University. 93 pp.
- Koch, J.D., M.C. Quist, K.A. Hansen, and G.A. Jones. 2009. Population dynamics and potential management of Bowfin (*Amia calva*) in the upper Mississippi River. *Journal of Applied Ichthyology* 25: 545 – 550.
- Page, L.M., and B.M. Burr. 2011. Peterson Field Guide to Freshwater Fishes of North America North of Mexico. Houghton Mifflin Harcourt. 663 pp.

Brothers, Collin and Clinton Nienhaus are from Winnebago, MN. Both attend Saint Mary's University in Winona, MN, where they are majoring in Environmental Biology. Clinton is conducting research for his undergraduate thesis on population dynamics and genetics of buffalo (Ictiobus spp.). Collin is tentatively planning to research the life history of Black Redhorse (Moxostoma duquesnei). Both authors enjoy fishing, sampling and observing native fishes, and birding.