

# Inventory of Fishes in Ninety Six National Historic Site



*Submitted by*

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## ***Introduction***

South Carolina Department of Natural Resources Freshwater Fisheries staff inventoried freshwater fishes during 2005-2006 for the National Park Service in four Cumberland Piedmont Network parks in South Carolina and North Carolina. This document reports the findings from inventory activities at Ninety Six National Historic Site (NISI). The inventory comprised a series of tasks that were addressed, as applicable:

- (A) Identifying species richness (to a 90% level),
- (B) Describing the distribution of each species within a park,
- (C) Determining abundance (particularly of sensitive species),
- (D) Collecting voucher specimens for those species where none exist or where species is not readily identifiable by photograph (no collecting of sensitive species),
- (E) Recording habitat variables and mapping observation coordinates
- (F) Collecting and organizing data to be compatible with existing databases,
- (G) Conducting representative sampling of common habitats and comprehensive coverage of specialized habitats,
- (H) Identifying fish species that are non-native to a park,
- (I) Reviewing Existing NPS Database Records for accuracy.

The Ninety Six National Historic Site is located in western South Carolina near the town of Ninety Six (Southern Outer Piedmont ecoregion). The frontier village of Ninety Six was settled by Europeans in the mid-1700's, and was later the site of a key Revolutionary War battle. The park encompasses 989 acres, and its water resources are part of the Saluda River drainage (Santee River system). There is one large impoundment, Star Fort

Lake, a small pond (well on its way to filling in as a marsh area), and a number of small streams on the property.

### ***Methods***

I obtained topographic maps and aerial photos from National Park Service staff to identify terrain features and hydrologic systems. Sites were initially selected using the maps and photos; actual sampling sites were then visited to determine accessibility and appropriate sampling methods. Freshwater habitats present were classified as reservoir, pond, and stream systems. No substantial springs capable of supporting fishes were identified. Recommendations of National Park Service personnel were also considered in selecting sampling locations. In determining where to sample stream systems, I weighted effort toward larger streams and downstream reaches because it is known that fish diversity increases with stream size, and given that a primary goal of the inventory is to collect a large percentage of species present on the park unit. A Geographic Positioning System unit (Garmin model 76CS, error typically reported +/- 4 to 12 m depending on topography and canopy cover) was used to assign coordinates (decimal degrees using datum NAD83) to selected sampling sites.

Fishes in NISI were sampled in June and August of 2005. Fish sampling was conducted using two electrofishing techniques: backpack gear in wadeable stream and pond habitat, and boat-mounted gear in Star Fort Lake. Sampled stream lengths varied among sites, and were equivalent to at least 30 times the average stream width because this effort has been shown to approach an asymptote of species richness for stream fishes (Angermeier

& Smogor 1995). Each stream was sampled with one pass from downstream toward upstream, with thorough effort to collect all encountered fishes in all habitats. The little pond was waded with a backpack electrofisher along shore and in open water areas. Star Fort Lake was sampled with a complete shoreline circuit of boat electrofishing. All fish collected were identified to species, counted and released. Voucher specimens of some species were retained and stored in a 70% ethanol solution with remaining vouchers comprising digital photos. No species listed as threatened or endangered by state or federal agencies were collected.

Number of individuals of each species collected was recorded for each sample location. Species relative abundance was calculated, determined by dividing the total number of fish of each species by the total number of fish collected at the site. Sites were pooled to give abundance and relative abundance by species for the entire park. I also report state conservation status of species as well as whether species were native or introduced to the system.

To give some likelihood that my effort captured 90% of fish species present on the park, I calculated the Chao1 estimator of total species richness from the park-wide sample data. This nonparametric estimator is based on the concept that rare species carry the most information about the number of missing ones, and uses single- and double-occurring species to estimate the number of species missing (Chao 2004). The Chao1 estimates of expected richness with 95% confidence intervals were computed from my samples using

the EstimateS software (Colwell 2005) and estimates were compared to the richness I observed during the inventory.

I collected habitat variables at each stream site at the time of sampling according to SCDNR standard protocols. Geomorphic variables included average depth (m) and average wetted width (m, taken from water edge to water edge) of the reach, obtained by taking widths and depths at five cross-section transects along the length of the sample reach. Water quality measured at the time of fish collection included water temperature (°C), dissolved oxygen (mg/L), pH, conductivity (uS/cm), and turbidity (NTU).

## ***Results***

I sampled three streams (all tributaries of Ninety Six Creek), one small pond, and Star Fort Lake in Ninety Six National Historic Site during spring/summer of 2005 (Figure 1). For the purposes of this study, the sites were labeled as followed: Tolbert Branch, Spring Creek, Henley Creek, Little Pond, and Star Fort Lake. Dates of sampling, site coordinates, habitat and water quality measures taken at each site are presented in Table 1. Water quality was within normal limits at all stream sites, but dissolved oxygen was very low in the small pond, likely due to warm temperatures and benthic oxygen demand from decay of dense aquatic vegetation prevalent in the shallow pond.

I collected a total of 22 species from 5 families (Table 2), three species of which are listed in South Carolina's Comprehensive Wildlife Conservation Strategy as priority

conservation species (SCDNR 2005): rosyface chub, flat bullhead (both moderate priority), and Carolina darter (highest conservation priority). Three species I collected are exotic to the Saluda River drainage: green sunfish, redear sunfish, and channel catfish (Warren et al. 2000). Two additional species, rosyface chub and blackbanded darter, are at the periphery of their range in the Saluda drainage, and there is some uncertainty as to whether they are native (Warren et al. 2000). However, both are native to the adjacent Savannah River drainage and I do not consider them to be exotic or invasive. To obtain information on distribution, ecology, and conservation status of any of the species mentioned in this report (as of the date of this publication), NatureServe's website <http://www.natureserve.org/explorer/> could be searched by typing species names (common or scientific) into the search field.

The site with greatest species richness was Tolbert Branch with 17 species, followed by Henley Creek with 10 species (Table 3). Both of these streams harbored native species expected to be present in the outer piedmont region of the Saluda drainage, as well as exotic species commonly introduced to waters of the Atlantic slope. Tolbert Branch was particularly noteworthy not only for the high diversity but also abundance of the fauna for a stream its size (161 individuals; Table 4). The smallest stream, Spring Branch, contained only a single creek chub, a common headwater species. Spring Branch may well be ephemeral, with water present only part of the year. Creek chubs are considered 'pioneering' species due to their ability to migrate into headwater streams.

The standing-water habitats were less diverse than the running waters on the park. Seven species were found in Star Fort Lake, typically consisting of sunfish in the family Centrarchidae (particularly bass and bluegill), channel catfish, and a cyprinid common in lakes, golden shiner. This assemblage is consistent with the management of the lake for recreational fishing. Although more fish were collected in Star Fort Lake than any other site (168 individuals; Table 4), far more collecting effort was expended during the shoreline electrofishing compared to the stream sites, so fish densities were actually much lower in the lake. Little Pond was inhabited by high densities of mosquitofish, estimated at 75 individuals per square meter. Within a few years if left alone the pond is destined to become a wetland and extirpate the fish population altogether. No other species were encountered in Little Pond.

Relative abundance (defined as abundance by species divided by total catch) gives a measure of fish assemblage structure. Overall in the park, the most common species collected were bluegill and largemouth bass (Table 5), due to the fact that these two species were dominant in Star Fort Lake. Yellowfin shiner ranked third most abundant overall, as it dominated the assemblage in Tolbert Branch, followed by redbreast sunfish, mosquitofish, and rosyface chub. Tolbert Branch was characterized by a diverse mix of shiners and chubs in the cyprinid family, two species of darters (one of which is on the state's list of highest conservation concern), catfishes, sunfishes, and the live-bearing mosquitofish. Henley Creek was dominated by redbreast sunfish, followed by two darter species composing 22% of the assemblage. Similar to Tolbert Branch, Henley Cr. also supported rosyface chub, several members of the catfish and sunfish families, and

mosquitofish. But unlike its tributary Tolbert Branch, Henley Creek was devoid of both yellowfin shiner and bluehead chub, a fairly uncommon condition for streams of this ecoregion as both species are widespread.

The occurrence of several species of state conservation concern in the park is noteworthy, as the three species listed as moderate or highest priority (SCDNR 2005) made up 17% and 20% of the fish assemblage, respectively, in Tolbert Branch and Henley Creek (Table 5). Rosyface chub and Carolina darter are endemic to the southern Atlantic Slope, with distributions limited to the Roanoke, Santee, and Pee Dee River drainages of South Carolina, North Carolina, and Virginia (Rohde et al. 1996). In particular, Carolina darter is an extremely range-restricted and uncommon species, with the Saluda drainage populations being disjunct from populations to the east and north. Both of these species face similar threats across their range: impacts from land development, deforestation, loss of riparian cover, siltation, and hydrologic alterations (channelization and impoundment construction). Flat bullheads are more widespread and common in the state, but face threats in South Carolina from the introduced piscivore, flathead catfish *Pylodictis olivaris* (SCDNR 2005).

I assessed my inventory effort within the park by comparing the inventoried species number, targeted at 90% of total species richness, to Chao1 estimates of total richness generated from my sampling data (Table 6). Observed richness within the park (22) was 93% of the computed expected richness value, and 60% and 99% of the upper and lower

confidence limits, respectively. Therefore I conclude that my effort was adequate to inventory the aquatic habitats supporting fishes.

Many other fish species that were not collected within the park occur in the piedmont region of the Saluda River drainage. A partial list is presented in Table 7. Note that this list is generated from recent DNR collections taken from often much larger streams and rivers at higher or lower elevations, so many of these species would not necessarily be expected to occur in NISI.

A list of digital photos taken at the NISI sites and their descriptions are included in Table 8. The images will be supplied separately from this report as digital files in JPG format.

### ***Summary***

The Ninety Six National Historic Site was found to contain several tributary streams of the Saluda River, Star Fort Lake, and one small pond. The fish inventory of these aquatic habitats produced 433 individuals of 22 species. Common stream and reservoir species were encountered along with three species of conservation concern to the South Carolina Department of Natural Resources.

The fact that the fish assemblage inhabiting the park includes three of South Carolina's priority conservation species, making up of about 11% of the park's fish fauna, is a good indicator. In particular, Tolbert Branch and Henley Creek assemblages are composed of nearly 20% of these sensitive species. The fisheries section of SCDNR has an interest in

monitoring “reference” stream conditions throughout the state, and these two NISI sites are certainly candidates. Land management is critical to aquatic systems, particularly headwater streams, since ecosystem processes such as hydrologic regime, carbon inputs and processing, and nutrient dynamics are highly influenced by the terrestrial drainage. Management to conserve aquatic ecosystem integrity includes restrictions on land development, maintenance of forested riparian zones to the maximum extent practical in keeping with cultural values of the park, and maintenance of natural hydrology and water quality. The role of the National Park System as good steward of these headwater streams is valuable and plays an important part in the future persistence of our native fishes in South Carolina.

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Table 1. Date of sampling, site coordinates in decimal degrees (datum NAD83), channel dimensions (meters), and water quality measures associated with each fish collection. Column abbreviations and measurement units are as follows: DO – dissolved oxygen (mg/L), CONDOC – conductivity ( $\mu\text{S}/\text{cm}$ ), TURB – turbidity (nephelometric turbidity units), TEMP – temperature ( $^{\circ}\text{C}$ ).

| NISI SITE ID   | FISH DATE | LAT      | LONG     | LENGTH | AVG WIDTH | AVG DEPTH | DO   | pH   | CONDOC | TURB  | TEMP  |
|----------------|-----------|----------|----------|--------|-----------|-----------|------|------|--------|-------|-------|
| Tolbert Branch | 7/5/2005  | 34.13195 | 82.02504 | 119    | 1.55      | 0.075     | 7.58 | 7.15 | 133    | 8.65  | 23.34 |
| Spring Branch  | 7/5/2005  | 34.14452 | 82.02187 | 100    | 0.83      | 0.07      | 6.61 | 6.53 | 98     | 17.92 | 19.76 |
| Henley Creek   | 8/15/2005 | 34.14360 | 82.00530 | 135    | 4.5       | 0.2       | 6.05 | 7.20 | 154    | 11.81 | 25.60 |
| Little Pond    | 7/21/2005 | 34.14217 | 82.01421 | na     | na        | 0.6       | 1.25 | 6.04 | 86     | -     | 26.95 |
| Star Fort Lake | 6/8/2005  | 34.14490 | 82.00760 | na     | na        | -         | -    | -    | -      | -     | -     |

Table 2. Fish species collected from Ninety Six National Historic Site, including their conservation and range status. Native refers to a species being indigenous to the Saluda River drainage. Any of the species mentioned in this report could be searched via NatureServe's website <http://www.natureserve.org/explorer/> as of the date of this publication. Species names (common or scientific) can be typed into the search field to obtain information on distribution, ecology, and conservation status.

| Common Name                   | Scientific Name                | Family        | State Conservation Status | Native/Introduced       | Voucher status             |
|-------------------------------|--------------------------------|---------------|---------------------------|-------------------------|----------------------------|
| bluegill                      | <i>Lepomis macrochirus</i>     | Centrarchidae |                           | Native                  | One specimen preserved     |
| green sunfish                 | <i>Lepomis cyanellus</i>       | Centrarchidae |                           | Introduced              | Photo NISlgreensunfish.jpg |
| redbreast sunfish             | <i>Lepomis auritus</i>         | Centrarchidae |                           | Native                  | Photo NISlredbreast.jpg    |
| redeer sunfish                | <i>Lepomis microlophus</i>     | Centrarchidae |                           | Introduced              | One specimen preserved     |
| warmouth                      | <i>Lepomis gulosus</i>         | Centrarchidae |                           | Native                  | Photo NISlwarmouth1.jpg    |
| largemouth bass               | <i>Micropterus salmoides</i>   | Centrarchidae |                           | Native                  | One specimen preserved     |
| black crappie                 | <i>Pomoxis nigromaculatus</i>  | Centrarchidae |                           | Native                  | Photo NISlblackcrappie.jpg |
| bluehead chub                 | <i>Nocomis leptcephalus</i>    | Cyprinidae    |                           | Native                  | 13 specimens preserved     |
| creek chub                    | <i>Semotilus atromaculatus</i> | Cyprinidae    |                           | Native                  | 2 specimens preserved      |
| rosyface chub                 | <i>Hybopsis rubrifrons</i>     | Cyprinidae    | Moderate Priority         | Native with reservation | 23 specimens preserved     |
| golden shiner                 | <i>Notemigonus crysoleucas</i> | Cyprinidae    |                           | Native                  | Photo NISlgoldenshiner.jpg |
| sandbar shiner                | <i>Notropis scepticus</i>      | Cyprinidae    |                           | Native                  | 13 specimens preserved     |
| spottail shiner               | <i>Notropis hudsonius</i>      | Cyprinidae    |                           | Native                  | -                          |
| yellowfin shiner              | <i>Notropis lutipinnis</i>     | Cyprinidae    |                           | Native                  | 2 specimens preserved      |
| yellow bullhead               | <i>Ameiurus natalis</i>        | Ictaluridae   |                           | Native                  | Photo NISlybullhead.jpg    |
| flat bullhead                 | <i>Ameiurus platycephalus</i>  | Ictaluridae   | Moderate Priority         | Native                  | Photo NISlflatbullhead.jpg |
| channel catfish               | <i>Ictalurus punctatus</i>     | Ictaluridae   |                           | Introduced              | -                          |
| marginated madtom             | <i>Noturus insignis</i>        | Ictaluridae   |                           | Native                  | -                          |
| Carolina darter (Saluda form) | <i>Etheostoma collis</i>       | Percidae      | Highest Priority          | Native                  | 12 specimens preserved     |
| tesselated darter             | <i>Etheostoma olmstedii</i>    | Percidae      |                           | Native                  | -                          |
| blackbanded darter            | <i>Percina nigrofasciata</i>   | Percidae      |                           | Native with reservation | One specimen preserved     |
| eastern mosquitofish          | <i>Gambusia holbrooki</i>      | Poeciliidae   |                           | Native                  | One specimen preserved     |

Table 3. Species distributions among sites. Total number of fish species in the park was twenty-two (22).

| Common Name                   | Tolbert Branch | Spring Branch | Henley Creek | Little Pond | Star Fort Lake |
|-------------------------------|----------------|---------------|--------------|-------------|----------------|
| Carolina darter (Saluda form) | X              |               |              |             |                |
| yellowfin shiner              | X              |               |              |             |                |
| bluehead chub                 | X              |               |              |             |                |
| bluegill                      | X              |               | X            |             | X              |
| redbreast sunfish             | X              |               | X            |             |                |
| blackbanded darter            | X              |               | X            |             |                |
| creek chub                    | X              | X             |              |             |                |
| green sunfish                 | X              |               | X            |             |                |
| warmouth                      | X              |               |              |             | X              |
| largemouth bass               | X              |               |              |             | X              |
| redeer sunfish                | X              |               |              |             | X              |
| spottail shiner               | X              |               |              |             |                |
| sandbar shiner                | X              |               |              |             |                |
| rosyface chub                 | X              |               | X            |             |                |
| black crappie                 |                |               |              |             | X              |
| eastern mosquitofish          | X              |               | X            | X           |                |
| tesselated darter             |                |               | X            |             |                |
| golden shiner                 |                |               |              |             | X              |
| marginated madtom             |                |               | X            |             |                |
| channel catfish               |                |               |              |             | X              |
| flat bullhead                 | X              |               | X            |             |                |
| yellow bullhead               | X              |               | X            |             |                |
| Number of Species             | 17             | 1             | 10           | 1           | 7              |

Table 4. Abundance of each fish species by site and totals within the park.

| Common Name                   | Number of Individuals |               |              |             |                |            |
|-------------------------------|-----------------------|---------------|--------------|-------------|----------------|------------|
|                               | Tolbert Branch        | Spring Branch | Henley Creek | Little Pond | Star Fort Lake | Park Total |
| Carolina darter (Saluda form) | 14                    | 0             | 0            | 0           | 0              | 14         |
| yellowfin shiner              | 45                    | 0             | 0            | 0           | 0              | 45         |
| bluehead chub                 | 19                    | 0             | 0            | 0           | 0              | 19         |
| bluegill                      | 7                     | 0             | 6            | 0           | 74             | 87         |
| redbreast sunfish             | 1                     | 0             | 34           | 0           | 0              | 35         |
| blackbanded darter            | 1                     | 0             | 11           | 0           | 0              | 12         |
| creek chub                    | 13                    | 1             | 0            | 0           | 0              | 14         |
| green sunfish                 | 4                     | 0             | 1            | 0           | 0              | 5          |
| warmouth                      | 4                     | 0             | 0            | 0           | 1              | 5          |
| largemouth bass               | 2                     | 0             | 0            | 0           | 67             | 69         |
| redeer sunfish                | 5                     | 0             | 0            | 0           | 7              | 12         |
| spottail shiner               | 12                    | 0             | 0            | 0           | 0              | 12         |
| sandbar shiner                | 13                    | 0             | 0            | 0           | 0              | 13         |
| rosyface chub                 | 11                    | 0             | 13           | 0           | 0              | 24         |
| black crappie                 | 0                     | 0             | 0            | 0           | 6              | 6          |
| eastern mosquitofish          | 8                     | 0             | 18           | X*          | 0              | 26         |
| tesselated darter             | 0                     | 0             | 11           | 0           | 0              | 11         |
| golden shiner                 | 0                     | 0             | 0            | 0           | 1              | 1          |
| marginated madtom             | 0                     | 0             | 1            | 0           | 0              | 1          |
| channel catfish               | 0                     | 0             | 0            | 0           | 12             | 12         |
| flat bullhead                 | 1                     | 0             | 7            | 0           | 0              | 8          |
| yellow bullhead               | 1                     | 0             | 1            | 0           | 0              | 2          |
| Number Individuals            | 161                   | 1             | 103          | *           | 168            | 433        |

\* not quantified – estimated at 75 individuals/m<sup>2</sup> from photo NISImosquitofish.jpg

Table 5. Relative abundance of each fish species by site and overall within the park.

| Common Name                   | Relative Abundance (%) |               |              |             |                |              |
|-------------------------------|------------------------|---------------|--------------|-------------|----------------|--------------|
|                               | Tolbert Branch         | Spring Branch | Henley Creek | Little Pond | Star Fort Lake | Park Overall |
| Carolina darter (Saluda form) | 9%                     | 0%            | 0%           | 0%          | 0%             | 3.2%         |
| yellowfin shiner              | 28%                    | 0%            | 0%           | 0%          | 0%             | 10.4%        |
| bluehead chub                 | 12%                    | 0%            | 0%           | 0%          | 0%             | 4.4%         |
| bluegill                      | 4%                     | 0%            | 6%           | 0%          | 44%            | 20.1%        |
| redbreast sunfish             | 1%                     | 0%            | 33%          | 0%          | 0%             | 8.1%         |
| blackbanded darter            | 1%                     | 0%            | 11%          | 0%          | 0%             | 2.8%         |
| creek chub                    | 8%                     | 100%          | 0%           | 0%          | 0%             | 3.2%         |
| green sunfish                 | 2%                     | 0%            | 1%           | 0%          | 0%             | 1.2%         |
| warmouth                      | 2%                     | 0%            | 0%           | 0%          | 1%             | 1.2%         |
| largemouth bass               | 1%                     | 0%            | 0%           | 0%          | 40%            | 15.9%        |
| redeer sunfish                | 3%                     | 0%            | 0%           | 0%          | 4%             | 2.8%         |
| spottail shiner               | 7%                     | 0%            | 0%           | 0%          | 0%             | 2.8%         |
| sandbar shiner                | 8%                     | 0%            | 0%           | 0%          | 0%             | 3.0%         |
| rosyface chub                 | 7%                     | 0%            | 13%          | 0%          | 0%             | 5.5%         |
| black crappie                 | 0%                     | 0%            | 0%           | 0%          | 4%             | 1.4%         |
| eastern mosquitofish          | 5%                     | 0%            | 17%          | 100%        | 0%             | 6.0%         |
| tessellated darter            | 0%                     | 0%            | 11%          | 0%          | 0%             | 2.5%         |
| golden shiner                 | 0%                     | 0%            | 0%           | 0%          | 1%             | 0.2%         |
| marginated madtom             | 0%                     | 0%            | 1%           | 0%          | 0%             | 0.2%         |
| channel catfish               | 0%                     | 0%            | 0%           | 0%          | 7%             | 2.8%         |
| flat bullhead                 | 1%                     | 0%            | 7%           | 0%          | 0%             | 1.8%         |
| yellow bullhead               | 1%                     | 0%            | 1%           | 0%          | 0%             | 0.5%         |

Table 6. Observed fish species richness within NISI, computed Chao1 estimate of species richness with 95% confidence limits, and percentage of observed richness versus the estimates. Goal of the inventory effort was to document 90% of species expected within the park.

|                           |           |                                  |
|---------------------------|-----------|----------------------------------|
| Observed Species Richness | <b>22</b> | % Observed vs.Estimated Richness |
| Chao1 Expected Richness   | 23.5      | 93.6%                            |
| Chao1 lower 95% CL        | 22.2      | 99.1%                            |
| Chao1 upper 95% CL        | 36.5      | 60.3%                            |

Table 7. A partial list of other fish species that were not collected within the park during this inventory, but which are native to streams of the outer piedmont ecoregion of the Saluda River basin.

| <b>Scientific Name</b>          | <b>Common Name</b>       |
|---------------------------------|--------------------------|
| <i>Etheostoma thalassinum</i>   | seagreen darter          |
| <i>Percina crassa</i>           | piedmont darter          |
| <i>Esox americanus</i>          | redfin or grass pickerel |
| <i>Hybognathus regius</i>       | eastern silvery minnow   |
| <i>Hybopsis hypsinotus</i>      | highback chub            |
| <i>Notropis altipinnis</i>      | highfin shiner           |
| <i>Cyprinella chloristia</i>    | greenfin shiner          |
| <i>Notropis cummingsae</i>      | dusky shiner             |
| <i>Cyprinella nivea</i>         | whitefin shiner          |
| <i>Notropis petersoni</i>       | coastal shiner           |
| <i>Catostomus commersoni</i>    | white sucker             |
| <i>Moxostoma macrolepidotum</i> | shorthead redhorse       |
| <i>Moxostoma pappillosum</i>    | slender redhorse         |
| <i>Scartomyzon rupiscartes</i>  | striped jumprock         |
| <i>Ameiurus brunneus</i>        | snail bullhead           |
| <i>Erimyzon sucetta</i>         | lake chubsucker          |
| <i>Minytrema melanops</i>       | spotted sucker           |
| <i>Moxostoma collapsum</i>      | V-lip redhorse           |
| <i>Ameiurus catus</i>           | white catfish            |
| <i>Ameiurus nebulosus</i>       | brown bullhead           |
| <i>Centrarchus macropterus</i>  | flier                    |
| <i>Enneacanthus gloriosus</i>   | bluespotted sunfish      |
| <i>Lepomis gibbosus</i>         | pumpkinseed              |
| <i>Micropterus coosae</i>       | redeye bass              |
| <i>Perca flavescens</i>         | yellow perch             |
| <i>Aphredoderus sayanus</i>     | pirate perch             |

| <b>Scientific Name</b> | <b>Common Name</b> |
|------------------------|--------------------|
| Erimyzon oblongus      | creek chubsucker   |
| Esox niger             | chain pickerel     |
| Etheostoma flabellare  | fantail darter     |
| Fundulus lineolatus    | lined topminnow    |
| Labidesthes sicculus   | brook silverside   |
| Noturus leptacanthus   | speckled madtom    |
| Noturus gyrinus        | tadpole madtom     |
| Cyprinella labrosa     | thicklip chub      |
| Cyprinella zanema      | Santee chub        |

Table 8. List of digital photographs taken at NISI with their descriptions. Site names are referenced in Table 1, and species information is found in Tables 2 through 5. The images will be supplied as digital files (JPG format) separate from this report.

| <i>Digital image file name</i> | <i>Description of image</i>                                                                                      |
|--------------------------------|------------------------------------------------------------------------------------------------------------------|
| NISIBlcrappie.JPG              | Identification voucher photo – black crappie                                                                     |
| NISIBluegill.JPG               | Identification voucher photo – bluegill                                                                          |
| NISIfatbullhead.JPG            | Identification voucher photo – flat bullhead                                                                     |
| NISIgoldsiner.JPG              | Identification voucher photo – golden shiner                                                                     |
| NISIGreensunfish.JPG           | Identification voucher photo – green sunfish                                                                     |
| NISILargemouthBass.JPG         | Identification voucher photo – largemouth bass                                                                   |
| NISImosquitofish.JPG           | Identification voucher photo – eastern mosquitofish; note high density among submerged vegetation in Little Pond |
| NISIREdbreast.JPG              | Identification voucher photo – redbreast sunfish                                                                 |
| NISIREdearSunfish.JPG          | Identification voucher photo – redear sunfish                                                                    |
| NISIsmallpond1.JPG             | Little Pond from east bank showing north end; note dense aquatic vegetation                                      |
| NISIsmallpond2.JPG             | Little Pond from east bank showing deepest spot                                                                  |
| NISIsmallpond3.JPG             | Little Pond from south bank                                                                                      |
| NISISpringBr1.JPG              | Spring Branch looking upstream                                                                                   |
| NISISpringBr2.JPG              | Spring Branch fish collection technique                                                                          |
| NISITolbertBr2.JPG             | Tolbert Branch looking upstream                                                                                  |
| NISIWarmouth1.JPG              | Identification voucher photo – warmouth                                                                          |
| NISIYbullhead.JPG              | Identification voucher photo – yellow bullhead                                                                   |

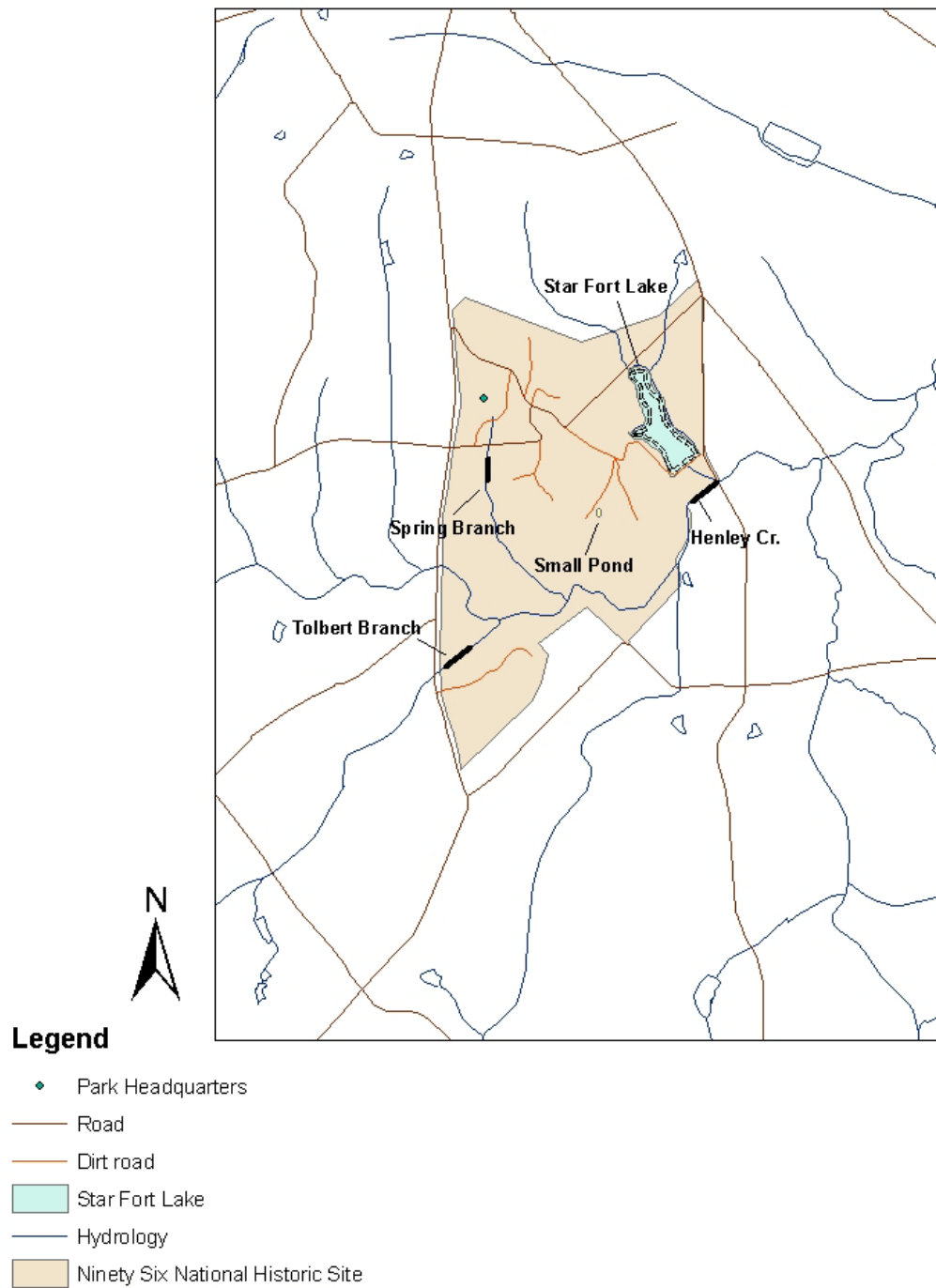


Figure 1. Map of Ninety Six National Historic Site, hydrological features, road network, and locations of fish collections on three streams, one small pond, and Star Fort Lake.