MISSION - FERC NO. 2619

FISHERIES STUDY

INTRODUCTION

During the biological studies consultation process subsequent to the issuance of the First Stage Consultation Package for the Mission Hydroelectric Project, the state and federal resource agencies identified the need for additional fisheries data in the vicinity of the project. A Technical Leadership Team (TLT) comprised of representatives from the North Carolina Wildlife Resources Commission (NCWRC), the United States Fish and Wildlife Service (USFWS), the United States Forest Service (USFS), the Land Trust for the Little Tennessee and the applicant developed a fisheries study to collect the needed data. The objectives of the study were to: (1) Describe the fishery resources within the project impoundment, and in the river upstream and downstream of the project (2) Determine any potential project-related impacts to the fishery resources associated with the project.

The fisheries study consisted of reviewing recent historical data (within the past 5 years) collected by state and federal resource agencies and/or consultants, and additional site-specific field surveys to describe the fisheries resources in the vicinity of the project. The field surveys incorporated both routine fishery inventories and directed surveys for any Proposed, Endangered, Threatened, and Species of Concern (PETS) species that may occur within the project waters or the adjacent upstream and downstream areas.

METHODS

Fisheries sampling for the Mission Project consisted of quantitative sampling within the project impoundment, in the immediate tailrace and in associated upstream and downstream riverine reaches of the Hiwassee River. The study plan identified four general areas where sample stations would be located: (1) a representative riverine reach upstream of the project impoundment, (2) representative shoreline within the project impoundment (one sampling reach on each side of impoundment), (3) the immediate tailrace just downstream of the project dam, (4) a representative riverine reach 2 to 3 miles downstream of the project dam, but upstream of the confluence of Brasstown Creek. These sample areas were selected to provide fisheries data for the Hiwassee River in the vicinity of the project. In consultation with state and federal agency biologists, specific sampling stations were selected in these four areas of the river (Figure 1 and Table 1). Stations were selected to be representative of the various mesohabitats present in that area of the river (e.g., riffle, run, pool sequence). Stations H-1 and H-2 are located downstream of the Mission Project, Station MR is located within the project impoundment and Station H-3 is located upstream of the project impoundment. A detailed description of each sample station is provided in the SITE DESCRIPTION section.

The study plan included four sample periods during 2001: two spring samples (early spring and late spring), one summer sample and one fall sample. Due to delays in finalizing the study plan, however, only the late spring, summer and fall samples were conducted during 2001. The early spring sample was conducted during spring 2002. Additionally, a late winter sample of the tailrace station, H-2, was conducted during 2002 to evaluate the presence of any migratory species

that may have been missed during the spring sampling. All riverine stations were sampled in May, July, and September of 2001 and again in March of 2002. As mentioned above, the tailrace station, H-2, was also sampled in February of 2002. The reservoir station, MR, was sampled in May 2001.

All sampling was conducted with boat-mounted and/or backpack electrofishing equipment, depending upon site-specific conditions and access. Sampling was conducted under base flow conditions, to ensure sample crew safety and sampling efficiency. According to the study plan, a 200-m reach of shoreline was to be sampled at all stations, however, the actual distance of shoreline sampled at each of the riverine stations was adjusted as necessary to incorporate all representative mesohabitats for that portion of the river. Sampling was conducted in an upstream direction. Sampling within the project impoundment was conducted with boat-mounted electrofishing gear and consisted of sampling a 200-m contiguous reach of shoreline on either side of the impoundment. Settings for voltage output of electrofishing gear were adjusted to achieve maximum sampling efficiency without injury to collected fishes.

Based on results of the spring 2001 sampling, the February and March 2002 samplings at the riverine stations also included electrofishing into a seine. This modification to the original study plan was implemented to ensure a representative sample of the species present during the spawning period. The method consisted of setting a 6-m seine in the riffle or run area, and backpack electrofishing an area approximately 7.5 m upstream of the seine. Sampling was conducted in a downstream direction towards the seine. Two electrofishing passes were made at each sample site. If the two passes resulted in the collection of new species not collected during the standard boat/backpack sampling, then additional passes were conducted until no new species were collected. Settings for voltage output of electrofishing gear were adjusted to achieve maximum sampling efficiency without injury to collected fishes.

All collected fish were identified, measured for individual total length (mm) and sorted by species into 25-mm size groups. For each species, all fish within a particular size group were enumerated and weighed in aggregate to yield number and biomass by size group. Once fish were measured and weighed, they were placed in a holding tank until the completion of sampling, after which they were returned to the river alive.

Catch data were summarized in tabular format by sample period, station and species for total number of fish and weight by size group. Additionally, catch per unit of effort (CPUE) was calculated for both number of fish per hour and number of fish per 100 m of shoreline. Cumulative time of active electrofishing (as opposed to total sample time) was used to calculate hourly CPUE.

SITE DESCRIPTION

Sampling for the Mission Project fish survey was conducted at four sample stations between the confluence of Brasstown Creek and the Tennessee Valley Authority (TVA) canoe launch upstream of the Mission impoundment. The specific description of each sample station is provided below.

Station H-1

A 50-m riffle area, upstream of the proposed water intake for the Town of Murphy, was selected for backpack electrofishing. The area was electrofished from bank to bank. The substrate in the riffle area consists of cobble, gravel and bedrock. Both shorelines in the riffle area support narrow woody buffer strips of oaks, yellow poplar and alder. The left ascending bank (LAB) has tall steep banks followed by residential development. The right ascending bank (RAB) has moderate banks with residential construction in progress. The average river width in this area is 41.1 m.

A 160-m pool area, downstream of the aforementioned riffle area, was selected for boat electrofishing. The substrate consists of sand and boulders. The sample area is unbounded at the lower end due to the size of the pool, and is bound on the upstream end by the adjacent sample riffle area. The RAB has moderate banks with residential housing near the upper end. The LAB has tall steep banks and is adjacent to a vacant parcel owned by the Town of Murphy. Vegetation on the LAB consists of understory, including doghobble, grasses and poison ivy.

Station H-2

A 50-m riffle area, located 500 m upstream of Highway 64, near the Cherokee/Clay County line, was selected for backpack electrofishing. The area was electrofished from bank to bank. The substrate in this area consists of boulder, cobble and gravel. On the LAB, a buffer strip of oaks, river birch, and yellow poplar separates the river from a large cow pasture and agricultural fields. The RAB is moderately developed with residential homes, but still supports many oaks, yellow poplar, and silverbell. The average river width in this area is 35.7 m.

A 150-m pool area, located immediately downstream of the aforementioned riffle area, was selected for boat electrofishing. The substrate in this area consists of sand and boulder. The lower end of the pool was unbound due to the large size of the pool, and is bound on the upstream end by the adjacent riffle. The RAB supports a buffer strip of oaks, river birch, and yellow poplar, with an understory including doghobble and ivy. Vegetation along the LAB is consistent with that of the backpack electrofishing area described above.

Station MR

A 200-m sample area within the Mission impoundment was selected approximately 500 m upstream of the Mission Dam. Boat electrofishing occurred along the LAB and RAB, as well as a shallow marshy area in the middle of reservoir. Substrate within the impoundment consisted of sand and silt, with some bedrock outcroppings interspersed along the shoreline. The LAB has moderately steep gradient banks with rhododendron, sycamore, and river birch comprising much of the canopy. Other vegetation included white pine, laurel, red maple and persimmon. The RAB also has moderately steep gradient banks with northern red oak, maple, rhododendron, laurel, and azalea comprising much of the overhanging vegetation. The shallow marshy area in the middle of the lake had willow and marsh grass for vegetative cover.

Station H-3

A 50-m riffle area, near the TVA canoe launch above the SR-1302 Bridge, was selected for the backpack-electrofishing. The area was electrofished from bank to bank. The average river width in this area is 35.4 m. The sample site is bound on the downstream end by the adjacent pool surveyed, and is bound on the upstream end by the formation of a run. Substrate in the riffle area consists of cobble, gravel, and bedrock. The LAB and RAB are forested with sycamore, maple, oaks, alder and hornbeam. This vegetation populated a moderately flat adjacent flood plain.

A 150-m pool area, located immediately downstream of the aforementioned riffle area, was selected for boat electrofishing. The downstream end of the sample area is bound by a downstream riffle, the upstream end bound by the adjacent riffle sample area. The bridge on SR-1302 bisects the pool area. Substrate in the pool area is primarily bedrock/boulder with cobble. The LAB has tall steep banks with sycamore, river birch and maple as vegetative buffer. The RAB is relatively void of understory due to the presence of the recreation park (upstream) and residential influence (downstream).

RESULTS AND DISCUSSION

During this study, a total of 8,314 fish representing 41 species were collected from the four stations sampled for the Mission project. Fish abundance and species diversity varied by location and sample period (Tables 2-10). Overall, fish abundance and species diversity increased from upstream to downstream. The average number of fish per sample site downstream of the Mission dam (2,853 fish) was 10% higher than the number of fish at the sample site upstream of the dam (2,602 fish). Diversity followed the same trend with 15 species collected at the station upstream of the dam and an average of 37 species collected at the stations downstream of the dam.

In terms of overall abundance by sample site, the highest numbers of fish were collected from the tailrace Station H-2 (3,770 fish) (Table 4), followed by the upstream Station H-3 (2,602) (Table 5), the most downstream Station H-1 (1,935) (Table 3) and the Mission Reservoir Station MR (7) (Table 6). Species diversity decreased from downstream to upstream. Species diversity was highest at Station H-1 (39 species, plus hybrid sunfish), followed by the tailrace Station H-2 (35 species, plus hybrid sunfish), the upstream riverine Station H-3 (15 species), and the Mission impoundment Station MR (4 species). Catches at the downstream and tailrace Stations H-1 and H-2 were generally dominated by minnows, suckers and sculpin (Tables 3 and 4), while catches at the upstream Station H-3 were dominated primarily by minnows and sculpin (Table 5). Of the seven fish collected from the Mission impoundment Station MR, six were sunfish (Table 6).

There were a number of species collections worth noting. Rainbow trout were collected from all four sample stations. The mountain brook lamprey was collected from all three riverine stations. Largemouth bass, spotted bass, smallmouth bass and walleye were collected from the downstream Stations H-1 and H-2 (Tables 3 and 4). There were four species collected at the most downstream Station H-1, which were not collected elsewhere; brown trout, common carp, green sunfish and black crappie. There were 26 species that were collected downstream of the Mission Dam, but not upstream of the dam; brown trout, common carp, bigeye chub, blotched chub, warpaint shiner, river chub, Tennessee shiner, roseyface shiner, river redhorse, golden redhorse, shorthead redhorse, sicklefin redhorse, channel catfish, redbreast sunfish, green sunfish, bluegill, smallmouth bass, spotted bass, largemouth bass, black crappie, redline darter, banded darter, yellow perch,

tangerine darter, gilt darter, and walleye. The creek chub was the only species collected at the upstream Station H-3, which was not collected elsewhere. Four species of special concern were collected in the vicinity of the Mission project. The sicklefin redhorse (Table 11), blotched chub (Table 12), and tangerine darter (Table 13) were collected from both downstream Stations H-1 and H-2. The fourth species, banded sculpin, was collected from all three riverine sample stations (Table 14).

The number of fish and biomass by species and size class for the standard boat/backpack electrofishing samples are presented in Appendix 1, Tables 1-14. The late winter/early spring 2002 supplemental seine sampling resulted in the collection of 397 additional fish with no new species (Appendix 1, Tables 15-18). A wide range of size classes, indicative of multiple year classes, was observed for the most frequently collected species. Overall, the size distributions for the most frequently collected species appeared to be similar among sample stations.

PROPOSED, ENDANGERED, THREATENED AND SPECIES OF CONCERN (PETS)

Four species listed as PETS or on the United States Forest Service (USFS) list of sensitive species were collected during this study. The sicklefin redhorse, listed as Rare Species (RS) by the North Carolina Wildlife Resource Commission (NCWRC), was collected at both Stations H-1 and H-2 (Table 11). The blotched chub, listed as a forest concern species by the USFS and as a Watch Category 2 (W2) by the NCWRC, was also collected at both Stations H-1 and H-2 (Table 12). The tangerine darter, listed as a forest concern species by the USFS and as a W2 by the NCWRC, was also collected at both Stations H-1 and H-2 (Table 13). The banded sculpin, listed as a forest concern species by the USFS and threatened by the NCWRC, was collected at all three riverine Stations H-1, H-2 and H-3 (Table 14).

POTENTIAL PROJECT IMPACTS

Fisheries data for the Mission project do not indicate that project operations have had any overall adverse impacts on fishery resources in the Hiwassee River in the vicinity of the project. In comments on the fish survey report for the project, however, the NCWRC did note that the project appeared to be the furthest upstream extent for the river redhorse, golden redhorse, shorthead redhorse, sicklefin redhorse and walleye (fish survey comments provided by Chris Goudreau, via e-mail dated August 7, 2002). Additionally, the NCWRC noted that low species diversity and fish abundance in the project impoundment suggest that fish habitat in the impoundment is less suitable for many species than habitat elsewhere in the river.

As suggested in the NCWRC's review comments, data from historical collections in the Hiwassee River upstream of the project were reviewed to determine if the project dam was the upstream extent of the species mentioned above. Historical data were limited and included NCWRC data from scientific collecting permit reports for 1993 and 2000 (data provided by Scott Loftis, NCWRC, District 9 Fisheries Biologist) and TVA data for collections during the same two years (unpublished data provided by Charles Saylor, TVA Aquatic Biology Lab, Norris TN).

The review of historical fisheries sampling of the Hiwassee River between the Mission impoundment and the Chatuge Dam did not provide documentation of the presence of river redhorse, golden redhorse, shorthead redhorse, sicklefin redhorse or walleye upstream of the project. However, the distribution of these and other species upstream and/or downstream of the

project is likely related more to the habitat present in the respective areas of the river and species habitat preferences (see **SPECIES LIFE HISTORY** section), than to any blockage to upstream migration posed by the project dam.

The NCWRC's conclusion that habitat diversity and quality in the project impoundment is less suitable for many species than habitat upstream and downstream of the project impoundment is valid. The shallow, riverine nature of the impoundment and sediment accumulation result in less suitable fisheries habitat, and corresponding lower species diversity and fish abundance.

The fisheries data for the project indicate an abundant and diverse fishery exists in the Hiwassee River in the vicinity of the project. The historical operation of the project has had no observable adverse impacts on fishery resources in the Hiwassee River. Accordingly, the continued operation of the project under the current operational regime should not result in any future adverse environmental impacts.

SPECIES LIFE HISTORY

This section contains life history data for the various species collected during this study and a summary of the sampling stations where each species was collected.

Ichthyomyzon greeleyi, mountain brook lamprey

A. Identification

The mountain brook lamprey is a member of the Family Petromyzontidae (the lampreys) in the Order Petromyzontiformes. This lamprey is nonparasitic and not anadromous.
Teeth are well developed in radiating rows and the lateral teeth are bicuspid. The posterior and outer teeth are bluntly rounded and short. The dorsal fin is not divided. Body color is olivaceous, brown, or gray. The gut of adults is thin, granular, and fragmented. There are 53-62 myomeres (muscle segments between the last gill opening and the anus), usually 55-58. The transverse lingual lamina (a feature of the oral region) is bilobed and has tiny denticles. Total length (TL) rarely exceeds 6 inches.

B. Range

The mountain brook lamprey occurs in the upper Ohio River drainage of Pennsylvania, and the southern tributaries of the Ohio River south through the Tennessee River. It is absent from the Coastal Plains area.

C. Habitat

Mountain brook lamprey habitat includes small upland rivers and creeks with gravel substrates and gentle riffles. They prefer clear water.

D. Local Occurrence

The mountain brook lamprey is limited in North Carolina, occurring only in a few western streams of the Appalachian Mountain Province.

This species was found in the Hiwassee River Stations H-1 and H-3.

E. Federal and State Status

No federal or state status.

***Oncorhynchus mykiss*, rainbow trout**

A. Identification

The rainbow trout is a member of the Family Salmonidae (the salmons) in the Order Salmoniformes. This is a streamlined trout with a moderately large terminal mouth (the upper jaw barely extends behind the eye) and teeth on the shaft of the vomer (a bone in the roof of the mouth). An adipose fin is present and the small scales covering the trout are embedded in slimy mucous. The head, back, and upper sides are olive-green and thickly speckled with black spots. The side has a broad pink or reddish longitudinal stripe, but no orange or red spots. The belly is silvery white or yellowish. The dorsal, adipose, and caudal fins have many black spots. The dorsal fin has 10-12 rays and the anal fin has 8-12 rays. The pectoral fin has 11-17 rays and the pelvic fin has 9-10 rays.

B. Range

The rainbow trout was native to the Pacific Coast drainages of western North America, primarily in the coastal streams of the Northwest, but has been widely introduced. It is stocked extensively in many coldwater streams and reservoirs throughout North America and the world.

C. Habitat

Rainbow trout preferred habitat includes streams, lakes, and reservoirs where water temperatures remain below 70^{o} F (21.3^{o} C). However, temperatures as high as 83^{o} F are tolerated. Rainbow trout prefer fast whitewater sections of cool streams, but adapt well to cool, deep reservoirs that have sufficient oxygen.

D. Local Occurrence

The rainbow trout occurs throughout the streams and reservoirs of the Appalachian Mountain Province and a few streams and reservoirs in the Broad, Catawba, and Yadkin drainage basins of the Piedmont Plateau in North Carolina.

This species was found in the Hiwassee River at Stations H-1, H-2, H-3 and Mission Reservoir.

E. Federal and State Status

No federal or state status.

***Salmo trutta*, brown trout**

A. Identification

The brown trout is a member of the Family Salmonidae (the salmons) in the Order Salmoniformes. This trout has a moderately large terminal mouth (the upper jaw barely extends behind the eye). An orange to orange-red adipose fin is present and the small scales covering the trout are embedded in slimy mucous. The back and upper sides are dark olive-brown, with scattered red or orange spots that may have pale blue halos. There is no lateral orange or red band present on the sides. The belly is yellowish white or silvery. The dorsal and adipose fins have black spots while the caudal fin has only a few spots on the dorsal portion or no spots. The leading edge of the anal fin is white. The dorsal fin has 12-14 rays and the anal fin has 10-12 rays. The pectoral fin has 13-14 rays and the pelvic fin has 9-10 rays.

B. Range

The brown trout in not native to North America, and only occurs naturally in Europe and western Asia. It has been widely introduced in North America, since its first stocking in 1883, and now occurs throughout the world.

C. Habitat

Brown trout habitat includes moderate to steeply sloped coldwater streams, rivers, reservoirs, and tailraces where water temperatures stay between 33 and 75^{o} F (although it can tolerate higher temperatures). It is often found around dense cover such as logs or undercut banks, or in deep pools below riffles. The brown trout appears to be more tolerant of turbid water and pollution than other trout.

D. Local Occurrence

The brown trout occurs mainly in streams and reservoirs in the Appalachian Mountain Province of North Carolina. However, it also occurs in a few streams in the Piedmont Plateau.

This species was found in the Hiwassee River at Station H-1.

E. Federal and State Status

No federal or state status.

***Campostoma anomalum*, central stoneroller**

A. Identification

The central stoneroller is a member of the Family Cyprinidae (the minnows) in the Order Cypriniformes. This is a heavy-bodied, large minnow (maximum 11.3 inches TL) that has a blunt head and rounded snout that overhangs an inferior, U-shaped horizontal mouth with a cartilaginous lower lip. Body color is variable: brownish, olivaceous, or gray above grading to white on the belly. Sometimes the central stoneroller is very silvery. Irregular patches of black or brown spots often mark the sides. Fins are clear or faint brown-orange and short and rounded. Breeding males have an orange band in the dorsal fin and black bands in the dorsal, and often the anal, pelvic, and pectoral fins. Breeding tubercles are extensively developed over the head, upper body, and along some of the rays of the dorsal, caudal, and pectoral fins. The dorsal fin has 8 rays and the anal fin has 7 rays. The pectoral fin has 16-18 rays and the pelvic fin has 8 rays.

B. Range

The central stoneroller is widespread and abundant in many of the upland waters of the eastern United States, but it is mostly restricted to the Blue Ridge in the Atlantic Coastal drainages.

C. Habitat

Central stoneroller habitat includes small streams to large rivers with gravel, cobble, or exposed bedrock substrates. It is occasionally found in small numbers in upland impoundments. The central stoneroller prefers clear streams, as they are intolerant of heavy siltation.

D. Local Occurrence

The central stoneroller is abundant in the Appalachian Mountain Province of western North Carolina and also occurs in a few streams of the Piedmont Plateau.

This species was found in the Hiwassee River at Station H-1, H-2, and H-3.

E. Federal and State Status

No federal or state status.

***Cyprinus carpio*, common carp**

A. Identification

The common carp is a member of the Family Cyprinidae (the minnows) in the Order Cypriniformes. This is a stout, laterally compressed fish with a long dorsal fin and an arched back. The head is small, with a long snout, and small eyes. The mouth has two barbels at each end of the upper jaw. There is a stiff, serrated spine on the first ray of the dorsal and anal fins. Body color is olivaceous to slate gray above, grading to bronze or gold laterally with a yellowish white belly. Fin color is generally orange, golden or light olive. Males become darker during the breeding season. The dorsal fin has 15-23 rays and the anal fin has 4-6 rays. The pectoral fin has 14-17 rays and the pelvic fin has 8-9 rays.

B. Range

The common carp is a native of Eurasia that was introduced into North America in the 1800's. They are now widely established throughout North America north to southern Canada.

C. Habitat

Common carp habitat includes large streams, rivers, and reservoirs. It prefers soft-bottomed, weedy pools in streams, although it probably adapts to a wider variety of conditions than almost any native fish. The common carp is tolerant of all bottom types and is found in clear or turbid waters.

D. Local Occurrence

The common carp occurs in reservoirs and sluggish rivers in all three physiographic provinces of North Carolina.

This species was found in the Hiwassee River at Station H-1.

E. Federal and State Status

No federal or state status.

***Hybopsis amblops*, bigeye chub**

A. Identification

The bigeye chub is a member of the Family Cyprinidae (the minnows) in the Order Cypriniformes. It is a slender, barbeled minnow with a large eye and a well-developed dark lateral stripe. The mouth is small and inferior with a tiny barbel at the posterior tip of the jaw. The snout is blunt and rounded and overhangs the mouth. Body color is olive on the back, silver on the sides, and white on the belly. The fins are colorless and sharply pointed. The dark lateral band extends from the base of the caudal fin forward onto the snout. Dark spots mark the lateral line anteriorly. The dorsal fin has 8-9 rays and the anal fin has 8 rays. The pectoral fin has 13-14 rays and the pelvic fin has 8 rays.

B. Range

The bigeye chub is native to the southern Great Lakes Basin, and the Mississippi Basin from the Illinois River through the entire Ohio, Cumberland, and Tennessee river drainages. It occurs west of the Mississippi River from the Central Arkansas River northeast to the Meramec River, a tributary to the lower Missouri River.

C. Habitat

Bigeye chub habitat includes larger creeks and small to medium rivers in areas of little to moderate current. It is typically absent from large rivers and headwater areas of streams. It is frequently found over sandy or silty sand substrates and is often associated with aquatic vegetation. This minnow cannot survive where siltation is extreme.

D. Local Occurrence

The bigeye chub occurs only in western North Carolina streams of the Appalachian Mountain Province in the Hiwassee, French Broad, and Toe drainage basins.

This species was found in the Hiwassee River at Stations H-1 and H-2.

E. Federal and State Status

No federal or state status.

***Erimystax insignis*, blotched chub**

A. Identification

The blotched chub is a member of the Family Cyprinidae (the minnows) in the Order Cypriniformes. A fleshy barbel is present at the posterior tip of the maxilla and the premaxilla is separated from the snout by a groove that is continuous along the entire posterior margin of the upper jaw. The lateral line is typically marked with a horizontal row of dark, vertically elongate rectangles. The dorsal area is streaked with alternating dark spots and overall background body color is silvery gray. Breeding males have a hard pad on the cheek region and they may develop tiny breeding tubercles on the head, fins, and most body scales. The dorsal fin has 8-9 rays and the anal fin has 6-7 (usually 7) rays. The pectoral fin has 15-17 rays and the pelvic fin has 8 rays.

B. Range

The blotched chub is endemic to, and occurs throughout most of, the Cumberland and Tennessee River drainages.

C. Habitat

Blotched chub habitat includes riffle areas in moderate-sized creeks to small rivers over coarse substrates of gravel and cobble.

D. Local Occurrence

The blotched chub occurs in western North Carolina streams in the Hiwassee, French Broad, and Toe drainage basins of the Appalachian Mountain Province.

This species was found in the Hiwassee River at Stations H-1 and H-2.

E. Federal or state status

The blotched chub is listed as W2 by the North Carolina Wildlife Resources Commission and as a forest concern species by the U.S. Forest Service. (Watch Category 2 includes species that are rare to uncommon in North Carolina, but are not necessarily considered to be declining or otherwise in trouble). The blotched chub is not listed by the U.S. Fish and Wildlife Service.

***Luxilus coccogenis*, warpaint shiner**

A. Identification

The warpaint shiner is a member of the Family Cyprinidae (the minnows) in the Order Cypriniformes. This is a large, deep bodied, active, and brightly colored shiner (maximum 4.7 inches TL). Adults and large young have pale basicaudal areas and red-orange at the anterior dorsal fin base, on the snout, and on the posterior margin of the preopercle. A black vertical bar is present on the dorsal fin and a dark humeral bar is present behind the operculum. Breeding males have large tubercles on the tip of the snout and in 2-3 rows along the lower jaw and red develops on the fins and body. Tubercles are also present on all fins, although not as common on the caudal fin. The dorsal fin has 8-9 rays and the anal fin has 8-10 rays. The pectoral fin has 15-17 rays and the pelvic fin has 8 rays.

B. Range

The warpaint shiner is found in the upper Tennessee River drainage. It also occurs in the upper Savannah and Santee river drainages of Georgia and the Carolinas, and in the upper New River system.

C. Habitat

Warpaint shiner habitat includes cool, clear streams with rocky substrates where it occurs in areas of moderate to swift currents. It is tolerant of water temperatures sufficiently cold to support trout populations.

D. Local Occurrence

The warpaint shiner occurs only in western North Carolina waters of the Appalachian Mountain Province.

This species was found in the Hiwassee River at Stations H-1 and H-2.

E. Federal and State Status

No federal or state status.

***Nocomis micropogon*, river chub**

A. Identification

The river chub is a member of the Family Cyprinidae (the minnows) in the Order Cypriniformes. This is a robust, rather cylindrical fish (maximum 13 inches TL) with orange-red fins. The body color is dark olivaceous above to dusky yellowish on the belly. The large, horizontal and slightly subterminal mouth has a barbel at the tip of the maxilla. The small eyes are remote from the mouth and are situated near the dorsal border of the head. Breeding males develop swollen heads, with pinkish-purple coloration on the body, and nuptial tubercles that are restricted to the area from the eyes to the snout tip. The dorsal fin has 8 rays and the anal fin has 7 rays. The pectoral fin has 15-19 rays and the pelvic fin has 8 rays.

B. Range

The river chub is widespread in the Great Lakes basin (except Lake Superior), the upper and middle Ohio and Tennessee river drainages, the upper Cumberland River drainage, and the Atlantic Coast drainages from the Susquehanna River south through the James River. It is also native in the upper Savannah River drainage and is present in the Santee River drainage and portions of the Coosa River system of Mobile Basin (likely introduced).

C. Habitat

River chub habitat includes large creeks to small rivers with rapid current, cool waters, and rocky substrates.

D. Local Occurrence

The river chub occurs only in western North Carolina waters of the Appalachian Mountain Province.

This species was found in the Hiwassee River at Stations H-1 and H-2.

E. Federal and State Status

No federal or state status.

***Cyprinella galacturus*, whitetail shiner**

A. Identification

The whitetail shiner is a member of the Family Cyprinidae (the minnows) in the Order Cypriniformes. This is a large, slab-sided shiner (maximum 6 inches TL) with small eyes, a terminal oblique mouth, and two conspicuous white patches at the base of the caudal fin. The two white patches may merge into one vertical patch. The body is silver and the fins are clear, except for a dusky black blotch on the last 2 or 3 membranes of the dorsal fin. The base of the anal fin is well pigmented. Dorsal, pectoral, and caudal fins are salmon-pink or red on breeding males while other fins are milky white. Males also develop breeding tubercles on the head, dorsum, fins, and body scales throughout the body (except on the breast). The dorsal fin has 8 rays and the anal fin has 8-10 rays. The pectoral fin has 14-17 rays and the pelvic fin has 8 rays.

B. Range

The whitetail shiner is common in all upland provinces of the Cumberland and Tennessee river drainages, and is also present in the headwaters of the Savannah and Santee river drainages of the Atlantic slope. Likely introduced in the Big Sandy and upper New systems of the Ohio River drainage. Disjunct populations are widespread in the Ozark region of southern Missouri and northern Arkansas.

C. Habitat

Whitetail shiner habitat includes clear upland creeks and rivers with swift runs or flowing pools and it has some tolerance for upstream storage reservoirs. Preferred substrates include silt-free gravel, cobble, and boulders.

D. Local Occurrence

The whitetail shiner is restricted to the Tennessee drainages and the headwaters of the Savannah, Broad, and Catawba drainage basins of the Appalachian Mountain Province in western North Carolina.

This species was found in the Hiwassee River at Stations H-1, H-2, and H-3.

E. Federal and State Status

No federal or state status.

***Notropis leuciodus*, tennessee shiner**

A. Identification

The tennessee shiner is a member of the Family Cyprinidae (the minnows) in the Order Cypriniformes. This is a slender bodied minnow with bright silver sides and a dark gray back (maximum 4.3 inches TL). The lateral-line canal and a rectangular black basicaudal spot are always visible. Breeding males develop bright red coloration on the head, anterior body, pectoral fins, and bases of the dorsal, pelvic, and caudal fins. Males also develop breeding tubercles on the head, most body scales, and on the pelvic, anal, and dorsal fins. The dorsal fin has 7-8 rays and the anal fin has 8-9 rays. The pectoral fin has 14-16 rays and the pelvic fin has 8 rays.

B. Range

The tennessee shiner occurs in the Tennessee and Cumberland river drainages, the Barren (Ohio) River system, and the upper Savannah River drainage. It has been introduced in the New River system.

C. Habitat

Tennessee shiner habitat includes pool areas to swift waters flowing over gravel to boulder and bedrock substrates in small creeks to large rivers. It is not tolerant of reservoirs.

D. Local Occurrence

The tennessee shiner occurs in the Tennessee, New, and Savannah drainages of western North Carolina in the Appalachian Mountain Province.

This species was found in the Hiwassee River at Stations H-1 and H-2.

E. Federal and State Status

No federal or state status.

***Notropis photogenis*, silver shiner**

A. Identification

The silver shiner is a member of the Family Cyprinidae (the minnows) in the Order Cypriniformes. This is a slender, slab-sided minnow that is straw-colored on the dorsum and has bright silver sides that obscure the dark lateral stripe. The dorsal margin of the lateral stripe is bluntly saw-toothed on the anteriodorsal margin and the origin of the dorsal fin is directly above the origin of the pelvic fins. Bright breeding colors do not develop in this minnow. Small breeding tubercles cover the head, body scales, and fins. The dorsal fin has 8 rays and the anal fin has 10-11 rays. The pectoral fin has 15-18 rays and the pelvic fin has 9 rays.

B. Range

The silver shiner occurs in Lake Erie tributaries south through the Ohio, Cumberland, and Tennessee River drainages.

C. Habitat

Silver shiner habitat includes large creeks to small rivers with firm substrates. It is associated with clear waters and flowing pools with moderate to swift currents. This shiner appears to like deeper waters than other *Notropis* species; however, schools often feed near the surface of the water, occasionally jumping from the water in pursuit of flying insects.

D. Local Occurrence

The silver shiner occurs in the Tennessee and New river drainages in the Appalachian Mountain Province of western North Carolina.

This species was found in the Hiwassee River at Stations H-1, H-2, and H-3.

E. Federal and State Status

No federal or state status.

***Notropis rubellus*, rosyface shiner**

A. Identification

The rosyface shiner is a member of the Family Cyprinidae (the minnows) in the Order Cypriniformes. This is a very slender, somewhat compressed, silvery minnow. It has a long, sharply pointed snout and a large terminal and slightly oblique mouth without any barbels. The dorsal fin origin is well behind the pelvic fin origin. The back is olive colored and the sides are silvery white with a thin iridescent green stripe above the lateral line. A narrow, dark middorsal stripe is well developed posteriorly, but fades anteriorly. The belly is silvery white and the fins are clear. Breeding males have red or orange on the head and body, and small tubercles on the head, body, and pectoral fin. The base of the dorsal fin is pink in adults throughout the year. The dorsal fin has 8 rays and the anal fin has 9-11 rays. The pectoral fin has 13-14 rays and the pelvic fin has 8 rays.

B. Range

The rosyface shiner is widespread in the Great Lakes and the upper Mississippi drainages and in the Red River system of the Hudson Bay drainage north to southern Manitoba and Ontario. It also occurs on the Atlantic slope south through the James River drainage, throughout the Ohio, Cumberland, and Tennessee river drainages, and in the Ozark region from the lower Missouri drainage south through the Red River system of southern Oklahoma.

C. Habitat

Rosyface shiner habitat includes large creeks and small rivers with clear water and cobble, boulder, and bedrock substrates. It often occurs in areas of considerable current. The rosyface shiner reportedly migrates from the foot of riffles in the spring and summer to deeper pool areas in the fall and winter.

D. Local Occurrence

The rosyface shiner occurs in the Tennessee and New river drainages in the Appalachian Mountain Province of western North Carolina.

This species was found in the Hiwassee River at Station H-1.

E. Federal and State Status

No federal or state status.

***Notropis spectrunculus*, mirror shiner**

A. Identification

The mirror shiner is a member of the Family Cyprinidae (the minnows) in the Order Cypriniformes. This elongate, cylindrical shiner is silver on the sides, gray on the back, and has a prominent triangular black basicaudal spot. The dorsal fin rays are outlined with melanophores and both the dorsal and anal fin margins are straight edged or rounded. The head is flat between the eyes. The lateral stripe is faint to absent. Breeding males have red and black pigment on the leading edge of the pectoral fin and the dorsal and caudal fins have a centrally located reddish area. Breeding males also have small tubercles on the head, pectoral fin, and dorsal fin. Tubercles are absent from other fins and body scales. The dorsal fin has 8-9 rays and the anal fin has 7-9 rays. The pectoral fin has 13-16 rays and the pelvic fin has 8 rays.

B. Range

The mirror shiner is restricted mostly to Blue Ridge habitats of the upper Tennessee River drainage from the Clinch and Powell river systems of Virginia south through the Hiwassee River system. There are several distinct Atlantic slope populations in the Savannah and Santee River drainages.

C. Habitat

Mirror shiner habitat includes mountain creeks and rivers where it occurs in rocky pools and runs.

D. Local Occurrence

The mirror shiner occurs in the mountain streams of western North Carolina in the Appalachian Mountain Province, including the Hiwassee, Little Tennessee, Savannah, Pigeon, French Broad, Broad, and Toe drainage basins.

This species was found in the Hiwassee River at Stations H-1, H-2, and H-3.

E. Federal and State Status

No federal or state status.

***Rhinichthys cataractae*, longnose dace**

A. Identification

The longnose dace is a member of the Family Cyprinidae (the minnows) in the Order Cypriniformes. This minnow has a frenum and a barbel at the tip of the maxilla. The snout is rather long and protrudes beyond the lower lip of the inferior mouth. Body color is reddish brown to dark olivaceous on the back and upper sides, and there scattered dark colored scales on the sides that may form faint stripes. The lateral stripe is usually absent posteriorly in adults, but is present in juveniles. Breeding males have red lips and red at the bases of the pectoral, pelvic, and anal fins. Males develop breeding tubercles on the head, body, and fins – except usually not on anal and pelvic fins. The dorsal fin has 8-9 rays and the anal fin has 7 rays. The pectoral fin has 13-15 rays and the pelvic fin has 8 rays.

B. Range

The longnose dace is wide ranging in the mountainous regions of North America, including the Rockies and the northwest coastal ranges as well as the eastern ranges. Present in the north central glaciated regions. In the southeast, mostly restricted to the Blue Ridge region.

C. Habitat

Longnose dace habitat includes swift, gravel riffle areas in cool to cold streams, which includes trout streams. It may also occur in cold lakes.

D. Local Occurrence

The longnose dace occurs in western North Carolina streams in the Appalachian Mountain Province.

This species was found in the Hiwassee River at Stations H-1, H-2, and H-3.

E. Federal and State Status

No federal or state status.

***Semotilus atromaculatus*, creek chub**

A. Identification

The creek chub is a member of the Family Cyprinidae (the minnows) in the Order Cypriniformes. This is a large minnow (maximum 12 inches TL) with a large head and a very large, oblique mouth (the upper jaw extends behind the front of the eye). There is a triangular, flaplike barbel in the groove between the maxilla and the snout just ahead of the corner of the mouth. Body color is dark gray to brown on the back, with cream-colored sides that are interrupted by a conspicuous dark lateral stripe. The belly is silvery white with a few dark speckles and fins are often yellow. A dark spot is present at the anterior base of the dorsal fin. Breeding males develop a rosy band along the side and red around the dark dorsal fin spot. Males develop breeding tubercles on the head, body, and fins. The dorsal fin has 8 rays and the anal fin has 7-9 rays. The pectoral fin has 13-18 rays and the pelvic fin has 8 rays.

B. Range

The creek chub is abundant throughout much of eastern North America, and avoids only the lowest Coastal Plain areas.

C. Habitat

Creek chub habitat includes small, clear gravel bottomed headwater streams and pool areas in intermittent streams that have available escape cover. It is reported to be somewhat tolerant of pollution and turbidity. The creek chub avoids larger streams having a continuous strong flow and a variety of competing fishes.

D. Local Occurrence

The creek chub occurs in streams and a few reservoirs of the Appalachian Mountain Province and the Piedmont Plateau of North Carolina. It occurs only in the most western streams of the Coastal Plain.

This species was found in the Hiwassee River at Station H-3.

E. Federal and State Status

No federal or state status.

***Hypentelium nigricans*, northern hogsucker**

A. Identification

The northern hogsucker is a member of the Family Catostomidae (the suckers) in the Order Cypriniformes. This hogsucker has a massive head and a slender, tapering, cylindrical body with four dark saddles across the back. The eyes are far back on the head and directed upward. The lips are fleshy and papillose, and the snout is long and strongly decurved. The head is rather squarish and the space between the eyes is broad and distinctly concave. The pectoral fins are large and expansive. Body color is reddish brown to olive above with yellow to white sides and a white belly. Fins are plain or with a few dark speckles, and the lower fins are usually tinged with orange. Breeding males develop minute tubercles densely covering the head, anal, pelvic, and caudal fins. The dorsal fin has 10-12 rays and the anal fin has 7 rays. The pectoral fin has 15-18 rays and the pelvic fin has 9 rays.

B. Range

The northern hogsucker is a wide-ranging upland species of the Mississippi, the eastern Great Lakes, and the middle Atlantic drainages. Disjunct southern populations occur on the Coastal Plain in the relatively higher gradient streams of southern Mississippi and eastern Louisiana.

C. Habitat

Northern hogsucker habitat includes clear, permanent streams with gravel or cobble bottoms. It generally prefers deep riffles, raceways, or pools having a current. The northern hogsucker is tolerant of coldwater streams and occurs in reservoirs. It is intolerant of pollution, silt, and the modification of stream channels. The northern hogsucker usually lies on the bottom of the stream where it is almost invisible because of its cryptic, mottled coloration.

D. Local Occurrence

The northern hogsucker occurs mainly in the streams and reservoirs of the Appalachian Mountain Province of western North Carolina. However, it also occurs in some waters of the Piedmont Plateau and the Coastal Plain of North Carolina.

This species was found in the Hiwassee River at Stations H-1, H-2, and H-3.

E. Federal and State Status

No federal or state status.

***Moxostoma carinatum*, river redhorse**

A. Identification

The river redhorse is a member of the Family Catostomidae (the suckers) in the Order Cypriniformes. This is a moderately heavy-bodied redhorse with a short dorsal fin, a large head, a large mouth that has heavy plicate lips, and a thick pharyngeal arch that has molarlike teeth. The rear margin of the lower lip forms a slight V-shaped angle. Body color is silver to bronze and the scales of the back and upper sides have a crescent-shaped dark spot at the base. The caudal fin base has a thin, black pencil line along the margin of the last scale row. The dorsal and caudal fins are bright red and the lower fins are orange to red. In adults, the dorsal lobe of the caudal fin is triangular and sharply pointed in contrast to the more rounded lower caudal lobe. Breeding males have large tubercles on the head and smaller tubercles on the anal and caudal fins. The dorsal fin has 12-15 rays and the anal fin has 7 rays. The pectoral fin has 16-17 rays and the pelvic fin has 18 rays.

B. Range

The river redhorse occurs in the Mississippi Basin above the Fall Line, in some Great Lakes tributaries, and the eastern Gulf Coast drainages east to the Escambia River. It is apparently disappearing from many Plains systems.

C. Habitat

River redhorse habitat includes clear, swift waters of medium to large rivers with gravel and cobble substrates. It rarely enters smaller streams except during the breeding season; however, it is sometimes found in reservoirs.

D. Local Occurrence

The river redhorse occurs in limited streams and reservoirs in North Carolina. It is reported from the Hiwassee, Little Tennessee, and French Broad drainage basins of the Appalachian Mountain Province and from one location in the Yadkin drainage basin of the Piedmont Plateau.

This species was found in the Hiwassee River at Stations H-1 and H-2.

E. Federal and State Status

No federal or state status.

***Moxostoma duquesnei*, black redhorse**

A. Identification

The black redhorse is a member of the Family Catostomidae (the suckers) in the Order Cypriniformes. This is a slender, elongate redhorse with a short, slightly concave dorsal fin and a rather small, horizontal mouth with thin plicate lips. The halves of the lower lip meet to form a shallow V. The pharyngeal teeth are comb-like and compressed. The snout is rounded and swollen and the caudal peduncle is slender. Body color is gray to brown above, grading to silver on the sides, and the belly is white. The dorsal and caudal fins are usually slate colored, but they may be red in the clear waters of trout streams. The lower fins are orangish. Breeding males have small, inconspicuous tubercles on the head, the fins, and on most body scales. The dorsal fin has 11-15 rays and the anal fin has 7 rays. The pectoral fin has 15-19 rays and the pelvic fin has 18-20 rays.

B. Range

The black redhorse occurs in the Mississippi Basin uplands, the southern Great Lakes tributaries, and the Mobile Basin above the Fall Line.

C. Habitat

Black redhorse habitat includes clear, cool, larger creeks and small rivers with gravel and cobble substrates. It is intolerant of silty waters and is uncommon in big rivers and rarely occurs in reservoirs. When found with the golden redhorse, the black redhorse tends to predominate in short, rocky pools with current, whereas the golden redhorse prefers large pools and backwaters without noticeable current.

D. Local Occurrence

The black redhorse occurs in limited streams and reservoirs of western North Carolina in the Appalachian Mountain Province.

This species was found in the Hiwassee River at Stations H-1, H-2, and H-3.

E. Federal and State Status

No federal or state status.

***Moxostoma erythrurum*, golden redhorse**

A. Identification

The golden redhorse is a member of the Family Catostomidae (the suckers) in the Order Cypriniformes. This is a moderately stout redhorse with a short, concave dorsal fin and a large, horizontal mouth that has many bladelike pharyngeal teeth. The rear margin of the lower lip forms a distinctly acute V-shaped angle. The caudal peduncle is short and heavy. Body color is olivaceous above, silvery brown on the sides, and the belly is white. The side and back scales do not have dark spots at the bases. The caudal fin is slate-colored and the paired fins are usually dusky, or they may have some reddish-orange pigment. Young-of-year have three diffuse, dusky saddle bands. Breeding males have a dark horizontal midlateral stripe, above which is a golden area and then another dark stripe. Males develop breeding tubercles on the head, body scales, and fins. The dorsal fin has 12-14 rays and the anal fin has 7 rays. The pectoral fin has 16-19 rays and the pelvic fin has 18 rays.

B. Range

The golden redhorse occurs in the Mississippi Basin (mostly above the Fall Line), the Mobile Basin, in Great Lakes tributaries, and some middle Atlantic Coastal drainages.

C. Habitat

Golden redhorse habitat includes larger creeks and small rivers with gravel and cobble substrates, where it often occurs with the black redhorse. It is more tolerant of larger rivers than the black redhorse, often occurring with the river, silver, and shorthead redhorses in larger rivers.

D. Local Occurrence

The golden redhorse occurs in limited streams and reservoirs of North Carolina. It is found in the Hiwassee, Little Tennessee, French Broad, and Toe drainage basins of the Appalachian Mountain Province and the Roanoke drainage basin of the Piedmont Plateau and Coastal Plain.

This species was found in the Hiwassee River at Stations H-1 and H-2.

E. Federal and State Status

No federal or state status.

***Moxostoma macrolepidotum*, shorthead redhorse**

A. Identification

The shorthead redhorse is a member of the Family Catostomidae (the suckers) in the Order Cypriniformes. This is a slender redhorse with a slate colored dorsal fin that has a very concave margin and is bright red distally. The small mouth has lower lips that meet to form a straight line and a distinctive pea shaped thickening is located on the middle of the upper lip. Body color is olivaceous above, golden yellow on the sides, and the belly is white. The back and upper side scales have a crescent shaped dark spot at the base. The caudal fin is bright red and the upper and lower lobes are very asymmetrical (the upper lobe is more sharply pointed and longer than the lower lobe). Lower fins are yellowish to orange red. Males have breeding tubercles on the head, body, and fins. The dorsal fin has 11-14 rays and the anal fin has 7 rays. The pectoral fin has 16-18 rays and the pelvic fin has 18-20 rays.

B. Range

The shorthead redhorse is widely distributed through the entire Mississippi Basin mostly above the Fall Line, in the Great Lakes, the Hudson Bay, and the middle Atlantic Coastal drainages.

C. Habitat

Shorthead redhorse habitat includes large rivers over gravel to boulder substrates with swift water, and it occurs occasionally in reservoirs. The shorthead redhorse avoids small streams inhabited by the black and golden redhorses.

D. Local Occurrence

The shorthead redhorse occurs in streams and reservoirs in all three physiographic provinces of North Carolina, although its occurrence is quite limited.

This species was found in the Hiwassee River at Stations H-1 and H-2.

E. Federal and State Status

No federal or state status.

***Moxostoma sp.*, sicklefin redhorse**

A. Identification

The sicklefin redhorse is a member of the Family Catostomidae (the suckers) in the Order Cypriniformes. A large fish, to 650-millimeters and 3125 grams, it is easily identified from other redhorse species by its highly falcate dorsal fin which, when depressed, shows the first few anterior rays extending beyond the tip of the most posterior dorsal ray. The body is compressed and elongate with a rounded snout, which is relatively bulbous in adults. The lips are medium to large and are plicate with branched furrows in the lower lip which is smaller than the upper lip and is straight or nearly so on the posterior edge. Dorsal rays number from 12 to 14, and pelvic rays may be 9-9 or 10-10. Scale counts are (43)44-46(47) for the lateral line, 12(13) for circumpeduncle, and (31)32-35(37) for the circumbody scale count. Males in breeding season exhibit nuptial tubercles on the anal and caudal fins. Body coloration varies from olive to coppery to brassy. Ventral fins are dusky to dark with pale-edges and are frequently tinted yellow to orange. The dorsal fin is olive but may be partly red. The caudal fin is distinctly red distally (Jenkins 01).

B. Range

The sicklefin redhorse appears to be limited to three (3) Tennessee River drainages, and two (2) lakes located primarily in southwestern North Carolina. The lowest elevation recorded in their range is Fontana Lake in Swain County. From Fontana, sicklefin redhorse have been documented to occur upstream to Ela Dam on the Oconaluftee (a tributary to the Tuckasegee River), and to Emory Dam on the Little Tennessee River in Franklin. They are also found in Hiwassee Lake upstream to Mission Dam and two of its tributaries, the Valley River and Brasstown Creek whose headwaters are in northwestern Georgia (Jenkins 99).

C. Habitat

Sicklefin redhorse are found in cool to warm streams with moderate gradients ranging in width from 20-meters to 100-meters. In these lotic habitats they can be found from bank to bank at almost any depth or flow as long as it is over gravel, cobble and boulder substrate. In lentic habitats, sicklefin are found in deep clear lakes with steep banks.

D. Local Occurrence

The sicklefin redhorse is strictly limited to southwestern North Carolina streams and lakes and a small tributary in northwest Georgia within the Appalachian Mountain Province.

This species was found in the Hiwassee River at Stations H-1 and H-2.

E. Federal and State Status

The sicklefin redhorse is listed as a rare species by the North Carolina Wildlife Resources Commission, but has no designation from the federal government, the U.S. Fish and Wildlife Service or the U.S. Forest Service.

***Ictalurus punctatus*, channel catfish**

A. Identification

The channel catfish is a member of the Family Ictaluridae (the North American freshwater catfishes) in the Order Siluriformes. This is a slender, elongate catfish with a deeply forked caudal fin and a free adipose fin. The upper jaw protrudes beyond the lower jaw. The anal fin is rounded and the premaxillary tooth pad on the upper jaw does not have backward extensions. The pectoral spine has a well-developed posterior serrae. The body is blue-gray on the back and sides, grading to yellowish-white on the belly. The sides have small dark randomly scattered spots on all but the largest adults and the smaller young. Median fins have dusky to black borders. Breeding males have blue-black enlarged heads, thickened lips, and the head has low rounded pads above and behind the eyes. The dorsal fin has 6 rays and the anal fin has 24-29 rays. The pectoral fin has 9 rays and the pelvic fin has 8 rays.

B. Range

The native range of the channel catfish is uncertain because it has been widely introduced, but probably included all central drainages of the United States and southern Canada, and some Atlantic slope drainages of the northern and southern United States.

C. Habitat

The channel catfish habitat includes medium to large warm rivers with alternating pool and riffle habitats where it spends the day associated with some cover in quiet pool areas and forages in both pools and swifter waters during the night. It adapts well to additional habitats such as reservoirs, natural lakes, farm ponds, and even the larger trout streams.

D. Local Occurrence

The channel catfish occurs in limited streams and reservoirs throughout North Carolina. In western North Carolina, the channel catfish occurs in the Savannah, Hiwassee, Little Tennessee, French Broad, Toe, and New drainage basins.

This species was found in the Hiwassee River at Stations H-1 and H-2.

E. Federal and State Status

No federal or state status.

***Ambloplites rupestris*, rockbass**

A. Identification

The rockbass is a member of the Family Centrarchidae (the sunfishes) in the Order Perciformes. This is a deep-bodied sunfish that is fully scaled. The dorsal, caudal, and anal fins are usually mottled with brown and the anal fin of the male has a black marginal band. Horizontal rows of dark scale spots occur on the sides below the complete lateral line while less obvious horizontal spots may be present above the lateral line. Body color is olive to brassy green with uniform mottling that can change drastically with surroundings. There are obscure dark blotches present on the back in the predorsal region and the undersides are dusky white. The eye is often rimmed in red and the posterior edge of the operculum lacks a sharp spine. Pelvic fins are beneath the pectorals and have one spine and five soft rays. The caudal fin is symmetrical with 17 principal rays and the well-joined dorsal fins have 10-13 spines and 10-12 soft rays. The anal fin has 5-7 spines and 9-11 soft rays.

B. Range

The rockbass is widespread and abundant in the Mississippi River, the Great Lakes, and the southern Hudson Bay basins. It is also native from Connecticut through Delaware river drainages on the Atlantic Coast. The rockbass was introduced to the Atlantic slope, the New River, and the Ozarks.

C. Habitat

Rockbass habitat includes sheltered pool areas in creeks and rivers, from warmwater streams to trout streams; and they are occasionally encountered in reservoirs near rocky shores. Rockbass are often found in association with smallmouth bass and trout. They are usually found near cover such as boulders, root complexes, brush, or water willow (*Justicia*) beds. Rockbass appear to be intolerant of high turbidity and siltation. In northern areas of its range, it is found in small, cool, weedy lakes or littoral regions of larger lakes.

D. Local Occurrence

The rockbass occurs only in western North Carolina in the Appalachian Mountain Province and a few locations in the Piedmont Plateau.

This species was found in the Hiwassee River at Stations H-1 and H-3.

E. Federal and State Status

No federal or state status.

***Lepomis auritus*, redbreast sunfish**

A. Identification

The redbreast sunfish is a member of the Family Centrarchidae (the sunfishes) in the Order Perciformes. It is a deep bodied, moderately compressed sunfish that is fully scaled. The redbreast sunfish has a long, narrow opercular flap that is uniformly dark to its margin. Its mouth is small with the upper jaw extending to just past the front of the eye. Palatine teeth are present in the roof of the mouth. There are no horizontal lines above the complete lateral line and the posterior edge of the operculum lacks a sharp spine. The back and upper sides are olive to blue-green and the lower sides are reddish orange to yellow. On breeding males, the breast, belly, and lower head are bright red. The soft dorsal fin and the upper lobe of the caudal fin have yellow margins, which are bright orange to scarlet on breeding males. There are usually bright blue, wavy lines on the cheeks and snout. Pectoral fins are short and rounded with 13-15 fin rays. The pelvic fins have one spine and five soft rays and the caudal fin is symmetrical with 17 principal rays. The well-joined dorsal fins have 10-11 spines and 10-12 soft rays. The anal fin has 3 spines and 9-10 rays (usually 10).

B. Range

This species was originally native to Atlantic Coast drainages east of the Appalachian Mountains and the eastern Gulf slope. Today, populations occur in these areas as well as in Arkansas, Oklahoma, and Texas.

C. Habitat

The redbreast sunfish is mainly a stream-adapted species in its native range, but it has become well established in a variety of habitats from small creeks to rivers and reservoirs. In streams with rapids, they move to deeper stretches with gravel or rocky bottoms and frequently concentrate around boulders, limestone outcroppings, logs or aquatic vegetation.

D. Local Occurrence

The redbreast sunfish occurs throughout North Carolina, although it is less common in the Coastal Plain of eastern North Carolina.

This species was found in the Hiwassee River at Stations H-1 and H-2.

E. Federal and State Status

No federal or state status.

***Lepomis cyanellus*, green sunfish**

A. Identification

The green sunfish is a member of the Family Centrarchidae (the sunfishes) in the Order Perciformes. This is a robust, elongate sunfish with a large mouth (the upper jaw usually extends to about the middle of the eye). The operculum is stiff to its margin and the short, round earflap is black with a white or yellow-orange margin. The back and sides are olive to bluish green (females may have several dark vertical bars on the sides), the belly is yellow-orange, and the sides of the head have iridescent blue or green mottlings. A black blotch is usually present near the posterior base of the dorsal and anal fins, and the pectoral fins are short and rounded. Fins of breeding males become dark and the margin of the caudal, anal, and pelvic fins are whitish orange. The well-joined dorsal fins have 9-11 spines and 10-12 soft rays. The anal fin has 3 spines and 8-11 soft rays.

B. Range

The green sunfish is native to central North America but has been widely introduced elsewhere. It also occurs in the Atlantic and Pacific slopes and the Southwest.

C. Habitat

Green sunfish is a highly adaptable species and can be found in almost every type of aquatic habitat (from small intermittent streams to ponds, lakes, and occasionally the margins of larger streams). It is a relatively sedentary fish with a very small home range. It is tolerant of a wide range of ecological conditions, particularly to extremes of turbidity, dissolved oxygen, temperature, and flow.

D. Local Occurrence

The green sunfish mainly occurs in streams and reservoirs of the Piedmont Plateau of North Carolina. However, it also occurs in several drainage basins in the Appalachian Mountain Province and the Coastal Plain.

This species was found in the Hiwassee River at Station H-1.

E. Federal and State Status

No federal or state status.

***Lepomis gulosus*, warmouth**

A. Identification

The warmouth is a member of the Family Centrarchidae (the sunfishes) in the Order Perciformes. This is a moderately large, robust sunfish with a large head and mouth (the upper jaw extends to or beyond the middle of the eye). Three or four prominent dark reddish brown lines radiate backwards from a red eye to the margin of the gill cover. The tongue has a small patch of teeth. The short, stiff opercular flap has a black spot and is tipped with orange. The back and sides are olive-brown and mottled or barred with dark purplish brown. Smaller individuals are more purple than brown. The belly is light yellow. Fins are dark and strongly mottled or banded with brown, especially the soft dorsal and anal fins. The pelvic fins have white edges. The dorsal fin has 9-11 spines and usually 10 soft rays. The anal fin has 3 spines and 9-10 soft rays.

B. Range

The warmouth occurs in the Mississippi River and the Great Lakes basins, and in the Atlantic and Gulf coastal drainages, above and below the Fall Line, from Chesapeake Bay through the Rio Grande. Introduced populations occur in the Pacific slope.

C. Habitat

Warmouth habitat includes oxbow lakes, quiet waters of bayous and rivers, and swamps having mud and detritus bottoms. It prefers clear water and thick growths of aquatic vegetation and is often found near submerged stumps, logs, and cypress knees. It will tolerate moderate levels of turbidity and does well in impoundments.

D. Local Occurrence

The warmouth mainly occurs in streams and reservoirs of the Coastal Plain of North Carolina. However, it also occurs in several drainage basins in the Appalachian Mountain Province and the Piedmont Plateau.

This species was found in the Hiwassee River at Stations H-2, H-3, and the Mission Reservoir.

E. Federal and State Status

No federal or state status.

***Lepomis macrochirus*, bluegill**

A. Identification

The bluegill is a member of the Family Centrarchidae (the sunfishes) in the Order Perciformes. This is a deep bodied, slab-sided sunfish that is fully scaled. The upper jaw of the small, oblique mouth does not extend past the front of the eye. Pectoral fins are long and pointed with 13-14 fin rays. The opercular flap is entirely black and it is long and flexible in adults, but shorter in juveniles. The sides are dark bluish-green with about 8-10 sets of double darker vertical bars that may be chain-like in appearance. The belly is a deep orange to rust color or white. The chin and lower part of the operculum are blue. In breeding males, all colors are more intense and fins become densely pigmented with the pelvic and anal fins turning almost black. A dark spot is present at the posterior base of the soft dorsal fin in adults. The complete lateral line is arched anteriorly. The well-joined dorsal fins have 9-11 spines and 10-12 soft rays. The anal fin has 3 spines and 10-12 soft rays.

B. Range

Occurs throughout the United States and in many countries in the world. Originally only native to eastern and central North America from the Great Lakes area south to northern Mexico, but not in the Atlantic Coastal drainages from Virginia northward.

C. Habitat

Bluegill habitat includes clear, quite, warm waters having at least some aquatic vegetation and other cover, and it is most frequently found in the shallow, shady areas along lake shorelines. Bluegill can live in most waters, except swift-flowing cold trout streams, so it is often found in slow-flowing streams and rivers. It also occurs in coastal estuaries in the less brackish water. The bluegill may sometimes be found in turbid water, but it is intolerant of continuous high turbidity and siltation. The bluegill is often found with largemouth bass.

D. Local Occurrence

The bluegill is found in all physiographic provinces and drainage basins of North Carolina.

This species was found in the Hiwassee River at Stations H-1, H-2, and the Mission Reservoir.

E. Federal and State Status

No federal or state status.

***Micropterus dolomieu*, smallmouth bass**

A. Identification

The smallmouth bass is a member of the Family Centrarchidae (the sunfishes) in the Order Perciformes. This is an elongate bodied, robust sunfish that is fully scaled. It has a moderately large mouth, but the upper jaw usually does not extend past the rear margin of the eye. The sides of the body are uniformly dusky (olive-brown to bronze), without lateral bands, but it may have several separate vertical bars. The lower sides (below the complete lateral line) sometimes have dark spots irregularly arranged but not forming horizontal rows. The cheek has 3-5 conspicuous dark bars radiating back from a commonly reddish eye. The belly is white and often may have a dusky pigment, as do the fins. Pectoral fins have 16-18 rays. The spinous dorsal fin (9-11 spines) is low and broadly joined to the soft dorsal fin (13-15 rays) with a shallow notch between them. The anal fin has 3 spines and 10-11 soft rays (usually 11).

B. Range

The smallmouth bass was native to interior eastern North America west of the Appalachians, but has been widely introduced elsewhere.

C. Habitat

Smallmouth bass habitat includes clear upland creeks, rivers, and lakes near submerged logs, stumps, or rock outcrops. They seem to prefer rocky bottoms and flowing water in streams. They are most often found in reservoirs at steep rocky slopes along submerged river and creek channels. Smallmouth bass are more intolerant to habitat alteration than any other black basses, and they are especially intolerant of high turbidity and siltation.

D. Local Occurrence

The smallmouth bass occurs in the Appalachian Mountain Province and a few areas in the western Piedmont Plateau of North Carolina.

This species was found in the Hiwassee River at Stations H-1 and H-2.

E. Federal and State Status

No federal or state status.

***Micropterus punctulatus*, spotted bass**

A. Identification

The spotted bass is a member of the Family Centrarchidae (the sunfishes) in the order Perciformes. This is a large, slender, elongate bass with a large mouth (the upper jaw reaches to near the center of the eye) and a patch of teeth on the base of the tongue. The spinous dorsal fin is broadly joined to the soft dorsal fin and there is a shallow notch between them. Body color above the complete lateral line is olive-green with darker mottlings, the midside has a broad, longitudinal dark band of more or less confluent blotches, the lower sides are white with regular rows of dark brown or black spots, and the undersides are white. Three dusky bars are generally present on the cheeks and opercles and the eyes are usually reddish. The dorsal fin has 9-11 spines and 11-13 soft rays while the pectoral fins have 14-17 rays. The anal fin has 3 spines and 9-11 soft rays.

B. Range

The spotted bass is native to the Gulf Coastal drainages from San Antonio Bay, Texas east to, but not likely including, the Apalachicola drainage.

C. Habitat

Spotted bass habitat includes sluggish portions of streams of all dimensions and also rocky areas of lakes and reservoirs. They are most abundant in streams having clear water, permanent flow, and gravel bottoms where they are usually found in deep pools. These fish tend to school more than any other member of the black bass family and are often seen chasing shad in open water in lakes.

D. Local Occurrence

The spotted bass occurs in a few streams and reservoirs of North Carolina (mainly in the Appalachian Mountain Province), but is not common in the rest of the state.

This species was found in the Hiwassee River at Stations H-1 and H-2.

E. Federal and State Status

No federal or state status.

***Micropterus salmoides*, largemouth bass**

A. Identification

The largemouth bass is a member of the Family Centrarchidae (the sunfishes) in the Order Perciformes. This is a large, slender, elongate bass with a very large mouth (in adults the upper jaw extends far behind the rear margin of the eye. There are no teeth present on the tongue. The midside of the body is olive to green with a broad, dark longitudinal band. The lower sides (below the complete lateral line) are white with irregularly arranged dark spots that do not form continuous horizontal rows. The undersides are white and the eye is brown. The spinous fins (9-11 spines) and the soft dorsal fins (12-14 rays) are narrowly joined with a deep notch almost completely separating them. Pectoral fins have 14-15 rays and the anal fin has 3 spines and 10-12 soft rays.

B. Range

The largemouth bass was native from the Mississippi Basin and the Great Lakes south to the southern Atlantic slope and Gulf slope through northern Mexico, but has been widely introduced throughout the world.

C. Habitat

Largemouth bass habitat includes clear, quiet, warmer waters in rivers, lakes, reservoirs and ponds, and is often found around aquatic vegetation. They also like other cover such as fallen trees, brush, and stumps. Largemouth bass are more tolerant of both turbidity and salinity than other member of the genus *Micropterus*.

D. Local Occurrence

The largemouth bass occurs throughout North Carolina, however it is uncommon in the higher-gradient streams of the Appalachian Mountain Province.

This species was found in the Hiwassee River at Stations H-1 and H-2.

E. Federal and State Status

No federal or state status.

***Pomoxis nigromaculatus*, black crappie**

A. Identification

The black crappie is a member of the Family Centrarchidae (the sunfishes) in the Order Perciformes. This is a silver sunfish with irregularly scattered black speckles and blotches on the sides that do not form vertical bars. The body is deep and compressed, the head is small, and the mouth is large (upper jaw extends well past the middle of the eye). The lower jaw protrudes beyond the upper jaw and the nape is concave. The spinous and soft dorsal fins are broadly joined, without a notch between them. The back is dark olive to bright green or bluish gray and the belly is silvery white. Dorsal, caudal, and anal fins are strongly mottled with black pigment. Breeding males become much darker, particularly on the head and breast. The dorsal fin has 7-8 spines and 14-16 rays and the anal fin has 6-7 spines and 16-19 rays. The pectoral fin has 13-15 rays and the pelvic fin has 8 rays.

B. Range

The black crappie range has been greatly expanded by introductions. It was native from the Mississippi Valley and Texas eastward, except in the Northeast. Today it also occurs in the Atlantic slope and the western half of North America.

C. Habitat

Black crappie habitat includes clear, cool waters of natural lakes and less turbid reservoirs with vegetation. It is uncommon in small streams. It is most abundant in large reservoirs, natural lowland lakes, and in the quiet backwaters of large rivers where it is almost always found near fallen treetops, standing timber, logs, or other cover. It is intolerant of turbidity and siltation. During the day, black crappie form loose schools near inshore cover and at night the schools generally move to deeper water.

D. Local Occurrence

The black crappie occurs in reservoirs and streams in the three physiographic provinces of North Carolina, however it is more abundant in the Coastal Plain.

This species was found in the Hiwassee River at Station H-1.

E. Federal and State Status

No federal or state status.

***Etheostoma blennioides*, greenside darter**

A. Identification

The greenside darter is a member of the Family Percidae (the perches) in the Order Perciformes and is the largest species in the genus *Etheostoma* (maximum TL of 6.5 inches). This is a moderately slender darter with a blunt snout that overhangs an inferior mouth. A frenum (a fleshy bridge that holds the front of the upper jaw bone to the snout) is present, but is often not evident because it is deep within the groove between the upper lip and snout. Body color is yellow-green with 6-7 dark green to brown saddles. The 6-7 lateral U- or W-shaped blotches are dark green. The upper sides have brownish red spots and small blotches. Both of the dorsal fins are green with basal red bands and the other fins are green. The belly is yellowish white to dusky. Gill membranes are broadly connected and the greenside darter has a complete lateral line. The dorsal fin has 12-14 spines and 12-14 soft rays. The anal fin has 2 spines and 7-9 soft rays. The pectoral fin has 14-16 rays and the caudal fin has 16-18 principal rays.

B. Range

The greenside darter is widespread and often abundant in upland streams from the Tennessee drainage north through the Ohio drainage and in southern tributaries to the eastern Great Lakes. It is absent from the Mississippi River Embayment, but widespread west of the Mississippi River from southern tributaries to the Missouri River south through the Ouachita River system.

C. Habitat

Greenside darter habitat includes swift riffle areas with boulder or coarse cobble substrates in small to moderate rivers with low turbidity. During cooler months they often stay in deep pool areas. Juveniles inhabit shallow pool areas adjacent to riffles. Adults are often associated with attached aquatic vegetation.

D. Local Occurrence

The greenside darter is limited to western North Carolina streams in the Appalachian Mountain Province.

This species was found in the Hiwassee River at Stations H-1, H-2, and H-3.

E. Federal and State Status

No federal or state status.

***Etheostoma rufilineatum*, redline darter**

A. Identification

The redline darter is a member of the Family Percidae (the perches) in the Order Perciformes and the subgenus *Nothonotus*. Body color is sexual dimorphic in this darter. Both sexes have orange lips, dark horizontal markings on the cheek, a dark humeral spot, prominent horizontal dark lines between scales rows on the posterior sides, and a pair of large, white basicaudal spots. Dorsal saddles are often present (8-10) and there are 8-11 dark blotches on the sides that may form oblique vertical bars. Females have dark brown background coloration and clear to pale yellow fins sprinkled with large black spots. The soft dorsal, caudal, and anal fins of the female have a black marginal band. Adult males are brightly colored throughout the year and color intensifies during the breeding season. Male background color is paler than in the females, and bright red spots occur between the dark lines on the sides. The lower sides are bright orange, and orange blotching often occurs on the cheeks and opercles. The breast on the breeding male is bright blue or green and this color extends onto the bases of the pelvic fins. The lateral line is complete, a frenum is present, and the gill membranes are narrowly joined or separate. The dorsal fin has 11-13 spines and 11-13 soft rays. The anal fin has 2 spines and 7-9 soft rays. The pectoral fin has 13-14 rays and the caudal fin has 17 principal rays.

B. Range

The redline darter is restricted to the Tennessee and Cumberland river drainages in Alabama, Georgia, Kentucky, North Carolina, and Tennessee.

C. Habitat

Redline darter habitat includes swift, shallow riffles over rocky substrates in clear streams. Large males are often found in the swiftest waters during the warmer months. Females and juveniles often occur in pools. This darter occurs in small streams to large rivers.

D. Local Occurrence

The redline darter occurs in the French Broad and Hiwassee drainages of the Appalachian Mountain Province in western North Carolina.

This species was found in the Hiwassee River at Stations H-1 and H-2.

E. Federal and State Status

No federal or state status.

***Etheostoma zonale*, banded darter**

A. Identification

The banded darter is a member of the Family Percidae (the perches) in the Order Perciformes and of the subgenus *Etheostoma*. Body color is gray to yellowish, with 6 dark green-brown dorsal saddles, about 10 green vertical bars on the sides, a subortibal bar, and 4 dark basicaudal spots. Dark markings are often present on the lower surface of the head. The spinous dorsal fin of females has a dark basal band and is gray elsewhere; the other fins have dark marks that may align to form banding patterns. Males (sometimes females) have bright green bars on the sides. The males also have a dark red basal band on both dorsal fins. Breeding males are brilliantly colored with bright green vertical bars encircling the body and dark green fins. The lateral line is complete, a frenum is present, and the gill membranes are broadly joined. The dorsal fin has 11 spines and 11-13 soft rays. The anal fin has 2 spines and 7-9 soft rays. The pectoral fin has 13-15 rays and the caudal fin has 16-17 principal rays.

B. Range

The banded darter is widespread but occurs only above the Fall Line throughout the Ohio, Cumberland, Tennessee, and much of the Mississippi river drainages. Introduced populations occur in the Susquehanna and upper Savannah rivers.

C. Habitat

Banded darter habitat includes medium sized streams and rivers in riffle areas with gravel and cobble substrates and in pools having some current. It is normally associated with attached vegetation, particularly *Podostemum*.

D. Local Occurrence

The banded darter is limited to western North Carolina streams in the Appalachian Mountain Province.

This species was found in the Hiwassee River at Stations H-1 and H-2.

E. Federal and State Status

No federal or state status.

***Perca flavescens*, yellow perch**

A. Identification

The yellow perch is a member of the Family Percidae (the perches) in the Order Perciformes. Body color is yellow on the sides while the back is brownish, bronze, or olivaceous. There are 6-9 dorsal saddles that extend well down the sides and narrow to a point on the belly. A prominent blotch is usually present in the posterior membranes of the spinous dorsal fin. The caudal fin and the remainder of the dorsal fin are dusky. The pectoral, pelvic, and anal fins are pale yellow to orange. The lateral line is complete, a frenum is absent, and the gill membranes are separate. An opercular spine is present and the posterior margin of the preopercle is strongly serrate. Teeth are present on the vomer and palatines (bones in the roof of the mouth). The dorsal fin has 13-15 spines in anterior portion, and 1-2 spines and 12-15 soft rays in the posterior portion. The anal fin has 2 spines and 6-8 soft rays. The pectoral fin has 15 rays and the caudal fin has 17 principal rays.

B. Range

The yellow perch is native to the northern states east of the Rocky Mountains, and the Atlantic Coastal drainages south to South Carolina, but it has been widely introduced elsewhere.

C. Habitat

Yellow perch habitat includes quiet waters in streams and lakes, but it also enters brackish waters along the Atlantic seaboard. It is often associated with rooted aquatic vegetation.

D. Local Occurrence

The yellow perch occurs in all three physiographic provinces in North Carolina but is most abundant in the Coastal Plain. In western North Carolina, the yellow perch occurs in the Hiwassee and Pigeon drainages.

This species was found in the Hiwassee River at Stations H-1 and H-2.

E. Federal and State Status

No federal or state status.

***Percina aurantiaca*, tangerine darter**

A. Identification

The tangerine darter is a member of the Family Percidae (the perches) in the Order Perciformes and the subgenus *Hypohomus* and is one of the largest darters (TL of 6.75 inches). Body color is bright yellow to orange on the sides with a row of small discrete dark spots above the wide black lateral band of 8-10 fused blotches. The top of the head is dark while the lower half is yellow to orange. The belly of the female is yellow to yellow-orange and it is bright orange on the male. The first dorsal fin of the male is black basally, orange submarginally, and with a black marginal band. The first dorsal fin on the female is clear except for a black marginal band. Dusky ventral fins become blackened in breeding males and they have iridescent blue highlights. The lateral line is complete, the frenum is well developed, and the gill membranes are separate. The dorsal fin has 14-16 spines and 13-15 soft rays. The anal fin has 2 spines and 10-11 soft rays. The pectoral fin has 14-15 rays and the caudal fin has 17 principal rays.

B. Range

The tangerine darter is confined to the upper Tennessee River system in Georgia, North Carolina, Tennessee, and Virginia.

C. Habitat

Tangerine darter habitat includes rivers of moderate to steep gradient. Adult males live in swift, deep, rocky riffles with boulders, large cobble, and bedrock substrates. Adult females and juveniles live in deep pools with silty sand substrates below riffles. Males are likely to spend the winter in these deeper pools.

D. Local Occurrence

The tangerine darter occurs in western North Carolina in the Appalachian Mountain Province.

This species was found in the Hiwassee River at Stations H-1 and H-2.

E. Federal and State Status

The tangerine darter is listed as a forest concern species by the U.S. Forest Service and W2 status with the North Carolina Wildlife Resources Commission. (Watch Category 2 includes species that are rare to uncommon in North Carolina, but are not necessarily considered to be declining or otherwise in trouble). The tangerine darter is not listed by the U.S. Fish and Wildlife Service.

***Percina evides*, gilt darter**

A. Identification

The gilt darter is a member of the Family Percidae (the perches) in the Order Perciformes and the subgenus *Ericosma*. It is a colorful species reaching 3 inches TL. The gilt darter is olive dorsally with 7-9 dark saddles. On the side is a series of 8-9 blue-green blotches, each directly below a dorsal saddles and often connected with the saddle to form a wide bar crossing over the dorsum. The belly is yellow to red-orange. On the basicaudal are 2 round white or yellow spots. A distinct suborbital bar is present. The first dorsal fin is often orange-black or amber basally and clear distally with an orange-yellow submarginal band. The second dorsal and caudal fins are vaguely spotted to distinctly banded. Other fins are clear to dusky. The breeding male is brilliantly colored, darkened overall, and has 5-8 wide blue-green or black-blue bars extending over the dorsum, the belly is bright orange-red or copper, the dorsal fins are orange-amber with a black base, and the anal and pelvic fins are blue-black. Breeding tubercles are well developed on the males and are sometimes present on the females. The lateral line is complete, a frenum is present, and the gill membranes are barely connected or separate. The dorsal fin has 11-13 spines and 11-13 soft rays. The anal fin has 2 spines and 7-9 soft rays. The pectoral fin has 13-15 rays and the caudal fin has 17 principal rays.

B. Range

The gilt darter is widespread in the upland portions of the Mississippi Basin from New York to Minnesota south to the White River system of Arkansas and the Tennessee River.

C. Habitat

Gilt darter habitat includes riffles in small to moderate-sized rivers. Larger individuals live in larger and faster riffles, often over cobble. Smaller individuals live in smaller gravel riffles. It has a strong preference for clear streams so it is most common in better quality rivers.

D. Local Occurrence

The gilt darter occurs in western North Carolina streams in the Appalachian Mountain Province.

This species was found in the Hiwassee River at Stations H-1 and H-2.

E. Federal and State Status

No federal or state status.

***Stizostedion vitreum*, walleye**

A. Identification

The walleye is a member of the Family Percidae (the perches) in the Order Perciformes. This is a slender, streamlined fish with a large mouth (upper jaw extends will behind the middle of the eye) and sharp teeth. Body color is extremely variable, ranging from bluish gray to brown to bright yellow. Pigment pattern is also variable, usually rather uniform, but it may have lateral and dorsal blotching. The first dorsal fin is dusky with a large, black basal posterior blotch. The second dorsal and caudal fins have narrow brown bands. The pectoral fin has a black spot at the base. The top of the anal fin, the lower lobe of the caudal fin, and the belly are white. The lateral line is complete, a frenum is absent, and the gill membranes are separate. The posterior margin of the preopercle is strongly serrate and adults get rather large (12 inches TL or much more). The dorsal fin has 12-16 spines and 18-21 soft rays. The anal fin has 2 spines and 11-14 soft rays. The pectoral fin has 13-16 rays and the caudal fin has 17 principal rays.

B. Range

The walleye has been widely introduced and hence their native range is uncertain. They occur throughout the Great Lakes and Hudson Bay drainages into the Arctic drainage in the Mackenzie River, and throughout the Mississippi and Missouri river basins. Populations also occur in the Atlantic slope from Pennsylvania to North Carolina and the Gulf Coast.

C. Habitat

Walleye are abundant in cool, sandy-bottom lakes, large rivers, and in clearer reservoirs. They are intolerant of turbidity, silt, and high temperatures and often occur together in loose schools. The walleye is sensitive to strong light and avoids it by seeking deeper water and sheltered areas during the day and moving inshore to shoal areas to feed at dusk.

D. Local Occurrence

The walleye occurs mainly in reservoirs and a few streams of the Appalachian Mountain Province of western North Carolina.

This species was found in the Hiwassee River at Stations H-1 and H-2.

E. Federal and State Status

No federal or state status.

***Cottus bairdi*, mottled sculpin**

A. Identification

The mottled sculpin is a member of the Family Cottidae (the sculpins) in the Order Scorpaeniformes. This fish is easily recognized by its large flattened head, expanded pectoral fins, and its heavy unscaled body. The body tapers abruptly from the large, broad head to a narrow caudal peduncle. The eyes are in a dorsal position. The dorsal fin is divided into two distinct parts. The spinous dorsal fin is red at the margin and black at the base. Body pigmentation is highly variable, indistinct dorsal saddles are usually as wide as or wider than the interspaces. The ground color of the body varies with the environment and can range from a coppery brown to a slate gray, and approaches black in breeding males. The dorsal fin has 7-8 spines and 16-18 soft rays. The anal fin has 12-14 soft rays. The pectoral fin has 14-16 rays and the caudal fin has 10-11 principal rays.

B. Range

The mottled sculpin is widespread in the eastern half of North America from Arctic Canada south. This range includes the Great Lakes area, the Ozarks, much of the Mississippi Basin, many Atlantic Slope drainages, and in the Mobile Bay drainage of the Gulf slope. Also found in western North America on both sides of the Continental Divide.

C. Habitat

Mottled sculpin occur in several habitat types, including quiet springs and small creeks to high gradient mountain rivers. They have adapted to some cool tailwater habitats below reservoirs. Mottled sculpin are often found in the faster current areas of streams over cobble or boulder substrates.

D. Local Occurrence

The mottled sculpin occurs in western North Carolina streams of the Appalachian Mountain Province and a few streams in the Roanoke basin of the Piedmont Province.

This species was found in the Hiwassee River at Stations H-1, H-2, and H-3.

E. Federal and State Status

No federal or state status.

***Cottus carolinae*, banded sculpin**

A. Identification

The banded sculpin is a member of the Family Cottidae (the sculpins) in the Order Scorpaeniformes. It is a distinctive fish with a large flattened head, large eyes, a large mouth, and an unscaled body. The preopercle has a sharp spine. Body color is variable from very dark to quite pale, even within a single population. This variation probably reflects the substrate color occupied at the time of capture. Generally, the body color is reddish brown or yellow, with three prominent black saddles crossing the dorsum and extending down the sides. A well-defined broad band crosses the body at the caudal base. The belly is yellowish white and the chin is strongly mottled. Fins are yellow to orange. Breeding males become very dark above and blue-green below. The dorsal fin has 7-8 spines and 15-18 soft rays. The anal fin has 12-14 soft rays. The pectoral fin has 15-17 rays and the caudal fin has 10-12 principal rays.

B. Range

The banded sculpin is widespread and common throughout the Ozark region, the Tennessee and Cumberland river drainages, and the Mobile Basin both above and, less commonly, below the Fall Line. They also occur in the Ohio River drainage from its mouth to its southern headwaters (New River system), but are absent from much of the northern portion of the Ohio drainage.

C. Habitat

Banded sculpin habitat includes streams of all dimensions. It is equally common from small springs to large upland rivers, and is frequently found in caves. It frequents riffle areas, living over gravel or cobble where its contrasting dark and pale dorsal pattern provides excellent camouflage. Small young occur in quiet shallows and detritus strewn areas.

D. Local Occurrence

The banded sculpin is uncommon in North Carolina, only occurring in the French Broad drainage basin of the Appalachian Mountain Province in western North Carolina.

This species was found in the Hiwassee River at Stations H-1, H-2, and H-3.

E. Federal and State Status

The banded sculpin is listed as threatened by the North Carolina Wildlife Resources Commission and as a forest concern species by the U.S. Forest Service. The banded sculpin is not listed by the U.S. Fish and Wildlife Service.

Figure 1. Map of the Mission project fish sampling stations on the Hiwassee River.