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Distribution and Status of the State-Endangered Redspotted Sunfish *Lepomis miniatus* in Illinois

[1*]Jeremy S. Tiemann, [2]Trent Thomas, [1]John Epifanio
[1]Illinois Natural History Survey, Prairie Research Institute at the University of Illinois, 1816 South Oak Street, Champaign, IL 61820
[2]Illinois Department of Natural Resources, Division of Fisheries, 301 South Date Street, Gibson City, IL 60936
[*]Correspondence: jtiemann@illinois.edu

ABSTRACT

The Redspotted Sunfish (*Lepomis miniatus*) occurs in clear, low gradient, well-vegetated streams and backwater lakes. Although never abundant in Illinois, the distribution of *L. miniatus* has been reduced in the state due to habitat destruction. From 2004-2007, we sampled historical locations to determine the distribution, status, and habitat preferences of *L. miniatus*. We found the sunfish at seven of 27 sites sampled, and all of these sites had aquatic vegetation or physical structure present. Most of the historical sites where we failed to find *L. miniatus* did not have aquatic vegetation or large accumulations of woody debris. Because of its rarity and occurrence in low abundances, we recommended to the Illinois Endangered Species Protection Board that the Redspotted Sunfish be changed from state-threatened to state-endangered; this recommendation passed in 2009.

INTRODUCTION

The Redspottted Sunfish (*Lepomis miniatus*) is a moderate-sized (<170 mm SL) centrarchid that occurs in clear, low gradient, well-vegetated streams and backwater lakes from the Illinois River basin, Illinois, south through the Mississippi River Valley (e.g., Cumberland and Jacks Fork rivers) to the Gulf Slope (Warren, 1992). Within Illinois, it historically had a sporadic distribution that included bottomland lakes along the Illinois River, the LaRue-Pine Hills Ecological Area (Big Muddy River drainage), and backwater lakes and oxbows along the Wabash and Ohio rivers (Figure 1; Forbes and Ricahrdson, 1920; Smith, 1979; Burr et al., 1988). Jelks et al. (2008) did not include *L. miniatus* in their list of imperiled North American fishes, but within Illinois, Smith (1979) stated that, although never abundant in Illinois, the distribution of *L. miniatus* (as *Lepomis punctatus*) had been reduced in the state due to habitat destruction (e.g., oil pollution and drainage of backwater lakes). As a result of this reduction, the Redspotted Sunfish was listed as state-threatened in 1989 (IL ADM CODE Ad Rule, 1989). The overarching goal of our project was to re-establish viable populations of *L. miniatus* within its historic range in central Illinois. To accomplish this goal, we established three objectives: 1) determine the current distribution and status of *L. miniatus* in Illinois, 2) examine the genetic diversity of the sunfish in Illinois and surrounding states, and 3) establish a broodstock source that a) maximizes within-population genetic variation of each of the brood sources while in captivity and minimizes the risk to the source populations from any unintended "brood mining" effects, and b) then propagate and release *L. miniatus* into historical and suitable habitats in Illinois. In this paper, we address the first objective and report the results of the current distribution and status of *L. miniatus* in Illinois as a precursor to reintroduction efforts. Additional papers on the other two objectives will be forthcoming.

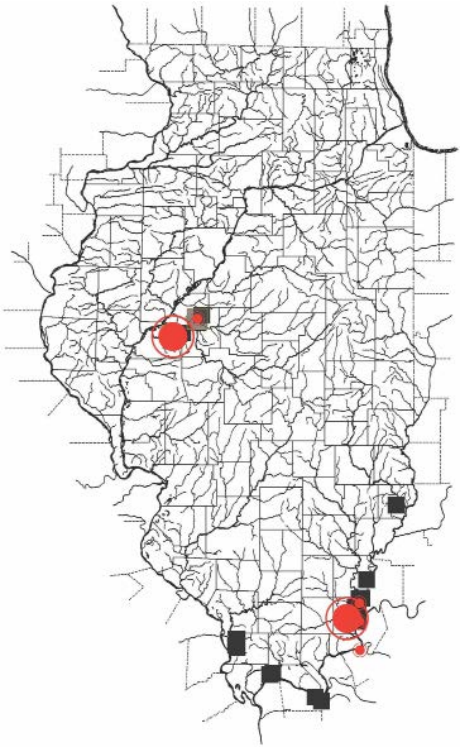

Figure 1. Distribution of the Redspotted Sunfish in Illinois based upon our 2004-2007 surveys. Gray squares are historical areas that did not yield any individuals and red circles are areas were individuals were collected. The larger two circles are the areas that we feel had self-sustaining populations.

METHODOLOGY

Twenty-seven sites were sampled from 2004-2007 (Table 1). These locations were established based on historical records for *L. miniatus*, with data being obtained from the literature (e.g., Smith, 1979; Burr et al. 1988); the Illinois Natural Heritage Database, Springfield; the Illinois Department of Natural Resources' (IDNR) Fisheries Analysis System, Springfield; and the fish collections at the Illinois Natural History Survey (INHS), Champaign, and Southern Illinois University, Carbondale. The Mississippi and Iroquois river locations listed in Smith (1979) were not sampled because exact locations could not be determined and these populations were presumed extirpated (Smith, 1979). Some sites listed by Burr et al. (1988) were not sampled because land-owner permission could not be obtained (e.g., Long Reach, Pulaski County, and Black Lake, Gallatin County). Also, the Illinois River was not sampled during our survey. The INHS, as part of its Long Term River Monitoring Program, has extensively sampled this river. Biologists have yet to find *L. miniatus* or record any large tracts of aquatic vegetation in the river (M. O'hara, INHS/IDNR, pers. comm). In addition, Spring and Sunset lakes, both backwater lakes of the Illinois River in Tazewell County, are historical locations (pre-1970)

Table 1. Results of the 2004-2007 Redspotted Sunfish surveys. Sub-basin locations were based on historical records. Site specific data are not given due to the rarity of the endangered sunfish. "# indiv" is the number of individuals collected within the sub-basin. "Habitat" is physical structure, if any, present at the site and includes aquatic vegetation (V), woody debris (W), rip-rap (R), and open water or no structure present (-). One site (Goose Pond) was drained and no water present.

Sub-basin	County	# indiv	Habitat
Central Ditch (Sangamon River basin)	Mason	0	V
Crane Creek (Sangamon River basin)	Mason	5	V
Angelo Lake (Sangamon River basin)	Mason	0	-
Long Branch Jordan Creek (Sangamon River basin)	Mason	0	V
Fish Lake (Sangamon River basin)	Mason	0	-
Fish Creek (Sangamon River basin)	Mason	12	V
Wolf Lake (Sangamon River basin)	Mason	0	-
Winters Pond (Clear Creek basin)	Union	0	V
Wolf Lake (Clear Creek basin)	Union	0	V
Running Lake Ditch (Clear Creek basin)	Union	0	V
Long Reach (Cache River basin)	Pulaski	0	-
Cypress Pond (Cache River basin)	Pulaski	0	-
Beaver Dam Lake (Ohio River basin)	Massac	0	-
Loon Lake (Ohio River basin)	Massac	0	-
Haney Creek (Ohio River basin)	Hardin	1	W
Big Lake (Ohio River basin)	Gallatin	0	-
Fish Lake (Ohio River basin)	Gallatin	2	V
Unnamed Wetland (Ohio River basin)	Gallatin	1	W
Hulda Lake (Ohio River basin)	Gallatin	0	-
Beaver Pond (Wabash River basin)	Gallatin	5	R
Yellowbank Slough (Wabash River basin)	Gallatin	0	-
Goose Pond (Wabash River basin)	Gallatin	0	Drained
Cypress Ditch (Saline River basin)	Gallatin	8	V
Old channel of the Wabash River	White	0	-
Upper Sandy Slough (Wabash River basin)	White	0	-
Brushy Slough (Wabash River basin)	White	0	-
Indian Creek (Embarras River basin)	Lawrence	0	-

for *L. miniatus* and are routinely sampled by the IDNR. Biologists have yet to collect the sunfish there (W. Herndon, IDNR, pers. comm).

Stream sites typically were <10 meters in width and were surveyed for a minimum of 100 meters in a single pass using one DC backpack electrofisher. Backwater lakes varied in size but typically were <25 hectares and were surveyed with a 3-phase AC electrofishing boat either to completion of 100% shoreline coverage or for one hour, whichever occurred first. The Winters Pond and Wolf Lake areas in Union County were difficult to sample. Navigating through these areas proved to be extremely difficult due to the high concentrations of aquatic vegetation and electrofishing efficiency appeared to be low likely due to the high conductivity of the tannin-stained water. As a result, a subsequent one-night survey with four mini-fyke nets was conducted. All sampling occurred in late spring – early summer when spring floods receded and water temperatures were >20° C.

Redspotted Sunfish collected were enumerated, partial caudal fin-clipped for tissue sample, and either photographed or vouchered for proof of identification; vouchered fish reside in the I NHS Fish Collection. In addition to the fish survey, physical habitat descriptors were recorded at each site. Habitat was scored as a "1" if vegetation, rock (e.g., rip-rap), or woody-debris was present, or as a "0" if the site was open water (e.g., no physical habitat). Pearson's correlation coefficient was calculated to examine potential relationships between the presence of physical habitat (e.g., aquatic vegetation / woody debris) and *L. miniatus* abundance (Zar 1999).

RESULTS

A total of 34 Redspotted Sunfish were collected in seven of the 27 sub-basins (Table 1). Of the sites where the sunfish was collected, four had aquatic vegetation, two had woody debris piles, and one contained rip-rap (Table 1). Five sites where we failed to collect *L. miniatus* had vegetation and another 14 sites lacked vegetation or physical structure. One of the historical sites, Goose Pond in Gallatin County, was drained and contained no water. Pearson's correlation showed that *L. miniatus* abundance was positively correlated with physical habitat ($r = 0.45$; $P = 0.02$).

DISCUSSION

Our data suggest that only two stable populations of *L. miniatus* remain in Illinois (Table 1; Figure 1): lower Sangamon River drainage (e.g., Fish Creek and Crane Creek) and Cypress Ditch (Saline River drainage). Both of these areas had the highest abundances (>5 individuals/hour). A third smaller (<5 individuals/hour) and patchily distributed population exists along the backwater lakes near the confluence of the Wabash and Ohio rivers, Gallatin County (Table 1). We failed to capture *L. miniatus* at the Cache River site reported by Burr et al. (1988) nor did we collect the fish in the Clear Creek basin (Table 1). We did find isolated populations in the lower Wabash River drainage in Indiana, including the River Deshee, Knox County, and Barren Ditch of the Patoka River basin, Pike County (J.S. Tiemann and T. Thomas unpublished. data), and the sunfish was captured from Bayou Creek near Paducah, McCracken County, Kentucky, in 2004 (M. Thomas, Kentucky Department of Fish and Wildlife, pers. comm.). It was because of these findings, we recommended to the Illinois Endangered Species Protection Board that the Redspotted Sunfish be changed from state-threatened to state-endangered; this change occurred in 2009 (IESPB 2010).

Potential threats. The majority of the areas where *L. miniatus* was collected in low numbers or not at all contained little or no aquatic vegetation. Because of its close association with aquatic vegetation, threats to the Redspotted Sunfish are the same as other vegetation-dependent fishes. The state-threatened northern Starhead Topminnow (*Fundulus dispar*), which is found within similar habitats (e.g., clear, well-vegetated floodplain lakes) and has a similar distribution in Illinois as *L. miniatus* (Smith, 1979), has experienced a drastic range reduction due to stream channelization, drainage of wetlands, and oil pollution (Smith, 1979; Taylor et al., 1994). Page and Retzer (2002) listed removal of native

submerged vegetation, introductions of non-native species and stocking of predators such as Largemouth Bass (*Micropterus salmoides*) as factors responsible for the range reduction of the state-endangered Blacknose Shiner (*Notropis heterolepis*) and the state-endangered Weed Shiner (*Notropis texanus*), both of which are vegetation-dependent cyprinids (Smith, 1979). Smith (1971) listed siltation as another cause for the disappearance of aquatic vegetation, and stated that the Sangamon and Saline river systems are affected by dredging and industrial (e.g., oil-field and coal mine wastes), domestic, and agricultural pollution. Locations where we failed to collect *L. minatus* had no aquatic vegetation and often had assemblages dominated by top-predators (e.g., *M. salmoides*). Some areas with no aquatic vegetation often had Grass Carp (*Ctenopharyngodon idella*) and Common Carp (*Cyprinus carpio*), both non-native species known to destroy aquatic vegetation (Laird and Page, 1996). We feel threats to *L. miniatus* include removal of aquatic vegetation, either by carps, siltation, or herbicide application, and stocking of predators (e.g., *M. salmoides*). Nyboer et al. (2006) suggested increasing protection of swamps, sloughs, and lake habitats to adequately protect *L. miniatus*. We agree with Nyboer et al. (2006), but would like to expand on their recommendation. Protection of aquatic vegetation and controlled presence of top-predators is key to the recovery and continued existence of the Redspotted Sunfish. Specifically, areas should be protected from pollution (e.g., herbicides), siltation, non-native species (e.g., Grass Carp and Common Carp), and sport fish introductions (e.g., the stocking of Largemouth Bass).

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