CENTER *for* BIOLOGICAL DIVERSITY *Because life is good.*

Mr. Ken Salazar
Secretary of the Interior
U.S. Department of the Interior
1849 C Street, N.W.
Washington DC 20240

March 14, 2013

Janet Mizzi, Chief, Division of Endangered Species
Ecological Services, Southeast Regional Office
U.S. Fish and Wildlife Service
1875 Century Blvd.
Atlanta, GA 30345

RE: Sixty-day notice of violation of section 4(b)(3)(A, and B) of the Endangered Species Act, relating to a late finding on a petition to protect 13 Southeastern freshwater species under the Endangered Species Act including the Suwannee Moccasinshell, Bridled Darter, Piebald Madtom, Atlantic Pigtoe, Yellow Lance, Trispot Darter, Sickle Darter, Barrens Darter, Saddled Madtom, Holiday Darter, Coosa Creekshell, Coosawattae Crayfish, and North Florida Spider Cave Crayfish.

Dear Secretary Salazar:

This letter serves as a sixty-day notice from the Center for Biological Diversity, Tierra Curry, and other interested parties of intent to sue you pursuant to the Endangered Species Act ("ESA") for failing to make required 12-month findings on petitioned freshwater species from the Southeastern United States including seven freshwater fishes, two crayfishes, and four freshwater mussels which were petitioned for federal protection in 2010 as threatened or endangered species under the Endangered Species Act. 16 U.S.C. § 4(b)(3)(A) and (B). This letter is being provided to you pursuant to the 60-day notice requirement of the citizen suit provision of the ESA. 16 U.S.C. § 1540(g)(2)(C).

In response to a petition to list a species as threatened or endangered, the ESA requires the Secretary to within 90 days determine whether the petition presents substantial scientific or commercial information indicating that the petitioned action may be warranted ("90-day finding"), and within 12 months to determine whether listing is warranted, not warranted, or warranted but precluded ("12-month finding"). 16 U.S.C. § 1533(b)(3)(A) and (B). The petition for these twelve species was filed April 20, 2010. The U.S. Fish and Wildlife Service issued a positive 90-day finding on the petition on September 27, 2011. Federal Register, 76: 59836-59862. A 12-month finding was due on

April 20, 2011. Accordingly, you are in violation of the law and have abrogated your duty to ensure that protection of endangered species occurs in a timely manner thereby avoiding further decline, increased risk of extinction, and increased cost of recovery.

The Southeastern United States is a global center of freshwater species diversity and is home to an astounding variety of freshwater animals. The rivers and streams which support these animals face many threats including pollution, drought, development, mining, logging, natural gas extraction, and global climate change. The Southeast is in the midst of an extinction crisis. More than 50 freshwater species from the region have already been lost to extinction. Freshwater species are disappearing at 1,000 the normal background extinction rate. The Service must act to protect the region's imperiled species before more pieces of our country's irreplaceable natural heritage are forever erased.

Though often under-appreciated, freshwater species play an important role in maintaining the health of streams and rivers. Crayfish are important components in aquatic ecosystems for several reasons. They are a keystone species in maintaining stream community structure, they play important roles as processors of energy, and they serve as prey for a variety of organisms including fish, birds, and mammals (Jones and Eversole 2011). Nearly half of all North American crayfish species are considered to be at-risk of extinction as many have limited geographic ranges, and the freshwater habitats on which they depend for survival face multiple threats (Taylor et al. 2007). Because of their narrow range of habitat requirements, crayfish are especially vulnerable to extirpation (Gilpin and Soule´ 1986).

Freshwater mussels are the most endangered group of organisms in the United States—35 species have been declared extinct, others are likely gone, and more than 70 species are on the brink of extinction (Stokstad 2012, p. 876). Mussels are aesthetically pleasing animals with colorful shells, a diversity of shapes, and interesting shell adornments such as ridges, knobs and spines. They are culturally significant because they were harvested by Native Americans and early pioneers for use as food, to make jewelry, ornaments and tools from their shells, and for pearls. Before the development of plastic, mussel shells were widely harvested to make buttons (Williams et al. 2008, p. 1).

Mussels are an important indicator species of water quality because of their feeding habits and long life spans (Strayer 1999, p. 1). Mussels play an important functional role in aquatic ecosystems. Mussels filter water constantly as they breathe and feed, and they turn over a substantial portion of the water column even at low densities. They have an important influence on ecosystem processes including community respiration, algal clearance rates, and concentrations of nutrients and pollutants such as nitrates, ammonia, and phosphorus (Williams et al. 2008, p. 60). Mussels improve water quality by filtering out bacteria, algae, and phytoplankton (Stokstad 2012, p. 878). Mussels play a very important role in the food web because they feed by filtering tiny particles from the water, and convert this otherwise inaccessible energy source into food for a variety of animals that prey upon them including fish, crayfish, amphibians, reptiles, birds, and mammals (Williams et al. 2008, p. 64). Mussels are also fascinating because of their life histories. They are the longest lived invertebrates and can live more than 100 years

(Williams et al. 2008, p. 1). They reproduce by making a lure that mimics a juvenile fish, worm, or insect that they use to attract fish that will serve as hosts for their parasitic larvae. Because mussels and their fish hosts have evolved together over time, they are scientifically important because of the complexity of the co-evolutionary relationships that have developed around the lure mimicry.

The health of the Southeast's waterways, the biodiversity they support, and the human communities in the region are all interrelated. Protecting the mussels, fish, and crayfish of the Southeast and the habitat they need to survive will also protect the health of the waterways for human communities.

The thirteen species which are the subject of this notice are the Suwannee Moccasinshell (*Medionidus walkeri*), Bridled Darter (*Percina kusha*), Piebald Madtom (*Noturus gladiator*), Atlantic Pigtoe (*Fusconaia masoni*), Yellow Lance (*Elliptio lanceolata*), Trispot Darter (*Etheostoma trisella*), Sickle Darter (*Percina williamsi*), Barrens Darter (*Etheostoma forbesi*), Saddled Madtom (*Noturus fasciatus*), Holiday Darter (*Etheostoma brevirostrum*), Coosa Creekshell (*Villosa umbrans*), Coosawattae Crayfish (*Cambarus coosawattae*), and North Florida Spider Cave Crayfish (*Troglocambarus maclanei*). Details on each of the species and the threats they face are provided below.

If the Secretary does not make the required findings for these imperiled freshwater species or contact us to develop a timeline for making these findings within the next sixty days, we intend to file suit. Please contact me if you have any questions or if you would like to discuss this matter.

Sincerely,

Tierra R. Curry
Conservation Biologist
Center for Biological Diversity
PO Box 11374
Portland, OR 97211
tcurry@biologicaldiversity.org

FRESHWATER MUSSELS

Suwannee Moccasinshell *(Medionidus walkeri)*

The Suwannee moccasinshell (*Medionidus walkeri*) is a small, dark freshwater mussel found only in the Suwannee River drainage in Florida. This two-inch long mussel has a black or yellowish-green shell, sometimes with broad very faint green rays. Males are shaped like rhomboids, while females are smaller and longer with more swollen shells (Johnson 1977). The Suwannee moccasinshell lives in sand, mud, or gravel in slow, clear water, and requires high water quality to survive (Johnson 1977, Nature Serve 2013).

Until two individuals were detected in 2012, scientists feared the Suwannee moccasinshell could already be extinct because the last individual had been detected in 1994 (Brim Box 2007). This species is endemic to the Florida portion of the Suwannee River system, and known from 11 historical occurrences. It was historically known from four occurrences on the main stem of the Suwannee River, one on the Withlacoochee River, five in the Santa Fe River and one in the New River. It was collected from the Santa Fe River in 1981 and the New River in 1987 and 1994. A dead shell was located at the type locality (Suwannee River, Ellaville) in 1981 (NatureServe 2013). Two individuals were detected in 2012, giving new hope for the species' survival.

Though it was once abundant in the Suwannee River (Johnson 1977), the moccasinshell is now exceedingly rare and has undergone a long-term decline of up to 90 percent (NatureServe 2013). It is ranked as "Critically Imperiled" by NatureServe (2013), as "Critically Endangered" by the International Union for the Conservation of Nature (Cummings and Cordeiro 2012), and as "Endangered" by the American Fisheries Society (2010 Draft, in review). Because this mussel has experienced significant population decline and faces many threats, its rank was changed from "Threatened" to "Endangered" by the American Fisheries Society (Williams et al. 1993, draft 2010), and from "Endangered" to "Critically Endangered" by the International Union for the Conservation of Nature (1996, 2012). It was identified as a candidate for federal listing in 1994 (59 FR 58982) but was not included in subsequent candidate lists. There are no existing regulatory mechanisms which adequately protect the species.

The Suwannee moccasinshell is threatened by a variety of factors which diminish water quality, by overcollecting, and by very small remaining population size (NatureServe 2013). It is threatened by sedimentation from agricultural and silvicultural activities, by phosphate mining in the upper Suwannee River main stem, by industrial pollution from a pulp mill in the Withlacoochee watershed, and by localized municipal pollution. Fairly high density residential development and phosphate mining have contributed to excessive eutrophication in the Suwannee main stem (NatureServe 2013).

The moccasinshell is also threatened by low flows and poor water quality conditions resulting from drought and groundwater pumping. Drought and groundwater pumping have led to record low flows in the Suwannee in recent years (Barnett 2011, Curry 2011) and pose an ongoing threat to the mussel's survival.

The species is also threatened by competition from invasive mollusk species and by overcollection. Overharvest by shell collectors and biologists has been a distinct possibility; more than 20 specimens of this species have been retained for collections at the GEXEMPSITE alone. Given already stressed populations throughout most or possibly all of its range, overcollecting can potentially contribute significantly to this species' decline (NatureServe 2013).

Atlantic Pigtoe (*Fusconaia masoni*)

The Atlantic pigtoe (*Fusconaia masoni*) is a small yellow to dark brown mussel with a two-inch shell that frequently has fine rays toward the back. This mussel is unique in that its shell is shaped somewhat like a rhomboid and the outer surface has a unique texture like cloth or parchment. The inside of the shell is iridescent blue, salmon, white, or orange. Individuals from headwater streams have more elongate shells than individuals further downstream (Johnson 1970, Fuller 1974, Adams et al. 1990, Bogan and Aldeman 2004). Potential fish hosts for the larvae of Atlantic pigtoe include shield darter (*Percina peltata*) and bluegill (*Lepomis cyanellus*) (Watters and O'Dee 1997, O'Dee and Watters 2000).

The Atlantic pigtoe lives in relatively fast-flowing rivers and creeks with high water quality, and is restricted to fairly pristine habitats (Price 2006). It prefers coarse gravel and sand at the downstream edge of riffles, and is less commonly found in sand, cobble, and mixtures of sand, silt, and detritus (Adams et al. 1990, Bogan and Alderman 2004).

The Atlantic pigtoe was once widespread along the southern Atlantic slope, ranging from the Ogeechee River basin in Georgia north to the James River basin in Virginia (Bogan 2002). It has undergone a drastic decline in both range and numbers, and most populations are now represented by few individuals. Only one to three occurrences are considered to have good viability (NatureServe 2013). It is estimated that the species has declined by up to 70 percent in population size and range (NatureServe 2013).

The Atlantic pigtoe is categorized as “Endangered” by the International Union for the Conservation of Nature (Bogan 1996). It is ranked as “Threatened” by the American Fisheries Society (Williams et al. 1993). It is listed as “Endangered” by the states of Georgia (Georgia Museum of Natural History 2008) and South Carolina (Price 2006). The pigtoe is ranked by NatureServe (2013) as globally “Imperiled” (G2), and as “Critically Imperiled” in Georgia (S1) and North Carolina (S1), as “Imperiled” (S2) in Virginia, and as historical in South Carolina (SH). It was identified as a candidate for federal protection in 1991 (56 FR 58804) and 1994 (59 FR 58982) but was not included in subsequent lists.

The Atlantic pigtoe has declined due to habitat loss and degradation from impoundments, siltation, and pollution. It is threatened from non-point source pollution including sedimentation and eutrophication. This species does not appear to be able to tolerate changes in its habitat and there has not been any documentation that it is able to

recolonize previously disturbed habitats (NatureServe 2013). The Atlantic pigtoe appears to be even more sensitive to sedimentation and channel modification than other freshwater mussel species (Price 2006). One of the healthiest, most viable populations of this species was recently lost in Virginia and many populations in North Carolina are not doing well (Price 2006). The glochidia (larvae) of the Atlantic pigtoe are extremely sensitive to pollution; levels of ammonia far below U.S. EPA criteria maximum concentrations caused the death of glochidia after only 24 hours of exposure in experiments (Augspurger et al. 2003).

In Georgia, the Department of Natural Resources reports that this species is threatened by development and timber removal in the Ogeechee River basin, excessive sedimentation from development and agriculture, and eutrophication and degraded water quality from poor agricultural practices (Wisniwewsi 2008). The Virginia Department of Game and Inland Fisheries (2010) reports that the Atlantic pigtoe is threatened by habitat fragmentation from agriculture and municipal development, sediment load and turbidity alteration from agriculture and forestry, pesticides from agriculture and municipal development, and hydrologic regime alteration from municipal development.

Atlantic pigtoe populations are now gone or highly reduced in many of its historic large river habitats. The general pattern of distribution now is that this species is limited to the headwater areas of drainages in which it is still present. Within Georgia it is only found in Jefferson and Jenkins counties (NatureServe 2013), but may no longer be viable in the Ogeechee River system (Sukkestad et al. 2006). In South Carolina, it once occurred in the Savannah River drainage but has not been collected in the state in more than 100 years (Bogan and Alderman 2004), although it occurs nearby in the Pee Dee River system of North Carolina including Goose Creek. In North Carolina, it was once found in every Atlantic drainage except the Cooper-Santee and Waccamaw drainage basins (Johnson 1970), but is now reduced to possibly only the Catawba, Pee Dee, Cape Fear, Neuse, Pamlico and Roanoke River basins (Bogan 2002). In North Carolina, it appears that the Atlantic pigtoe has recently been extirpated from the Deep River in Moore County, Cape Fear River in Harnett and Cumberland counties, and Black River in Sampson, Bladen, and Pender counties. In Virginia, it is found in the Upper and Middle James, Nottoway, Appomatox, Lower Dan, Meheriin, Rivanna, and Upper Roanoke basins (NatureServe 2013).

Coosa Creekshell (*Villosa umbrans*)

The Coosa creekshell (*Villosa umbrans*) is a small freshwater mussel with a smooth, thin, elliptical shell that is olive or tan, darkening to blackish as the mussel ages. Adults are generally about three inches long. The inside of the shell is coppery purple, and younger shells have distinct green rays toward the back (Parmalee and Bogan 1998). The Coosa creekshell is primarily found in small creeks to medium rivers in sand, gravel, and cobble substrates in moderate current (Williams et al. 2008). This mussel uses bluegill (*Lepomis macrochirus*) and banded sculpin (*Cottus carolinae*) as fish hosts for its larvae (Mirarchi et al. 2004).

The Coosa creekshell is endemic to the Coosa River drainage above the Fall Line in Alabama, Georgia, and Tennessee (Williams et al. 2008). It was once fairly widespread, but is now declining across its distribution (Mirarchi et al. 2004). NatureServe (2013) estimates that is has declined by up to 90 percent. It was ranked as "Special Concern" by the American Fisheries Society (Williams et al. 1993, but its rank is being changed to "Threatened" due to increased concern about its survival (AFS 2010 draft, in review). It is ranked as "Imperiled" by NatureServe (2013) globally (G2) and in Alabama (S2) and Tennessee (S2), and as "Critically Imperiled" in Georgia (S1S2). It is categorized by the state of Alabama as a species of "High Conservation Concern" (Alabama Department of Conservation and Natural Resources 2008).

This mussel's distribution has been drastically reduced and it now persists primarily in isolated populations in headwater tributaries (Evans 2001, Gangloff 2003, Mirarchi et al. 2004, Williams et al. 2008). It is still found in a few tributaries in the uppermost reaches of the Coosa River system, primarily in Georgia but also at a few sites in Alabama (Mirarchi et al. 2004). In the Coosa River basin in Georgia, it was known historically from the Coosa, Etowah, Oostanaula, Conasauga, and Coosawattee River drainages (Williams and Hughes 1998). In Tennessee, it is endemic to the upper Coosa River system occurring in the Conasauga River of the Coosa River basin in Polk County (Parmalee and Bogan 1998). This species was recently reported from the Conasauga River inside and adjacent to the Cherokee and Chattahoochee National Forests in Polk and Bradley counties in Tennessee, and in Murray and Whitfield counties in Georgia (Johnson et al. 2005). Gangloff (2003) reports that in the Upper Alabama River drainage, this mussel is extant at 20 or more sites in at least 8 sub-basins. In the Conasauga River drainage, it is sporadically distributed but may be locally abundant (Evans 2001). McGregor et al. (2000) reported it absent from the Cahaba River, Alabama.

The Coosa creekshell has narrow habitat requirements, preferring small riffles in shoal habitat, which makes it intrinsically vulnerable to habitat degradation (Mirarchi et al. 2004). Many factors contribute to the loss and degradation of mussel habitat in the region where the Coosa creekshell occurs including dams, reservoirs, channelization, sedimentation, logging, mining, industrial waste, livestock feedlots, septic pollution, and non-point source runoff including fertilizers, pesticides, and road runoff (Flebbe et al. 1996, Swift et al. 1996). The aquatic mollusk fauna in the Coosa River system has been decimated by dams, with many species having been pushed into very small ranges (Flebbe et al. 1996). The Coosa Creekshell is declining on the Cherokee National Forest, where aquatic habitats have experienced degradation from logging and off-highway vehicle use (USFS 2006). The Biological Assessment for the Alabama Power Company Coosa River Relicensing Projects states that the project is likely to adversely affect listed freshwater snails and mussels in the Coosa River, and that mussels in the Coosa have declined due to habitat modification, sedimentation, eutrophication, and water quality degradation (Alabama Power Company 2007). Krause and Roghair (2010) report habitat isolation and severe drought as threats to freshwater species including the Coosa creekshell. There are no existing regulatory mechanisms which adequately protect this mussel.

Yellow Lance (*Elliptio lanceolata*)

The yellow lance (*Elliptio lanceolata*) is a long freshwater mussel that grows to be around 6 inches in length with a shell that is more than twice as long as it is tall. Individuals living in rivers are more elongate than those from smaller streams (Britton and Fuller 1980). Juveniles have bright yellow shells that darken to brown or black with age. The inside of the shell is salmon, white, or iridescent blue. Most shells lack rays, though mussels have been detected with prominent wide green rays on the back of the shell (Adams et al. 1990). The yellow lance inhabits creeks and medium-sized rivers and is found in areas with low flow rates, in sandy, rocky, or muddy substrates (Johnson 1970).

The yellow lance is native to the Coastal Plain of the southeastern United States. It occurs in Virginia and North Carolina, and possibly in Maryland and South Carolina. There are unresolved taxonomic issues for this mussel in Maryland, and if it ever existed there, it may now be extirpated. Taxonomy of this species is also unresolved in South Carolina.

The yellow lance is listed as "Endangered" by the state of North Carolina and as a "Species of Special Concern" by the state of Virginia. It is ranked as "Endangered" by the American Fisheries Society (Williams et al. 1993, 2010 draft, in review). It is ranked as "Imperiled" by NatureServe (G2G3) globally and in Virginia (S2S3), and as "Critically Imperiled" (S1) in North Carolina (NatureServe 2013).

This mussel appears to be declining in abundance throughout most of its historical range. Many remaining populations are small and of dubious viability. Numerous historic occurrences of this species are likely extirpated. NatureServe (2013) reports that this species has declined by up to 50 percent.

Within the range where the yellow lance is currently recognized to occur, Johnson (1970) lists three historical occurrences from the Neuse River drainage, two from the Tar River, two from the Roanoke River system, one from the Chowan River system, seven from the James River drainage, two from the South Anna River drainage, and four from the Rappahannock River system. It is threatened with extirpation in the Neuse River system. Stable populations exist in the Tar River, but these are patchily distributed and vulnerable to extirpation. It appears to be extirpated from historical occurrences in the Tar River below Rocky Mount, North Carolina. It also appears to have been recently extirpated from Ruin Creek in Vance County and from the Tar River in Edgecombe County, North Carolina. It may currently be extirpated from the Roanoke River system and from the main stem of the Rappahannock River (NatureServe 2013). In Virginia, this mussel is extirpated, or nearly so, from the Lower Chesapeake and James River basins with extant occurrences only in the Rapidan-Upper Rappahannock and Mattaponi, and the Upper James and Middle James-Willis (NatureServe 2013). It occurs in the Chowan River basin, but has a restricted range within that system. It is vey rare in the South Anna River.

The yellow lance is threatened across its range by habitat loss and degradation resulting from agriculture, logging, and municipal development. Additionally, in parts of its range,

this mussel is threatened by impoundment and channelization. In North Carolina, aquatic species in the Neuse drainage have been negatively affected by the construction of Falls Lake, which has significantly altered water temperatures below the dam. Thermal alteration and general pollution problems around Raleigh have reduced habitat in the upper Neuse River (NatureServe 2013). The Neuse is routinely considered to be an endangered basin (American Rivers Foundation 2007) with impacts such as urban wastewater, fertilizer, industrial development and animal operations all contributing to eutrophication (Pinckney et al. 1997, Paerl et al. 1998). In-stream habitat in the Neuse Basin has been lost and degraded by forestry, urban and residential development, impoundments, and effluent (North Carolina Department of Environment and Natural Resources 2002). Agriculture and farming operations have contributed to habitat degradation, and development is rapidly increasing (Midway 2008). The North Carolina Wildlife Resources Commission (2005) reports that aquatic species in the Neuse Basin are threatened by agriculture, forestry, impoundments, water withdrawals for irrigation, development, wastewater discharges, and increasing human population. The human population within the basin is expected to grow by more than 867,000 by 2020 to almost 3 million people. Development, confined animal feeding operations, and forestry also threaten aquatic species in the Tar River basin, but to a lesser extent than the Neuse (Starnes 2002).

Aquatic species in the Tar River basin are threatened by erosion, sedimentation, channelization, agriculture, irrigation withdrawals, confined animal feeding operations, and increasing human population growth and development pressure (North Carolina Wildlife Resources Commission 2005b). In Virginia, the yellow lance is threatened by sediment load alteration from agriculture, forestry, and municipal development, by channel and shoreline alteration from agriculture, and by hydrologic regime alteration from municipal development (Virginia Department of Game and Inland Fisheries 2010). Water pollution threatens the survival of this mussel. The Virginia Department of Game and Inland Fisheries (2010) reports that the yellow lance is threatened by toxins from roadways and from municipal development, and by organic matter from agriculture. Aquatic species in Virginia's Mid-Atlantic Coastal Plain are threatened by water pollution including low dissolved-oxygen levels, high fecal coliform counts, and altered pH resulting from agricultural and urban runoff. In Virginia's Southern Piedmont, water is polluted by these same sources and by abandoned mine runoff. In the Blue Ridge mountains, aquatic species face the same threats and are also contaminated with mercury and PCBs (Virginia Wildlife Action Plan 2006a, 2006b, 2006c). Water pollution is also a documented threat to this species in North Carolina (North Carolina Wildlife Resources Commission 2005a, 2005b).

The yellow lance is also threatened by any factor which threatens the host fish on which it is dependent for reproduction. This mussel is also threatened by stochastic genetic and environmental events due to its extant distribution primarily in small, isolated populations.

CRAYFISHES

Coosawattae Crayfish (*Cambarus coosawattae*)

The Coosawattee crayfish (*Cambarus coosawattae*) is a small, brownish to olive crayfish with a three-inch body with reddish or burgundy coloration framing the back edges of its shell. The margins of the shell in front of the eyes are orange to reddish (Hobbs 1981). It lives in clear streams with moderate flow and rubble bottoms, usually occurring in riffles under small to medium-sized rocks (Hobbs 1981, Schuster 2001). It likely feeds on live and decaying vegetation, aquatic insect larvae, small fishes, and dead animal matter (Skelton 2012).

The Coosawattee crayfish is only found in the Coosawattee River system in Gilmer County, Georgia, in twelve locations (NatureServe 2013). The small range of the species and the high development rates within its limited range pose significant threats to its survival. Heavy sedimentation resulting from poor development and land management practices may cover substrates and other daytime hiding places on which crayfishes rely to avoid predation (Skelton 2008, 2012). Populations of the Coosawattee crayfish are currently considered to be stable, but the species is threatened by habitat loss and degradation within its limited range (Cordeiro et al. 2010).

The Coosawattee watershed has experienced a large increase in residential development in recent years, and an additional 116,300 acres of forest have been allocated for residential building to be completed by 2030 (White 2009). There are no existing regulatory mechanisms to protect the crayfish from the habitat loss and degradation which will result from the proposed developments. Upcoming developments are expected to rapidly reduce the number of locations from which this species is known (Cordeiro et al. 2010). Its range has already been fragmented by the construction of Carters Lake (NatureServe 2013). It is also currently threatened by pollution from confined animal feeding operations in the headwaters above Carters Lake (Corderio et al. 2010, NatureServe 2013). The species is also threatened by the spread of non-native crayfishes (Skelton 2008).

The Coosawattee crayfish is listed as “Endangered” by the state of Georgia (Georgia Wildlife Resources Division 2010), but this designation does not provide any protection for the habitat on which the crayfish depends for survival. It as ranked as “Endangered” by the American Fisheries Society (Taylor et al. 2007), as “Critically Imperiled” by NatureServe 2013 (G2S1), and as “Near Threatened” by the International Union for the Conservation of Nature (Cordeiro et al. 2010).

North Florida Spider Cave Crayfish (*Troglocambarus maclanei)*

The North Florida spider cave crayfish (*Troglocambarus maclanei*) is found in a single arc-shaped distribution extending from Suwannee to Hernando counties in northern Florida, a range of about 80 miles. The spider cave crayfish occupies subterranean karst habitat near sites of detrital input, particularly large sinkholes and areas under bat roosts

in caves. The crayfish is likely attracted to fine detritus that floats near the walls and ceilings of flooded cave passages (Deyrup and Franz 1994). This crayfish has been observed hanging upside down from the ceilings of caves. It is associated with caves where the floor is coated with fine silt and contains vegetative litter. This crayfish is likely an active predator on smaller invertebrates (Deyrup and Franz 1994).

It is ranked as "Special Concern" by the American Fisheries Society (Taylor et al. 2007) and as "Imperiled" by NatureServe (G2S2) (2013). Florida lists it as a "Species of Greatest Conservation Need."

This species is threatened by groundwater pumping, drought, and human population growth. NatureServe (2013) reports that this species is susceptible to pollution of the aquifer and changes in inflow of detritus, and that it is threatened by urban development. The type locality is threatened by urban development of nearby Gainesville, which could be having adverse impacts on the groundwater quality. In at least three caves, it is threatened by disturbance by SCUBA divers (Doonan 2001). According to Deyrup and Franz (1994), "[t]his crayfish is restricted to groundwater habitats in caves, where it maintains small populations, usually in association with fine silt. The species is probably susceptible to groundwater pollution and may be affected by changes in land use." No existing regulatory mechanisms adequately protect this species.

FRESHWATER FISHES

Bridled Darter (*Percina kusha*)

The bridled darter (*Percina kusha*) is a slender fish reaching about three inches in length, with a series of overlapping dark circular blotches that form a continuous undulating stripe on its sides. It is found in a small range in the Conasauga River drainage in northern Georgia and extreme southeastern Tennessee and the Etowah River drainage in northern Georgia. Its habitat is threatened by municipal and industrial development and forestry and agricultural activities.

The bridled darter is classified as "Endangered" by the American Fisheries Society (2008) and by the state of Georgia (Albanese 2008). It is ranked by NatureServe (2013) as "Critically Imperiled" in Georgia (S1) and Tennessee (S1) and as "Imperiled" globally (G2). It has declined by up to 50 percent (NatureServe 2013).

Its habitat consists of small rivers and lower reaches of tributaries with moderate gradient, exceptionally good water quality, and sand, gravel, cobble and bedrock substrates (Etnier and Starnes 1993). It is usually found in flowing pools and backwaters adjacent to runs. Within pools, the bridled darter has been observed hovering over underwater objects, such as boulders or woody debris (Etnier and Starnes 1993, Williams et al. 2007).

The bridled darter is threatened by pollution from a variety of sources (Williams et al. 2007). Its limited geographic range and the species' restriction to clear flowing pools in

medium-sized rivers make the bridled darter vulnerable to habitat degradation. Land disturbance associated with residential and urban development in the north Georgia mountains threatens populations, especially in the upper reaches of the Etowah River and Long Swamp Creek where development is imminent. Failure to follow agricultural best-management practices is a threat to the Conasauga River population (Albanese 2008).

This fish is endemic to the headwaters of the Coosa River in Georgia and Tennessee, where it is found in the main channel of the Conasauga River in Murray and Whitfield counties, Georgia, and Bradley and Polk counties, Tennessee, three tributaries of the Conasauga River, including Holly Creek, Murray County, Georgia; and Ball Play and Minnewauga creeks, Polk County, Tennessee, in the main channel of the Etowah River in Dawson and Lumpkin counties, Georgia, and in several tributaries of the Etowah, including Amicalola, Little Amicalola, Cochran and Shoal creeks, Dawson County, Georgia (Williams et al. 2007).

Piebald Madtom (*Noturus gladiator*)

The piebald madtom (*Noturus gladiator*) is a recently described species that is limited to the coastal plain of Tennessee and Mississippi (Thomas and Burr 2004). The species historically occurred in seven river systems, but is now limited to the Wolf, Hatchie and Obion River systems (Thomas and Burr 2004). It is likely extirpated from the Loosahatchie River (last record, 1954), Yazoo River drainge (last record, 1978), and Big Black River drainage (last record, 1983). Precise information is lacking, but it is estimated that the madtom has declined by up to 50 percent (NatureServe 2013).

It is ranked as “Vulnerable” by the American Fisheries Society (Jelks et al. 2008). It is ranked by NatureServe (2013) as “Vulnerable” globally and in Tennessee (S3), and as “Critically Imperiled” in Mississippi (S1).

The madtom is threatened by habitat loss and degradation from changes in flow regime and from siltation (NatureServe 2013). It is particularly vulnerable to extirpation from habitat change due to its life history traits including small clutch size (Thomas and Burr 2004). The Tuscumbia River and lower Hatchie River sites sampled by Rakes and Shute (2001) were severely degraded by poor agricultural and forestry practices. Both reaches had been channelized, the Tuscumbia was silt-choked with very little flow, and the Hatchie lacked any appreciable cover. The lower reaches of the Hatchie River had extreme siltation or lacked woody debris cover. Riverbanks in the lower reaches were often severely eroded and consequently had much-reduced shallow shoreline habitat. Firm, sandy substrates with shallow, flowing water, favored by *N. gladiator,* were often missing from disturbed stretches of the river. This species formerly may have occurred in the Forked Deer drainage, where it likely was extirpated as a result of extensive channelization in that system (Rakes and Shute 2001).

Holiday Darter ***(Etheostoma brevirostrum)***

The holiday darter (*Etheostoma brevirostrum*) is a small fish endemic to the upper Coosa River system of Georgia, Alabama and southeastern Tennessee (Page and Burr 1991, Etnier and Starnes 1993, Boschung and Mayden 2004, Georgia DNR 2009). The holiday darter actually represents a species complex including as many as five distinct forms. One form of this darter occurs in Alabama in Shoal Creek and three springs in the Choccolocco Creek system (Boschung and Mayden 2004, Pierson 2004, Freeman and Hagler 2009). The four other forms are found in Georgia in the upper Conasauga system, upper Coosawattee system, and upper Etowah River system (Freeman and Hagler 2009). In the Etowah, one form is found in the upper Etowah River and its tributaries, and another in Amicalola Creek and its tributaries (Ibid.) These various forms likely qualify at least as distinct population segments and should be considered as such. The species was recently determined to have disappeared from lower Shoal Creek in Alabama (Pierson 2004).

The holiday darter occurs in small creeks to moderate sized rivers with cool, clear water and bedrock and gravel substrates, where it is frequently associated with lush growths of river weed (Etnier and Starnes 1993, Boschung and Mayden 2004).

A recent review considered the holiday darter to be uncommon in its limited range in the Coosa River System of Alabama and rare in the upper Coosa of Tennessee and Georgia (Boschung and Mayden 2004). Freeman and Hagler (2009) observed that the species can be locally abundant in the Etowah and Conasauga River systems.The nominal population in Shoal Creek used to extend down into Chocolocco Creek; existing Shoal Creek populations are fragmented by two or three small impoundments in the Talladega National Forest. It has been relatively common at the type locality since at least 1992. It is moderately common in tributaries and patchily distributed in the mainstem Conasauga River; abundance increases above agricultural areas adjacent to the Cherokee National Forest in Tennessee and upstream into the Chattahoochee National forest in Georgia. The Coosawattee River population occurs in tributaries above Cartersville Reservoir, northwest of Ellijay in the upper half of Mountaintown Creek, including the tributary Bear Creek where it is relatively common in limited portions of the creek, and northeast of Ellijay in Turniptown and lower Little Turniptown creeks, and in Rock Creek, but it is absent from tributaries of the Cartecay River southeast of Ellijay. Total range in the Coosawattee is limited and tributary populations may be fragmented, possibly due to reduced water quality of the Ellijay and Cartecay rivers. The Amicalola Creek system population is the most abundant of the five allopatric populations; it is relatively common in tributaries. The uppermost mainstem Etowah River population is the most restricted population; darters are relatively uncommon, patchily distributed and have a limited range occurring in approximately 12 to 15 stream miles.

Jelks et al. (2008) list the holiday darter as “Endangered” in Amicalola and Shoal creeks, and in the Conasauga, Coosawattee, and Etowah rivers. Boschung and Mayden (2004) recommend that the species should be of special concern in Alabama. NatureServe (2013) classifies it as “Critically Imperiled” in Alabama and Tennessee and “Imperiled”

in Georgia. Etnier and Starnes (1993) state that because of the holiday darter's "restricted range in small portions of only three states, it is likely a candidates for future consideration for Federal protected status." The Georgia Department of Natural Resources (2009) considers the species “Endangered” in the state. It is listed as “Threatened” by the state of Tennessee. In Alabama, Pierson (2004) warns that "any further decline in distribution, or reduction in population size, would make species a likely candidate for some level of federal protection."

Jelks et al. (2008) list several populations as endangered based on the present or threatened destruction, modification or curtailment of habitat or range. NatureServe (2013) states that the holiday darter is threatened by logging, road building, impoundments, and any activities which remove riparian cover. Sprawl is a threat throughout its range, including houses right along the Coosawatee. There was a recent proposal to lease areas of the Talladega National Forest for fracking, making natural gas development a threat to this species.

Freeman and Hagler (2009) identified a number of threats to the holiday darter including “habitat loss due to excess silt and sediment runoff, reduced water quality and stream impoundment. The holiday darter is a montane species, and poor riparian management practices, including inadequate implementation of Forestry Best Management Practices (BMPs), pose a significant threat to the species. Sedimentation may also result from failure to control erosion from construction sites and bridge crossings. Holiday darters require clean cobble or other stable substrate for spawning, thus excess sediment could inhibit spawning success. Stream degradation results from increased stormwater runoff from developing urban and industrial areas." There are no existing regulatory mechanisms which adequately protect the holiday darter.

Saddled Madtom (***Noturus fasciatus)***

The saddled madtom (*Noturus fasciatus*) has a very small range in the Duck River system and adjacent western tributaries of the Tennessee River in Hardin and Wayne counties, Tennessee (Burr et al. 2005). It was historically recorded in additional areas, including a few records from the mainstem Duck River in Bedford, Henry, and Marshall counties, five localities in the Indian Creek system and one locality in Rogers Creek (Burr et al. 2005).

Habitat for the saddled madtom includes second and third order streams with clear water, dark gravel and slabrock substrates, and abundant riffle habitat. During the day, the species is typically found buried in gravel, cobble, rubble, or slate substrates in riffle habitats, whereas at night the species is thought to forage in pools or pool margins (Burr et al. 2005).

Burr et al. (2005) extensively sampled for the saddled madtom from 1992-1994 and found the species at "few sites" and a "low number of specimens per site (mean= 2.1)," leading the authors to conclude that either the madtom had "declined dramatically in abundance and range over the past 10-20 years; or our seasonal timing, collecting

techniques, and efforts differ significantly relative to those of previous collectors." They further speculated that one reason they may have undersampled the madtom was that they had sampled during the day, rather than at night when the species is easier to capture (Burr et al. 2005). Despite this limitation, however, Burr et al. (2005) state that "repeated diurnal collections by BMB have consistently yielded ten or more *N. fasciatus* from several localities in the previous 15 years," indicating that their surveys do accurately document that "the species has disappeared from some sites over the past 10-20 years." NatureServe (2013) reports that the saddled madtom has experienced a long-term, moderate decline of 25-50 percent, consistent with findings of Burr et al. (2005) that the species has disappeared from some sites.

NatureServe lists the saddled madtom as “Imperiled” in Tennessee because of its "restricted range in the Duck River drainage, Tennessee," because it is "known from only 13 sites since 1992," and because "numbers are very low where found." Jelks et al. (2008) list the madtom as “Vulnerable” because of the present or threatened destruction, modification, or reduction of habitat or range and because of a restricted range.

Burr et al. (2005) identify channelization, removal of riparian vegetation, and agricultural runoff as threats to the saddled madtom. The fish is also threatened by drought and pollution (Burr et al. 2005, Jelks et al. 2008, NatureServe 2013). Burr et al. (2005) observed that "severe drought in the late 1980s could have contributed to local extirpation" because "peak spawning for *N. fasciatus* is probably in June and July," when low flows "might have disrupted nesting and reduced recruitment, especially in smaller tributaries lacking permanent spring input." This indicates the saddled madtom is threatened by future droughts and increasing water demands from a growing human population. Burr et al. (2005) also cited organic pollution as a threat, stating: "the wide variety of complex organic chemicals added to streams may interfere with the highly developed olfactory sense of madtoms, disrupting behavioral patterns important for survival." Other threats include impoundment, bridge construction, and range fragmentation (Burr et al. 1993, 2005, Eisenhour et al. 1996, NatureServe 2013).

Sickle Darter (*Percina williamsi*)

The sickle darter (*Percina williamsi*) historically occurred in the upper Tennessee River of Tennessee, Virginia and North Carolina, including the French Broad, Emory, Holston and Clinch Rivers (Page and Near 2007). The species has been extirpated from streams where it was previously collected and is considered extirpated in North Carolina (Page and Near 2007). The sickle darter occurs in flowing pools over rocky, sandy, or silty substrates in clear creeks or small rivers most often in association with woody debris, vegetation or boulders (Page 1978, Etnier and Starnes 1993, Jenkins and Burkhead 1994, Page and Near 2007). Page and Near (2007) note that: "as its fusiform shape suggests, it spends most of its time swimming in current in the water column" with the prominent black stripe on its side "characteristic of darters living near vegetation in flowing pools."

According to Page and Near (2007), the sickle darter "can be observed with regularity in a few streams, but populations are widely scattered and the species has been extirpated

from several streams where it was collected in the late 1800s and early to mid-1900s." In total, Page and Near (2007) identify 15 localities where the species has been collected over the past roughly 30 years. The species is known to have disappeared from several streams and is considered extirpated in North Carolina (Etnier and Starnes 1993, Page and Near 2007, NatureServe 2013).

The sickle darter is considered extirpated in North Carolina (SX), “Critically Imperiled” (S1S2) in Virginia, and “Imperiled” (S2) in Tennessee (Etnier and Starnes 1993, Jenkins and Burkhead 1994, NatureServe 2013). Jelks et al. (2008) list the species as “Threatened” based on the present or threatened destruction, modification or reduction of habitat or range. It is listed as “Threatened” by the state of Tennessee.

Page and Near (2007) identify "increased turbidity and siltation resulting from agricultural, industrial, and municipal development" as likely threats to the sickle darter, noting that these factors are "the ultimate result of population growth in *Homo sapiens*." Other threats include chemical pollution and impoundment, which has isolated many populations (Burkhead and Jenkins 1991, NatureServe 2013). The sickle darter is restricted to a small number of isolated locations in the upper Tennessee River and is thus highly vulnerable to stochastic genetic and environmental events.

Barrens Darter ***(Etheostoma forbesi)***

The barrens darter (*Etheostoma forbesi*) is limited to a small number of tributaries of the Barren Fork and Lower Collins rivers in Tennessee and may have occurred formerly in the adjacent Duck River system (Page et al. 1992, Etnier and Starnes 1993, NatureServe et al. 2013). It inhabits pools and gently flowing riffles in small streams with cobble substrates (Etnier and Starnes 1993, Hansen et al. 2006).

The barrens darter is likely one of the rarest freshwater fishes in North America (Page et al. 1992, Hansen et al. 2006). Surveys in 1994 identified barrens darter at 11 sites in nine streams with the largest population apparently in Charles Creek (Madison 1995). A 2004 survey of ten sites, including nine of the 1994 sites, found the species in eight sites (Hansen et al. 2006). In contrast to the 1994 survey, the species was found in low abundance in Charles Creek in 2004 and was not found in two streams where it occurred in 1994 (Witty and Mud Creeks). Abundances were generally low in both the 1994 and 2004 surveys (Madison 1995, Hansen et al. 2006).

The barrens darter has a very restricted range, where it receives little protection and faces threats from livestock grazing and agricultural water withdrawal and pollution (NatureServe 2013). NatureServe (2013) lists it as “Critically Imperiled” and Jelks et al. (2008) list it as “Threatened.” Hansen et al. (2006) conclude "[d]ue to its restricted distribution, small population sizes, and current threats, the barrens darter warrants consideration for federal listing as an endangered species."

Jelks et al. (2008) classify this species as threatened due to habitat loss and degradation and restricted range.

NatureServe (2013) describes increasing threat from agriculture, including increased groundwater withdrawal that is leading to declining stream flows and degraded water quality from siltation and pesticides. Madison (1995) reports that this fish is threatened by heavy silt loads at some sites due to livestock grazing. Bergen et al. (2008) reported that a population in Mud Creek had low abundance and that the stream appeared to be "suboptimal" because of dewatering and poor water quality. A growth in nurseries in the area has increased water demands and stream withdrawals.

Trispot Darter (*Etheostoma trisella*)

The trispot darter (*Etheostoma trisella*) is found in portions of the upper Coosa River system in Alabama, Tennessee and Georgia, including the Conasauga River system above the Coosawatee River and eight of its tributaries, the Coosawatee River and three tributaries below Carters Reservoir, and in at least one tributary to the Oostanaula River system (Etnier and Starnes 1993, Boschung and Mayden 2004, Georgia DNR 2008). It was long believed extinct in Alabama, but was recently found on protected forest land east of Gadsden, Alabama (Freeman 2009).

The trispot darter utilizes two distinct habitats. When not breeding, the darter occupies slack water in the Conasauga and its tributaries, Coahulla and Mill Creeks in association with detritus, logs, sticks and beds of water willow (Boschung and Mayden 2004). For spawning, the darter migrates during flooding to seepage waters and small ditches in pastures adjacent to Mill Creek and floodplain forests adjacent to the Conasauga River (Etnier and Starnes 1993, Boschung and Mayden 2004). This requirement for two distinct, but interconnected habitats makes the species highly sensitive to habitat modification.

Although populations of the trispot darter may have occurred throughout the Ridge and Valley corridor portion of the Conasauga River, populations are currently restricted to limited areas of a few mainstem rivers and a small number of tributaries (Etnier and Starnes 1993, Freeman 2009). The trispot darter is extirpated from portions of its historic range due to impoundment and other factors, indicating long-term decline (Boschung and Mayden 2004, Freeman 2009).

The trispot darter was reclassified from “Threatened” to “Endangered” by Jelks et al. (2008) due to increasing threats to its survival. Boschung and Mayden (2004) conclude, "[b]ecause the trispot darter is so restricted in range, so few in numbers, and needs two distinctly different and interconnecting habitats, it is very vulnerable to any environmental insults that would disrupt its normal life cycle," adding that they "concur with Warren et al. (2000) in recommending endangered status for the trispot darter." NatureServe (2013) lists the species as extirpated in Alabama (SX) and “Critically Imperiled” globally (G1) and in Georgia and Tennessee (S1). It is listed as “Endangered” by the state of Georgia and as “Threatened” by the state of Tennessee. In Alabama, it is categorized as extinct. There is no substantial regulatory protection for this species.

Jelks et al. (2008) cite the present or threatened destruction, modification, or reduction in habitat or range as a threat to the survival of this species. This fish is known to have been lost from portions of the mainstem Coosa River following impoundment (Etnier and Starnes 1993, Boschung and Mayden 2004, Georgia DNR 2008). Freeman (2009) concluded: "The greatest threat to the trispot darter is habitat loss and degradation, including loss of access to spawning areas in seepage streams. Dams built on tributary streams and springs and dredging or filling in small seepage streams could eliminate spawning habitat for the trispot darter. Droughts or excessive water withdrawal which de-water spring runs could also lead to reproductive failure." This species is also threatened by urban sprawl from Birmingham in the Little Canoe River area.

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