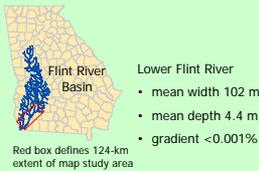


Assessing Shoal Bass Habitat Use in the Lower Flint River from Low-cost Side Scan Sonar and Electrofishing Data

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Shoals are Important, Complex Habitats

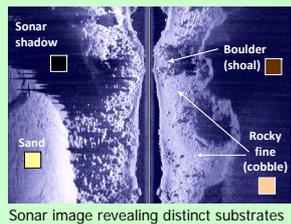
- Shoals (i.e., shallow, boulder-strewn areas with swift currents) are areas of high biological diversity and productivity, used by shoal bass and other endemic species in the Flint River (e.g., Alabama shad, Gulf sturgeon)
- Shoal habitat quality likely differs on a variety of characteristics and scales, but an assessment of such characteristics at the landscape scale (i.e., throughout the river) is unfeasible using traditional approaches
- Adult shoal bass are difficult to sample, but appear to migrate long distances to specific shoals where they form spawning aggregations. Narrowing the search for spawning sites by identifying key spawning site characteristics may improve our ability to collect and tag adult shoal bass for research and management investigations.



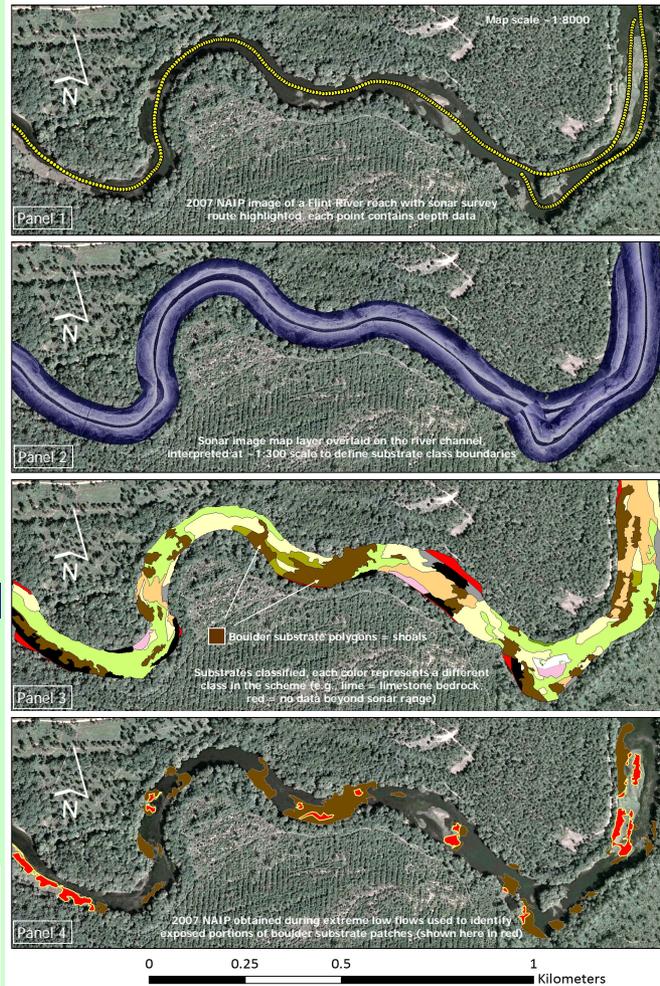
- OBJECTIVES:** 1) map and characterize shoal habitat throughout the lower Flint River using our low-cost, sonar habitat mapping approach
2) identify shoal characteristics associated with spawning site selection
3) use this information to screen and identify other potential spawning locations

Mapping Habitat Throughout the River

- Sonar survey conducted April 2008 during high water (Panel 1, Image 1)
- Sonar data geoprocessed using our tools to create sonar image map layers in ArcGIS 9.x (Panel 2)
- Major substrate classes digitized, classified, and accuracy assessed (Panel 3, Image 2)
- Aerial imagery from summer 2007 used to classify portions of boulder (i.e., shoal) substrate as exposed during low flows (Panel 4, Image 3)

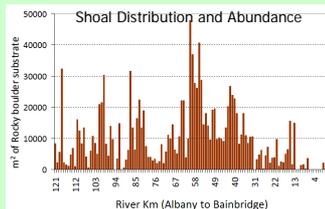


Evolution of the Lower Flint River Habitat Map



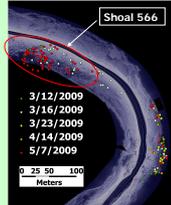
Map Results

- 124 km river map produced by summer intern
- 607 shoals (boulder polygons) represented in map, with several areas of high concentration (e.g., km 35-60, see adjacent figure)
- Classification accuracy for boulder was very high (94%)
- 13.4% of boulder substrate exposed during extreme low flows



A Spawning Aggregation found at Shoal 566

- During spring 2009, a large group of adult shoal bass was located during electrofishing efforts aimed at capturing adult fish for a tag-return, exploitation study
- Subsequent sampling of the area revealed that these fish moved between a deep, outside bend of the river (a staging area), and a shoal located on the inside bend ~250 m upstream
- Observations in early May suggested that the group had moved from the staging area to the shoal site to spawn
- Why so many fish chose to spawn at this site, and how far they traveled to do so, are important questions



Extracting Characteristics from the Habitat Map

Patch Level Variables

- Size (area)
- Shape (perimeter)
- Edge:Area ratio
- Edge within 15 m buffer
- % Exposed
- Distance to nearest shoal (centroid-centroid)
- Size (area) of nearest shoal



Neighborhood Variables

- Mean, Min, Max, SD, Range of mid-channel depth
- Additional shoal area (Rb)
- Area of each additional substrate class present
- Total edge (heterogeneity)



Is Shoal 566 (a Spawning Site) Unique?

Principal Components Analysis (PCA)

Patch Variables

PC	Eigen-value	Cumulative % Variance
1	2.83	0.40
2	1.11	0.56
3	0.95	0.70

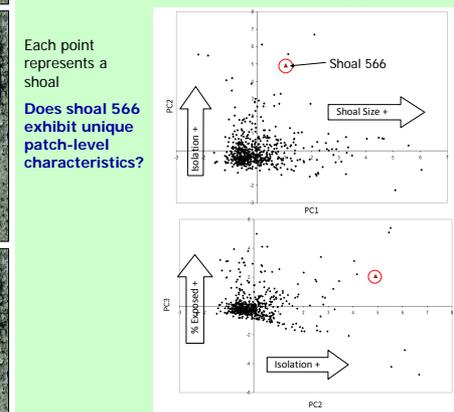
Variable	PC1	PC2	PC3
Length	0.93	-0.01	0.04
Area	0.93	0.04	0.01
Ratio	-0.62	-0.06	0.21
% expo	-0.35	-0.04	0.74
Edge	0.69	-0.28	-0.02
Dist near	0.29	0.73	-0.38
Area near	-0.10	0.70	0.45

PC1= Shoal Size Gradient

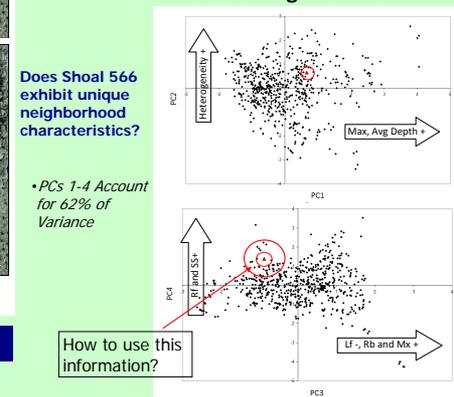
PC2= Isolation Gradient (with larger distant shoals)

PC3= % Exposed Gradient

PCA Plots - Patch Variables



PCA Plots - Neighborhood Variables



Will these associations help us locate additional spawning areas?

- Whether the distinct characteristics of shoal 566 and its neighborhood truly relate to spawning habitat selection or are merely coincidental requires further investigation
- Two sets of shoals (one set similar and another dissimilar to shoal 566) have been identified using PCA scores; these shoals will be sampled to determine if other spawning aggregations of shoal bass can be located
- Beyond shoal bass, the generated data set of shoal characteristics is available for future studies involving Alabama shad and Gulf sturgeon, two species that selectively spawn over coarse, rocky substrate

*For more information on low-cost, sonar habitat mapping contact Adam at adam.kaeser@dnr.state.ga.us