

Surveys of Sugar River Sloughs

River Planning Grant Study



UPPER SUGAR RIVER WATERSHED ASSOCIATION
(USRWA)

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Summary

As part of River Planning Grant Study, 28 floodplain habitat sites were sampled along the middle and lower Sugar River in 2009 and 2010. Information collected during the surveys included water chemistry, water transparency, nearshore fish species, and aquatic vegetation. Twenty-seven fish species were identified within the Green and Rock counties section of the Sugar River floodplain. Key findings of the project include:

1. The State Endangered starhead topminnow (*Fundulus dispar*) was found in numerous locations in the Rock County portion of the Sugar River in 2010 and it was previously thought to be extinct from the watershed. None were found in 2009.
2. The invasive mosquitofish (*Gambusia affinis*) was collected in a Green County slough just above Hwy F in 2009-10.
3. Less turbid water was found in oxbows that lacked permanent connections to the river. Aquatic vegetation was more abundant in these waterbodies and common carp were not present.
4. Habitat loss was common in most sloughs due to sedimentation. Common carp and forest canopy shading reduced aquatic plant habitats in river connected sloughs.
5. State Endangered starhead topminnows, blackstripe topminnows and American grass pickerel were not found above the Albany dam; one of two fish migration barriers in Green County.

Change can be considered a constant within the sloughs as river stages alter habitat conditions. The flooding that occurred in 2010 demonstrated how floodplain habitats can drastically change (Figure 4). The State Endangered starhead topminnow was not found in 2009, but in 2010 flooding may have expanded habitats for this *Fundulus* species that has potential for multiple spawning. The backwater fish populations appear to be adapted to periodic environmental stressors, but additional stressors such as groundwater contamination, sedimentation - loss of oxbow storage capacity and polluted runoff can threaten the environmentally sensitive ecosystems. The study demonstrated off-channel habitats are environmentally sensitive but vital for sustaining ecological diversity along the Sugar River.

Recommendations

1. The Green County and Rock County segment of the Sugar River needs conservation partners to advocate for the protection and restoration of this important resource.
2. Sugar River partners should consider management options that are needed to protect the environmentally sensitive oxbows and sloughs.
3. Establishing or expanding existing buffer zones could benefit floodplain habitats that are vulnerable to upland groundwater contamination and runoff pollution.
4. The Dane and Green counties section of the Sugar River is currently classified Exceptional Resource Water (ERW). However, given that the Rock County portion sustains the highest biodiversity, the ERW classification for the Sugar River should be amended to include the Rock County portion as originally intended.
5. Conservation easements may be useful in areas where nutrient management problems can be linked to high nitrate levels in groundwater.
6. This study certainly doesn't finalize floodplain lake research or provide a complete dataset. Additional monitoring should focus on the status of rare fish such as the State Endangered starhead topminnow and invasive non-native mosquitofish. Additional surveys are needed to determine the status of starhead topminnows, blackstripe topminnows and American grass pickerels above the Brodhead dam.
7. Consider restoring oxbows for the State Endangered starhead topminnow and associated slough species within Avon Bottoms to reverse the long term trends of habitat loss due to sedimentation and common carp.
8. Consider removing obstacles to fish migrations.
9. Avoid channel modifications that may alter natural fluvial processes such as armoring.

Introduction

While most glacial lakes and impoundments in southern Wisconsin have been the focus of lake monitoring, planning and management, another entire class of surface waters has been largely ignored. Scores of oxbows and other floodplain habitats are essential for aquatic communities that live within transitional zones linking the Sugar River to the surrounding watershed. The relatively high diversity of fish species in the Sugar River reflects the connections of riverine and off-channel habitats.

Prior to this project, information on Sugar River oxbows and sloughs was limited to a brief description of these waterbodies (as waterfowl habitats) in "Surface Water Resources of Green County" (1980). In that publication, there is no discussion of floodplain habitat functions for nongame fish species diversity or rare starhead topminnows. The general lack of information on sloughs has been standard for rivers across the state.

In response to the dearth of information on these ecologically important oxbows, the USRWA applied for and received a River Planning Grant to collect information that is needed to better understand these unique ecosystems and develop management recommendations. The surveys were designed to collect the following information: water chemical parameters, nearshore fish populations and aquatic plants and other habitat features that may affect off-channel fish populations and aquatic communities.

Methods

A Garmin 76 was used to log all sampling locations. A YSI Model 52 meter was used to measure dissolved oxygen and temperature. A YSI Model 63 meter was used to measure pH and specific conductivity. Calibration of the instruments followed manufacturer recommendations including the 2 point calibration for pH. Back-up systems for pH included a LaMotte meter and ExStik conductivity probe. The water quality sampling was performed during the 2009 and 2010 open water season. Secchi transparency tube (120 cm) measurements replaced standard secchi since the sloughs were very shallow. Aquatic plant species and other habitat features were noted for each site. Photographs routinely captured aquatic plant and shoreline habitat conditions at each site. Habitat conditions were estimated by assigning Low = 1, Medium = 2 and High = 3.

Nearshore fish population sampling included small mesh dipnetting, small mesh seining and towed DC electro-shocker. The combination of sampling gear was needed to effectively sample the different niches and behaviors of diverse fish populations. All specimens were immediately released after field identification and enumeration except where immature specimens required further review. The fish surveys were designed to sample populations of nongame species and juvenile stages of sportfish. The surveys were indicators of ecological diversity and distribution of fishes that inhabit nearshore areas. This type of survey did not evaluate the growth rates, size structures or densities of sport fish populations.

Findings

Twenty-eight Sugar River floodplain habitats (36 samples – 20 in Rock County and 16 in Green County) were surveyed in 2009-10. The fish species are listed in Table 1. The north end of the survey area encompassed a small Green County slough located near Dayton, along Highway 92 (42 degrees 49.653'), and extended downstream to about two river miles above the Illinois State Line (42 degrees 31.228'). Figure 1 displays the distribution map of key backwater fish species. Since the sampling gears select for different niches, the results are presented separately to include the dominant species collected with seines and electro-shockers (Figure 2) and dip netting surveys (Figure 3). The American grass pickerel, blackstripe topminnow and starhead topminnow were only found below the Brodhead dam. None of these species were found above the Albany dam. The dams likely restrict the distributions of these species but additional sampling is needed above the Brodhead dam for confirmation.

The water was typically turbid in connected sloughs but dense weedy aquatic plant growths (usually coontail, Elodea and small duckweed) were abundant in unconnected sloughs where the water clarity was better. The lowest dissolved oxygen level was measured in an unconnected slough with dense aquatic vegetation. The daytime dissolved oxygen level was only 3.9 mg/l. All other dissolved oxygen measurements were above minimum criterion level of 5 mg/l for warm water habitat (NR 102). At another unconnected slough, daytime dissolved oxygen was influenced by filamentous algae and rooted plants and supersaturated levels exceeded instrument detection (> 20 mg/l). Specific conductance and pH levels reflected typical hardwater alkaline conditions for southern Wisconsin. The invasive mosquitofish was found at a single location in 2009 and 2010 and threatens native fish populations.

Overall habitat conditions were estimated as unfavorable for fish populations above the Albany dam or below the Brodhead dam. The poor habitat conditions reflected lack of aquatic vegetation and/or very shallow water depths due to sedimentation. At an unnamed slough (WBIC 5579900) sediment had essentially filled the entire oxbow and it was dry in 2009. Woody debris provided habitat in some areas. Above the Albany dam the mean habitat value was 1.33 and below Brodhead the mean value was 1.29.

Table 1: Summary of 2009-10 Sugar River Slough Fish Collection – all gear

Common name	Scientific name	2009	2010	Total
Central mudminnow	<i>Umbra limi</i>	3	7	10
American grass pickerel	<i>Esox americanus</i>	2	5	7
Northern pike	<i>Esox lucius</i>	2	1	3
Golden shiner	<i>Notemigonus crysoleucas</i>	1	5	6
Common carp	<i>Cyprinus carpio</i>	1	2*	3
Spotfin shiner	<i>Cyprinella spiloptera</i>	1	1	2
Bluntnose minnow	<i>Pimephales notatus</i>	2	5	7
Fathead minnow	<i>Pimephales promelas</i>	1	1	2
White sucker	<i>Catostomus commersoni</i>	0	1	1
Golden redhorse	<i>Moxostoma erythrurum</i>	1	0	1
yoy Buffalo	<i>Ictiobus</i>	0	1	1
Yellow bullhead	<i>Ameiurus natalis</i>	1	1	2
Black bullhead	<i>Ameiurus melas</i>	0	2	2
Starhead topminnow	<i>Fundulus dispar</i>	0	9	9
Blackstripe topminnow	<i>Fundulus notatus</i>	2	11	13
Mosquitofish	<i>Gambusia affinis</i>	1	1	2
Brook silverside	<i>Labidesthes sicculus</i>	0	2	2
Brook stickleback	<i>Culaea inconstans</i>	0	2	2
Green sunfish	<i>Lepomis cyanellus</i>	4	5	9
Bluegill	<i>Lepomis macrochirus</i>	2	6	8
Orangespotted sunfish	<i>Lepomis humilis</i>	2	0	2
Pumpkinseed sunfish	<i>Lepomis gibbosus</i>	0	1	1
Largemouth bass	<i>Micropterus salmoides</i>	1	2	3
Black crappie	<i>Pomoxis nigromaculatus</i>	3	0	3
Johnny darter	<i>Etheostoma nigrum</i>	3	3	6
Iowa darter	<i>Etheostoma exile</i>	1	1	2
Blackside darter	<i>Percina maculata</i>	3	0	3

*One juvenile

Figure 1: Distribution map of starhead topminnow, blackstripe topminnow and American grass pickerel that were only found below the Brodhead dam.

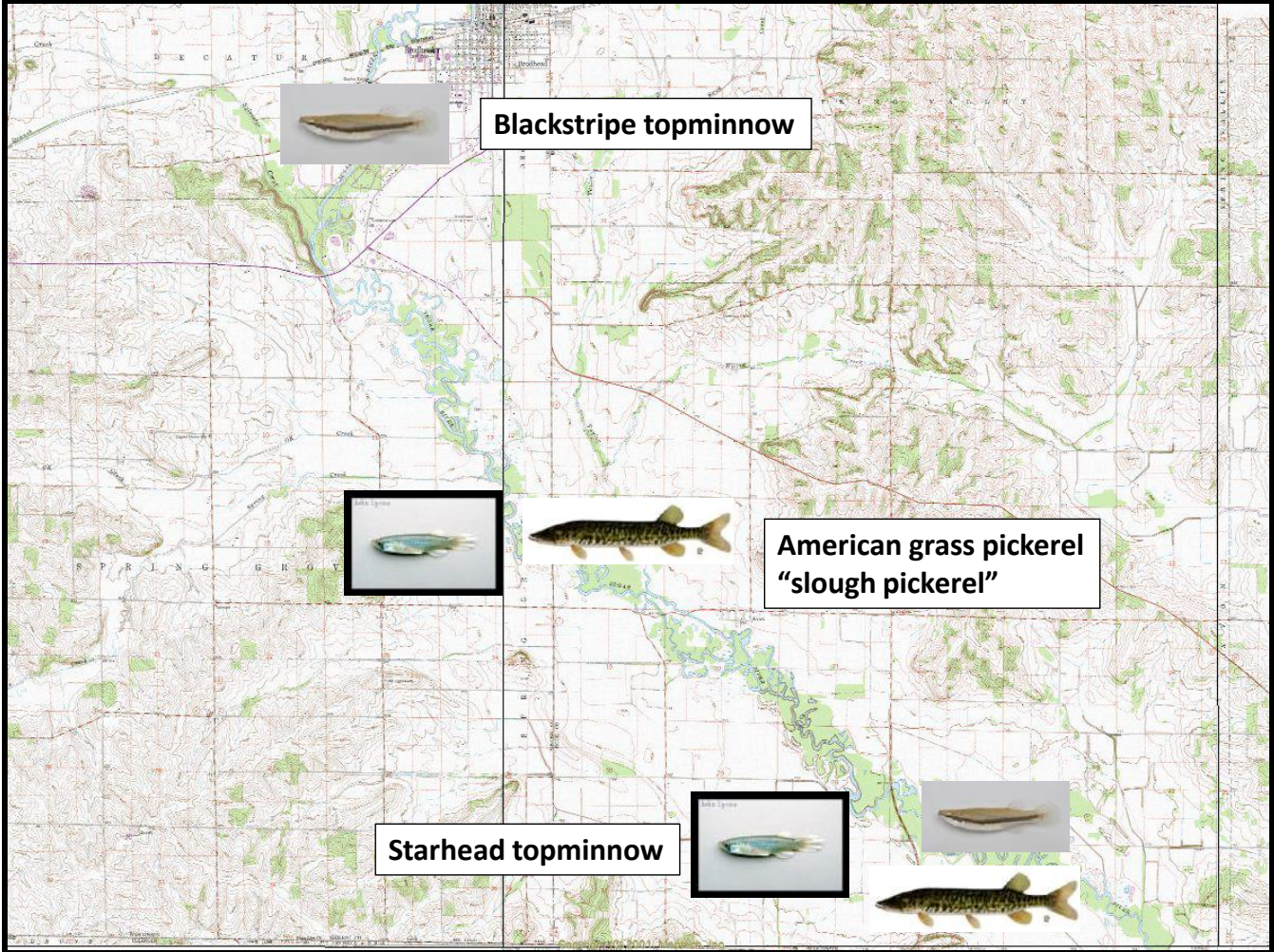


Figure 2: Dominant species collected with small mesh seines and electroshocking

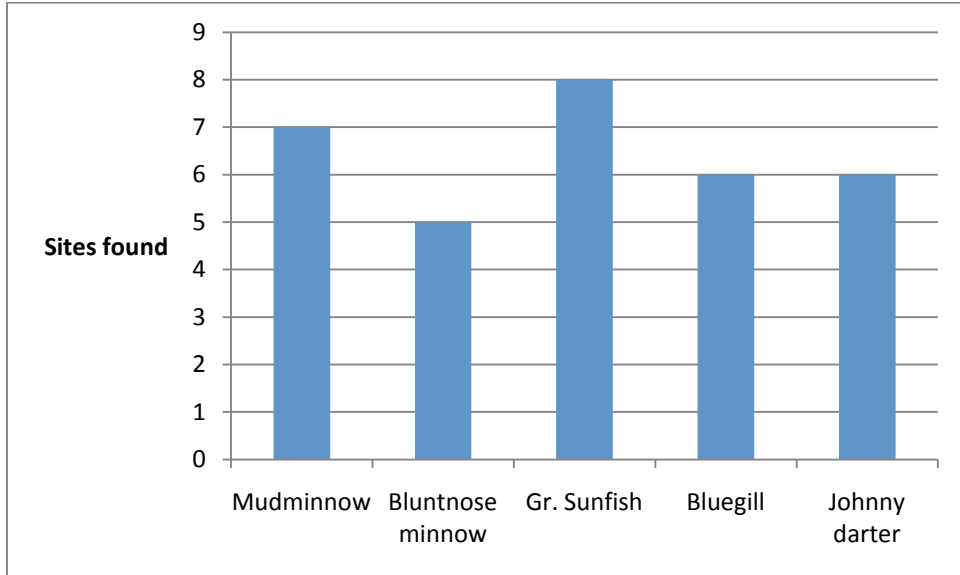
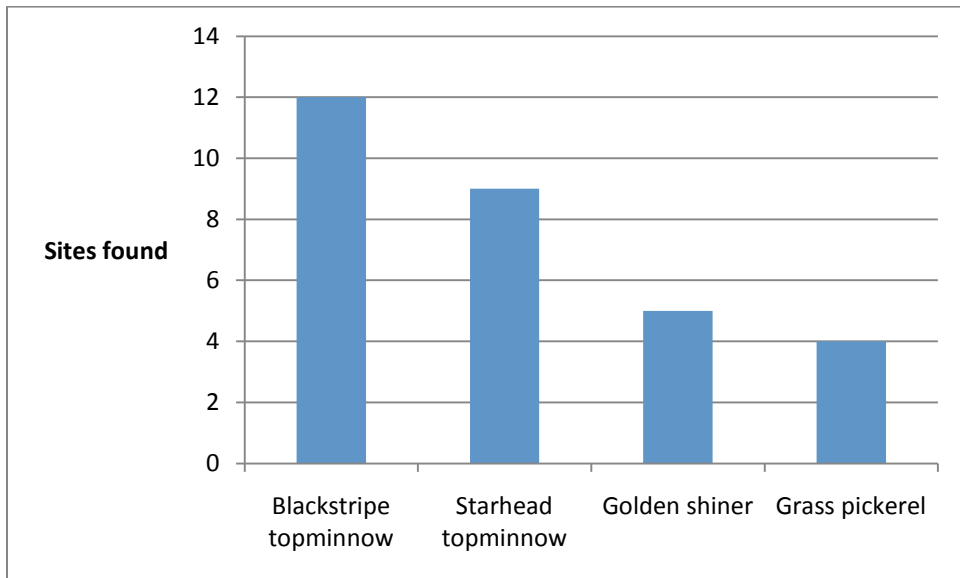
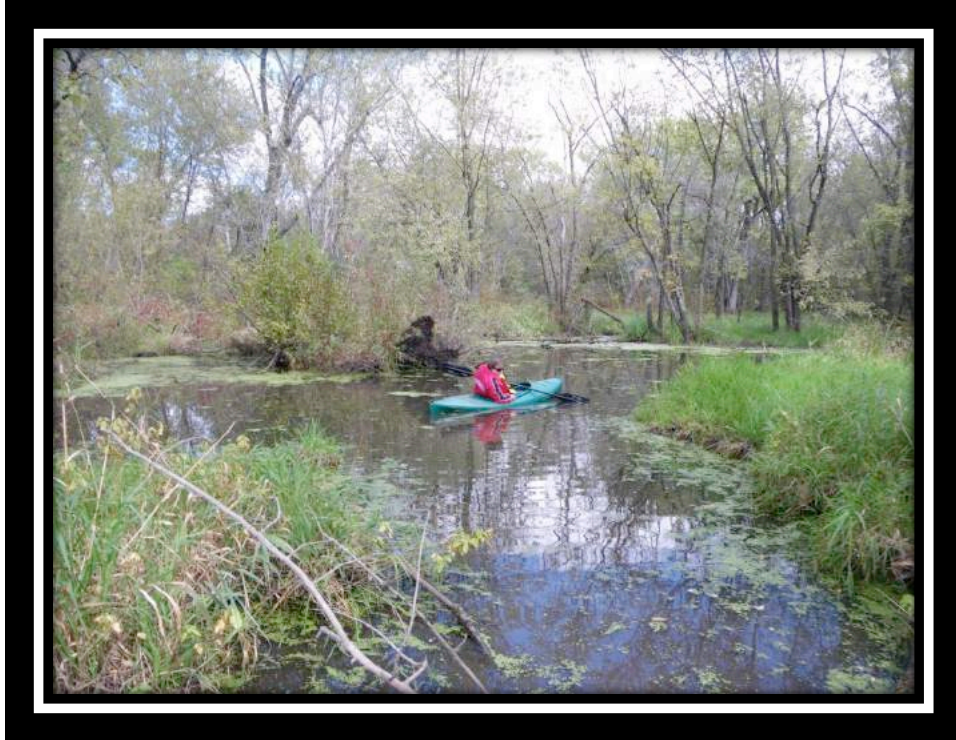


Figure 3: Dominant species collected with small mesh dip nets





Lisa Keen investigates a small slough north of Albany.



Next to the Sugar River bike trail, the USRWA “slough pirates” investigated a Green County slough during a September 2010 paddling event near Albany.



Shallow water and common carp disturbances limit habitat within an Avon Bottoms oxbow.



Amphibians such as this Central newt are often observed in the same floodplain habitats with off-channel fish populations. The newt was collected from a small isolated slough near CTH T in Rock County.



The invasive mosquitofish is a threat to native topminnow species and floodplain slough habitats.

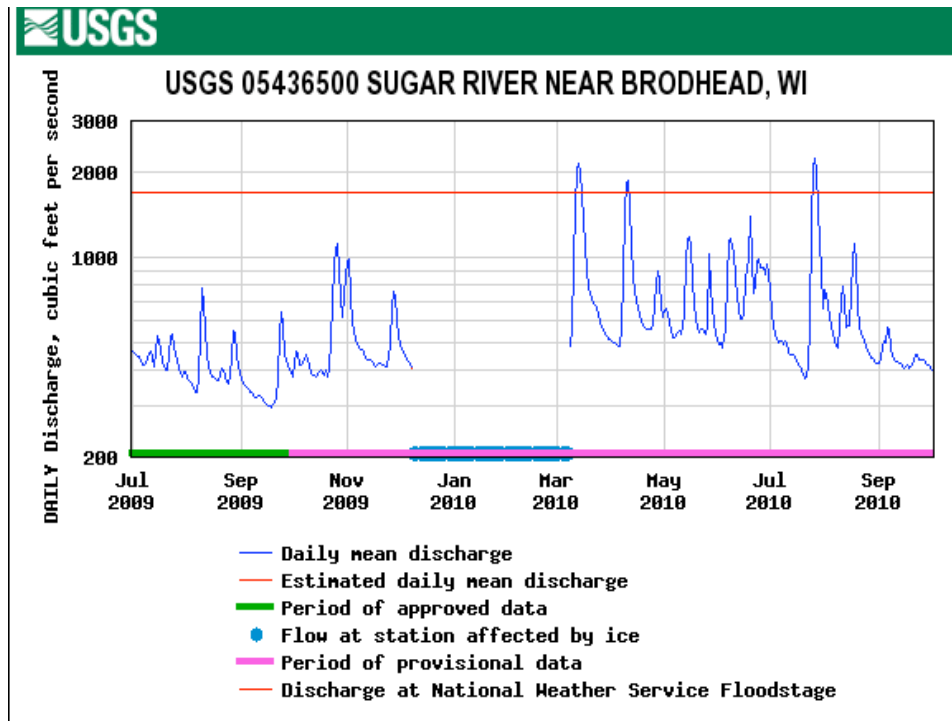
Discussion

The Sugar River is a predominantly a sinuous single threat channel and the floodplain holds numerous meandered oxbow lakes. The floodplain lakes and sloughs significantly enhance the biodiversity of the river. Some of the floodplain connectivity appears to be reduced as the river had become more incised and oxbows had filled with sediment. In natural meandering rivers, oxbows are formed with deep outer banks and shallow inner banks. Restoring depth to the outer banks could ultimately restore groundwater connectivity (Amoros 2001, Amoros and Bornette 2002). The status of the State Endangered starhead topminnow in the Sugar River could be improved by restoring habitats in oxbows. Starhead topminnows and associated off-channel fish populations share a strong affinity for aquatic vegetation and groundwater flow. Selective excavation may be needed to restore groundwater connectivity in oxbows with aquatic vegetation but lack sustainable water quality. In other sloughs, habitat restorations would involve both outer bank excavation and carp removal to establish aquatic vegetation. In connected sloughs close to the main channel, aquatic vegetation was typically very scarce. Restoration of these habitats may involve selective tree drops to increase light for aquatic plant photosynthesis while increasing coarse woody debris. Carp exclosures may be needed to protect the aquatic plants as well. Once aquatic vegetation is established in oxbows, along with favorable water quality linked to groundwater connections, a positive feedback may reduce future common carp problems. Common carp reproduction is rarely found in Lower Wisconsin State Riverway floodplain lakes and sloughs that hold clear water, abundant aquatic plants and scores of predators including panfish, largemouth bass, American grass pickerel and northern pike. The clear weedy sloughs also provide optimum habitat for the starhead topminnow

(Marshall 2009). Alternatively, common carp reproduction within the Albany millpond appeared to be widespread. Habitat destruction and high turbidity was evident throughout the millpond. The Sugar River millponds are likely common carp recruitment zones that affect the entire river.

Starhead topminnows were not found in 2009 when river flows were relatively normal (Figure 4). Our inability to locate starhead topminnow populations in 2009 appeared to reinforce concerns that the species was extirpated from the watershed. The rare fish had not been found in the Sugar River watershed for decades (Lyons et al. 2000). However, in early September of 2010 we found a few juveniles at the southern end of the surveys. A week later we found more individuals upstream including some adults. The next week we found hundreds of individuals in a few partly connected oxbows. We also collected more blackstripe topminnows as well. The flooding in 2010 likely expanded floodplain habitats for both the starhead topminnows and blackstripe topminnows. In typical years with lower flow rates, some of these habitats are likely dry. *Fundulus* species have demonstrated a multiple spawning strategies (Taylor and Burr 1997). The high water in 2010 likely allowed the topminnow species access to new spawning habitats that don't exist under more typical river conditions. Multiple spawning within expanded habitats may explain the relative high numbers in 2010 compared to other years when the starhead topminnows were undetected, probably due to very low numbers. Selective habitat restorations may provide stable spawning and over-winter sites for the rare fish and other off-channel species. Restoration efforts should also focus on expanding riparian buffers since both polluted runoff and contaminated groundwater can threaten floodplain habitats. Camargo et al. (2005) demonstrated that high nitrate levels threaten fish, aquatic insects and crustaceans with similar physiological effects that threaten human infants. The authors recommended a nitrate standard of 2 mg/l for surface waters.

Figure 4: 2009-10 Sugar River flow trends at Brodhead



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Appendix A:

Waterbody	WBIC	County	Date	Trans Tube	D.O. mg/l	Temp C	pH su	Sp Cond
Un slough	875300	Green	9/11/2009	120	8.7	13.1	8	563
Un slough	5579900	Green	9/11/2009					
Un slough	875300	Green	9/11/2009	47	8	20		
Un slough	none	Green	5/4/2010	52	>20	23.5	8.8	631
Un slough	875300	Green	9/26/2010	66	6.2	14		580

Un slough	875300	Green	9/26/2010		6.1	14		590
Un slough	875300	Green	9/26/2010		12	16.5		512
Sugar R	875300	Rock	7/17/2009	35	7.4	19.8		595
Un. Slough	none	Rock	7/17/2009	120	3.9	18.1		426
Un. Slough	5580634	Rock	7/17/2009	70	15.1	20.9		471
Un. Slough	5580582	Rock	7/17/2009	105	13.1	21		327
un. Ditch	none	Rock	8/25/2010		8	27.3	7.77	473
un. Trib	none	Rock	8/25/2010	57	7	25.5	7.51	378
Sugar R	875300	Rock	8/25/2010	53	8.5	25.5	7.98	633
Sugar R	875300	Rock	9/13/2010					
Sugar R	875300	Rock	9/13/2010	36	8.4	18.6	8.3	649
Sugar R	875300	Rock	9/13/2010					
Taylor Cr	876300	Rock	9/13/2010	96	10.2	16.7	8.25	605
Sugar R	875300	Rock	9/13/2010	73	9	19.6		
Sugar R	875300	Rock	9/13/2010					
Sugar R	875300	Rock	9/13/2010	22	7.3	20.8		
Un. Slough	5580634	Rock	9/17/2010		3.2	17.3		
Un. Slough	none	Rock	9/17/2010		8.6	19.5		