



June 8, 2018

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Dear Mr. Frazer and Ms. Fahey:

We are writing to comment on 61 southeastern species for which the Center for Biological Diversity filed a petition seeking Endangered Species Act protection on April 20, 2010. On September 27, 2011 the Service determined that the species may warrant protection and issued “positive 90-day findings” on their protection (76 FR 59836) The Service should have thus initiated status reviews and published listing proposals or not warranted findings by 2012. The Service is now six years overdue in completing required status reviews for these species.

In November 2017 the Center learned from concerned citizens that the Service was considering withdrawing positive 90-day findings for dozens of species absent completing 12-month status reviews as mandated by the Act. Because the Act clearly requires the Service to publish 12-month findings for species once the agency has determined that they may warrant protection, it would be clearly unlawful for the Trump administration to reverse the Obama administration’s “may warrant protection” determinations for these 61 imperiled species. The Center is deeply concerned about this unprecedented assault on the Endangered Species Act.

In an effort to take a more cooperative approach, the Center contacted the Service and asked to review the list of species which were under threat of not receiving completed status reviews and to consider withdrawing some if information indicated this was warranted. We have reviewed the spreadsheet the Service provided and researched current information on the species from scientists, published literature, Freedom of Information Act materials, and conservation organizations. Based on new scientific information, surveys, conservation actions, and the opinion of scientific experts, we hereby withdraw 38 species from the 2010 petition (Table 1). Of the species under consideration here, however, we urge the Service to complete status reviews and listing proposals for 23 of the species because available information indicates that they are at risk of extinction (Table 2).

We filed the Southeast multi-species petition in 2010 because the region's rivers and wetlands are a global hotspot of aquatic biodiversity with more species of fish, mussels, crayfish and other aquatic organisms than anywhere else in North America, but a high proportion of the region's unique freshwater species face imminent and high magnitude threats to their survival, including water quality degradation, drought, dams, urbanization, and a host of other factors. At least 164 species from the southeast region have already been lost to extinction since 1900, including 65 snails, 37 mussels, 21 plants, 18 insects, 7 mammals, 7 crustaceans, 5 birds, 2 fish, and 1 amphibian (Center for Biological Diversity Database).

These extinctions are not a thing of the past in the Southeast. Just since 2000, several southeastern species have been identified as extinct including the beaverpond marstonia snail, Tatum Cave beetle, Florida zestos and rockland grass skipper butterflies, the green blossom, yellow blossom, tubercled blossom, and turgid blossom pearly mussels, the Florida fairy shrimp, and the South Florida rainbow snake. Some of these species had been identified as needing protection, but did not receive any.

Two of the species the Service is considering dropping without completing status reviews could already be extinct, the bigcheek cave crayfish and the three-tooth long-horned caddisfly. The Service must determine if these species are still extant and if so, immediately propose protection for them.

To avoid further extinctions, it is critical the Service provide timely protection to the most critically imperiled species. In cases where there are data gaps, the Endangered Species Act requires giving the benefit of the doubt to the species. Where the best available science demonstrates threats to known populations such that species are at risk of disappearing forever, the Service must provide timely protection.

Thank you for taking our comments into consideration and please contact us for additional information.

Sincerely,

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Table 1. Species we are withdrawing from the Southeast Petition

Alabama cave crayfish	<i>Cambarus jonesi</i>	Withdraw
Alachua light fleeing cave crayfish	<i>Procambarus lucifugus alachua</i>	Withdraw
Appalachian cave crayfish	<i>Orconectes packardi</i>	Withdraw
Appalachian fissidens moss	<i>Fissidens appalachensis</i>	Withdraw
Appalachian snaketail	<i>Ophiogomphus incurvatus</i>	Withdraw
Bayou Bodcau crayfish	<i>Bouchardina robisoni</i>	Withdraw
Big South Fork crayfish	<i>Cambarus bouchardi</i>	Withdraw
Bryson's sedge	<i>Carex brysonii</i>	Withdraw
Carolina bishopweed	<i>Ptilimnium ahlesii</i>	Withdraw
Elliott's croton	<i>Croton elliotii</i>	Withdraw
Enterprise siltsnail	<i>Floridobia monroensis</i>	Withdraw
evergreen (or winter) quillwort	<i>Isoetes hyemalis</i>	Withdraw
freemouth hydrobe	<i>Aphaostracon chalarogyrus</i>	Withdraw
Hall's pocket moss	<i>Fissidens hallii</i>	Withdraw
Jefferson County crayfish	<i>Fallicambarus gilpini</i>	Withdraw
knobby rocksnail	<i>Lithasia curta</i>	Withdraw
Lea's bog lichen	<i>Phaeophyscia leana</i>	Withdraw
Long Beach seedbox	<i>Ludwigia brevipes</i>	Withdraw
Swamp justiceweed	<i>Eupatorium paludicola</i>	Withdraw
Ozark emerald	<i>Somatochlora ozarkensis</i>	Withdraw
patch-nosed salamander	<i>Urspelerpes brucei</i>	Withdraw
regal burrowing crayfish	<i>Procambarus regalis</i>	Withdraw
skirted hornsnail	<i>Pleurocera pyrenella</i>	Withdraw
southern lance	<i>Elliptio ahenea</i>	Withdraw
southern meadow-rue	<i>Thalictrum debile</i>	Withdraw
spathulate seedbox (creeping smallflower)	<i>Ludwigia spathulata</i>	Withdraw
St. John's elephantear	<i>Elliptio monroensis</i>	Withdraw
Tennessee cave crayfish	<i>Orconectes incomptus</i>	Withdraw
Thorne's beaked-rush	<i>Rhynchospora thornei</i>	Withdraw
eastern ribbonsnake - lower FL Keys	<i>Thamnophis sauritus</i> pop. 1	Withdraw
setose cream and brown mottled microcaddisfly	<i>Oxyethira setosa</i>	Withdraw
blue spring hydrobe	<i>Aphaostracon asthenes</i>	Withdraw
Smokies snowfly	<i>Allocapnia fumosa</i>	Withdraw
Ocmulgee marstonia	<i>Pyrgulopsis agarhecta</i>	Withdraw
Godfrey's privet	<i>Forestiera godfreyi</i>	Withdraw
piedmont barren (lobed) strawberry	<i>Waldsteinia lobata</i>	Withdrawn 2017
Louisiana eyed silkmoth	<i>Automeris louisiana</i>	Withdraw

Wekiwa hydrobe	<i>Aphaostracon monas</i>	Withdraw
Wekiwa siltsnail	<i>Floridobia wekiwae</i>	Withdraw

Table 2. Species that need completed status reviews and listing proposals

Bigcheek cave crayfish	<i>Procambarus delicatus</i>
ciliate-leaf tickseed	<i>Coreopsis integrifolia</i>
coastal lowland cave crayfish	<i>Procambarus leitheuseri</i>
Correll's false dragon-head	<i>Physostegia correllii</i>
domed ancyliid	<i>Rhodacmea elatior</i>
Florida pondweed	<i>Potamogeton floridanus</i>
Godfrey's stitchwort	<i>Minuartia godfreyi</i>
Harper's fimbristylis	<i>Fimbristylis perpusilla</i>
hartwrightia	<i>Hartwrightia floridana</i>
Karst snowfly	<i>Allocapnia cunninghami</i>
Logan's agarodes caddisfly	<i>Agarodes logani</i>
Raven's seedbox	<i>Ludwigia ravenii</i>
Santa Fe cave crayfish	<i>Procambarus erythropus</i>
Sevier snowfly	<i>Allocapnia brooksi</i>
slenderwrist burrowing crayfish	<i>Fallicambarus petillicarpus</i>
southern snaketail	<i>Ophiogomphus australis</i>
sunfacing coneflower	<i>Rudbeckia heliopsidis</i>
Sykora's hydroptila caddisfly	<i>Hydroptila sykorai</i>
Tallapoosa orb	<i>Quadrula asperata archeri</i> now <i>Cyclonaias archeri</i>
Tennessee forestfly	<i>Amphinemura mockfordi</i>
thin-wall quillwort	<i>Isoetes microvela</i>
three-tooth long-horned caddisfly (triaenodes)	<i>Triaenodes tridentus</i>
yellow-sided clubtail	<i>Stylurus potulentus</i>

Additional Information on the 23 Species that Warrant Status Reviews

The **bigcheek cave crayfish** (*Procambarus delicatus*) is ranked as endangered by the American Fisheries Society, as critically endangered by the IUCN, and as critically imperiled by NatureServe (G1S1 2014). This species is found in a single cave system associated with Alexander Springs in Lake County, Florida. The springs are a popular destination for recreationists and no management is in place by the Ocala National Forest to safeguard the species. The highly endemic crayfish is threatened by trash, fishing, snorkeling, SCUBA diving, swimming, pollution, and groundwater withdrawal. As an aquatic cave species, it is likely highly sensitive to changes in water quality. The bigcheek cave crayfish hasn't been seen since 1976 and needs immediate surveys to determine if it still survives.

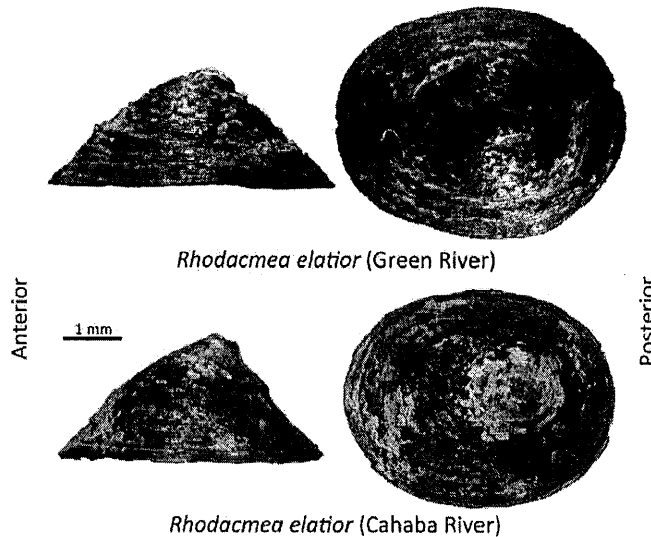
Ciliate-leaf tickseed (*Coreopsis integrifolia*) is a perennial flower in the aster family with bright yellow ray flowers with a purple red center. It grows on streambanks, low floodplains, and the edges of swampy areas. It is ranked as critically imperiled by NatureServe (2010). It is a rare southeastern endemic known from only a few widely scattered populations in northern Florida, Georgia, and South Carolina. Threats include damming of streams, clearcutting bottomlands, right-of-way maintenance such as herbicides and mowing, road-widening projects, trampling by cattle, trampling by recreationists at boat ramps and river camps, and by siltation and pollution.

The **coastal lowland cave crayfish** (*Procambarus leitheuseri*) is ranked as endangered by the American Fisheries Society and by the IUCN. It is ranked as critically imperiled by NatureServe (G1S1S2 2014). It is known from eight sites, five of which are within a 3-mile radius and may constitute one occurrence, in Pasco and Hernando counties, Florida. It is threatened by water quality degradation from eutrophication, water extraction, and pollution from industry, urban and residential development, and recreation.

Correll's false dragon-head (*Physostegia correllii*) is a 7-foot tall purple-pink flower in the mint family that resembles a snapdragon and grows in fewer than 15 isolated populations in scattered wetland habitats in Louisiana and Texas. It is threatened by the loss of wetland habitat, herbicide runoff, invasive species, and human disturbance of roadside and irrigation ditches and creek-beds. Each isolated population is highly vulnerable to extirpation.

The **domed ancyloid** (*Rhodacmea elatior*) is a freshwater limpet that is incredibly rare and in need of proactive conservation including captive propagation and reintroduction (Foighil et al. 2011). The entire genus is nearly gone except for three known surviving populations. Foighil et al. (2011) categorize the entire *Rhodacmea* genus as "critically endangered" and "nearly extinct" and urge conservation action to protect this biologically significant group: "All three surviving populations of the genus *Rhodacmea* merit specific status. They collectively contain all known survivors of a phylogenetically highly distinctive North American endemic genus and therefore represent a concentrated fraction of continental freshwater gastropod biodiversity" and "Our data indicate that each extant population represents the only known living representatives of a discrete species: two members of a *Rhodacmea elatior* cryptic species complex and *R. filosa*. There is, to our knowledge, no record of extant *R. hinckleyi*. Our three study populations therefore contain all known extant members of a phylogenetically highly distinctive North American endemic genus." Foighil et al. conclude: "The extensive evolutionary history retained within the three surviving *Rhodacmea* populations imbues them with exceptionally high biodiversity value, thereby making

their conservation maximally cost-effective and justifying a proactive program of protection, propagation and reintroduction.”



Domed ancyloid graphics from Foighil et al. 2011: Foighil, D.O., J. Li, T. Lee, P. Johnson, R. Evans, and J.B. Burch. 2011. Conservation genetics of a critically endangered limpet genus and rediscovery of an extinct species. PLoS ONE 6(5): e20496. doi:10.1371/journal.pone.0020496.

For *R. elatior*, NatureServe (2008) estimates a long-term decline of up to 90 percent. The limpet is currently only known from the Green River in Kentucky and the Cahaba River in Alabama. We urge the Service to list the domed ancyloid, as well as to list *R. filosa*, and to develop a recovery plan that includes reintroduction. Both species are threatened by small, isolated population effects, the inadequacy of existing regulatory mechanisms to ensure their continued survival, and factors which threaten water quality including siltation and global climate change.

Florida pondweed (*Potamogeton floridanus*) is an aquatic plant with floating, elliptical leaves that is ranked by NatureServe (2001) as critically imperiled because it is known from only the Blackwater River in Santa Rosa County, Florida and is threatened by recreational impacts including trampling, swimming, motor boating, canoe put-in and take-out, and by development, road runoff, road widening, water pollution, and clearing of vegetation by homeowners. There are no existing regulatory mechanisms to ensure the continued existence of the species. It has an extremely restricted distribution and is known from only two surviving populations, only one of which is large.

Godfrey's stitchwort (*Minuartia godfreyi*) is a wetland flower in the carnation family with tiny white flowers. It is ranked as critically imperiled by NatureServe (G1 S1(FL)(NC)(TN) SH(AL) SNR(GA) SX(TN) 2011). It is a rare regional endemic with very few, irregular, widely scattered occurrences. It is threatened by logging, wetland loss, timber plantations, and roadside

maintenance. Many historical populations have disappeared. It has specific habitat needs and limited dispersal ability.

Harper's fimbriatilis (*Fimbristylis perpusilla*) is a rare annual wetland sedge found in scattered, highly localized populations from Maryland to Georgia on the lower Coastal Plain. Though it is wide ranging, populations are very vulnerable to habitat degradation and NatureServe (2009) describes the threat level as high stating, "Manipulation of the site hydrology by draining or inundation is a major threat, as this species is very vulnerable to hydrologic change." It apparently only germinates and becomes established when specific conditions are met and is restricted to areas in ponds and rivers that are exposed, but not desiccated, during seasonal low-water periods. It is threatened by wetland draining and filling, drawdown of the water table, destruction of vernal pools, trampling, shading, off-road vehicles, invasive species, logging, agriculture, road construction, development, drought, and global climate change. A site in Delaware was recently extirpated to construct a fishing pond. NatureServe (2009) reports that in the past 20 years or so, plants have disappeared at many sites, or known sites have been destroyed. Approximately 55 occurrences are believed extant, but only 24 of these have been observed in the past 20 years (NatureServe 2009). The long-term decline is estimated at more than 70 percent. It was a candidate for federal listing from 1975 until 1993. There are no existing regulatory mechanisms that adequately safeguard this sedge.

Hartwrightia (*Hartwrightia floridana*) is a rare obligate wetland flower in the aster family with tiny whitish, pale pink or light lavender flowers that grows up to three feet tall. It ranges from northcentral Florida to southeastern Georgia and grows in wet prairies, and flatwoods with wet, peaty soils. Few occurrences are adequately protected. It is threatened by conversion of native habitat to pine plantation and cattle pasture, wetland drainage, fire suppression, roadside mowing and spraying, and digging by feral hogs. Draining and silviculture have nearly eliminated this species from private lands. NatureServe (2009) describes the overall threat level as very high to high because its habitat has been lost through systematic drainage and conversion of land to pine plantation or to improved pasture, and is adversely affected by grazing and canopy closure. It is the only species in its genus and should thus be a priority for listing and recovery. Though it is found on state forests in Florida, the sites are not managed to prioritize maintaining the species.

The **karst snowfly** (*Allocapnia cunninghami*) is a rare winter stonefly from a few counties in Tennessee and Kentucky that is ranked as critically imperiled by NatureServe (2006) because all known sites "are experiencing severe impacts from poor agricultural practices and development." Kondratieff and Kirchner (1999) report that the Tennessee streams at the type locality of *A. cunninghami* have been extremely degraded by poor agricultural practices, especially siltation and organic enrichment, perhaps due to septic system leakage (Kondratieff, B. C., and R. F. Kirchner. In Search of Rare *Allocapnia* (Capniidae). *Perla* 17 (1999): 63-65. Available at: http://www.zobodat.at/pdf/perla_17_0063-0065.pdf). Following a survey for *A. cunninghami* and *A. perplexa*, Kirchner et al. (2002) conclude that "These species are, no doubt, imperiled throughout their ranges and it is strongly suggested that potential listing should be considered" (Kirchner, R.F., B.C. Kondratieff, and R.E. Zuellig. 2002. The Tennessee type locality of *Allocapnia perplexa* and a new Kentucky location for *Allocapnia cunninghami* (Plecoptera: Capniidae). *Entomological News* 113(5): 332-335). Based on available published literature, the karst snowfly clearly may warrant listing and merits a status review.

Logan's agarodes caddisfly (*Agarodes logani*) is a rare caddisfly known only from one spring-fed stream in Gadsden County, Florida. NatureServe (2013) states that it is in danger of extinction because of its extremely limited range. It is known only from a "farm stream" at Florida Agricultural and Mechanical University. It is highly vulnerable with very narrow environmental specificity and the area surrounding the only known occurrence needs to be managed to prevent anything that adversely affects water quality, such as pollution, siltation or degradation of surrounding habitat.

Raven's seedbox (*Ludwigia ravenii*), also known as raven's primrose-willow, is a water primrose in the evening primrose or willowherb family. It is ranked by NatureServe (2016) as critically imperiled. It is known from the Coastal Plain of southeastern Virginia, eastern North Carolina, southeastern South Carolina and northeastern Florida. More than half of known populations have likely been extirpated. At least seventeen of the nearly 30 occurrences known are historic; knowledge of current status of these populations (as well as additional inventory of suitable habitat within the range) is needed; only five to six occurrences are known to be extant. Only one to two currently known occurrences have good viability. North Carolina has 17 occurrences in 11 counties but only two to four are known to be extant. Virginia has nine occurrences in two counties but only three are known to be extant. South Carolina has one vouchered collection from Berkeley County (H.W. Ravenel) that is historical; and the species has not been relocated in Berkeley County despite intensive searches. The site of the original collection is likely inundated by Lake Moultrie. The species may not be extant in Florida as it has not been seen there since 1982; there is one record in Clay County. It is threatened by maintenance of ditches and powerline rights-of-way including herbicide use, excavation and deepening of ditches, road widening and paving.

The **Santa Fe cave crayfish** (*Procambarus erythropus*) is ranked as endangered by the American Fisheries Society and the IUCN. It is ranked as critically imperiled by NatureServe (G1S1 2014). This species is known from five likely interconnected sites in southern Suwannee County, Florida. It is threatened by pesticide and herbicide use in surrounding areas, mining pollution, and groundwater extraction. Crayfish can also be killed during Suwannee River flooding due to either physicochemical changes or contamination. The IUCN Redlist (2010) states: "This species is threatened by human disturbance (Streever 1996), groundwater abstraction, pollution from mining, and pesticide and herbicide use in surrounding areas (Florida Fish and Wildlife Conservation Commission 2009). This mining activity is also known to destroy the cavern systems supporting this species (P Moler pers. comm. 2010). Furthermore, garbage dumping in the 1970s is thought to have caused the extirpation of this species from one site (Florida Fish and Wildlife Conservation Commission 2009)." All available information indicates that this rare crayfish merits a status review. The IUCN Redlist (2010) states, "Further site protection measures are required to ensure further populations are not extirpated, and further research is needed to determine the population status of this species."

The **Sevier snowfly** (*Allocapnia brooksi*) is a rare winter stonefly known from three counties in Tennessee. It is threatened by water pollution from heavy siltation and organic enrichment from poor agricultural practices and runoff from development (Kondratieff and Kirchner 1999).

The **slenderwrist burrowing crayfish** (*Fallicambarus petilicarpus*) is a primary burrowing crayfish that lives in sandy loam soil in shrub dominated wetlands and roadside ditches. It is known from two counties in Arkansas and is ranked as critically imperiled by NatureServe (2010) and as endangered by the IUCN (2010) and the American Fisheries Society (2007). It is “highly localized” and “locally uncommon” (Robison and Crandall 2007). NatureServe states that it is threatened by a continuing decline in the quality of its habitat as a result of pollution and changes in land use.

The **southern snaketail** (*Ophiogomphus australis*) is a rare dragonfly with a green thorax with two lateral black stripes. The larvae need clean gravel stream bottoms. Odonate experts describe it as restricted, vulnerable, and declining. It is ranked as endangered by the IUCN (2007) and as critically imperiled by NatureServe (G1G2 S1(FL)(LA) SNR(MS) 2008). This dragonfly has a limited range and is susceptible to pollution and perturbation of stream flow. It is known from three rivers and streams in eastern Louisiana, and western Mississippi totaling approximately 50 miles, and from Eglin Air Force Base in Okaloosa County, Florida. It has not been detected in surveys of many historical locations. The dragonfly is threatened by water quality deterioration from gravel mining, siltation, pesticides, and logging. The larvae are harmed by pollution and flood scouring. The IUCN Redlist (2007) states: “Carle in his description considered *O. australis* among the rarest of the Odonata. He found that the pristine nature of the streams inhabited by this species were so degraded that the species might be in danger of extinction. The habitat of this species is being rapidly reduced by gravel removal and farm water run-off. Known from maybe 50 miles of stream, probably thousands in each of the three streams. Only known from three rivers and streams in eastern Louisiana and adjacent Mississippi. According to Frank Carle there is much negative survey data. Undoubtedly declining because of susceptibility of *Ophiogomphus* larvae to flood scouring and pollution.”

Sunfacing coneflower (*Rudbeckia heliopsidis*) is a four-foot tall yellow flower in the aster family that is found in Alabama, Georgia, Virginia, and the Carolinas, with most occurrences in Alabama. It is wide-ranging but widely scattered and rare. NatureServe (2016) reports that it is threatened by drainage of swales, fire suppression, and the succession of woody vegetation, and that most sites require manual removal of woody vegetation by mowing, selective cutting, or controlled burns. Plant experts describe this species as one that has fallen through the cracks of existing conservation efforts. NatureServe (2016) states that it has likely experienced a rapid decline attributed to a number of factors: fire exclusion, hydrological alterations, development, quarrying, and other habitat modifications.

Sykora’s hydroptila caddisfly (*Hydroptila sykorai*) is a critically imperiled caddisfly that is only known from five specimens from one spring run in Gadsden County, Florida and is in danger of extinction because of its extremely limited range (NatureServe 2013). It is known only from a “farm stream” at Florida Agricultural and Mechanical University. It is highly vulnerable with very narrow environmental specificity and the area surrounding the only known occurrence needs to be managed to prevent anything that adversely affects water quality, such as pollution, siltation or degradation of surrounding habitat.

The **Tallapoosa orb** (*Cyclonaias archeri*, formerly *Quadrula asperata archeri*) is currently ranked as a critically imperiled subspecies by NatureServe (G4T1Q 2010) but it might be a full

species (*Cyclonaias archeri*). Either way, it is highly localized, faces imminent threats, and might already be extinct. It is restricted to the Tallapoosa River in Alabama above the Fall Line. In a 2002 survey no live individuals or shells were found. Evaluation is critical because additional impoundments in the upper Tallapoosa River drainage in Georgia could drive this taxon to extinction.

The **Tennessee forestfly** (*Amphinemura mockfordi*) is a rare stonefly known from only two streams, one in Tennessee and one in Alabama. It is threatened by poor land management practices (NatureServe 2009). Morse et al. (1993) list the Tennessee forestfly as a species that is vulnerable to extirpation due to sedimentation and water pollution (Morse, J.C., B.P. Stark, and W. P. McCafferty. 1993. Southern Appalachian streams at risk: implications for mayflies, stoneflies, caddisflies, and other aquatic biota. *Aquatic Conservation: Marine and Freshwater Ecosystems* 3.4 (1993): 293-303).

Thin-wall quillwort (*Isoetes microvela*) is a critically imperiled quillwort known from only 10 sites in North Carolina. NatureServe (2004, 2015) reports that it is threatened by hurricanes and that one known site is threatened by campground activities. It occupies habitats strongly affected by storm-induced flooding. According to experts on the species it merits a status review for federal listing.

The **three-tooth long-horned caddisfly** (*Triaenodes tridentatus*) is a potentially extinct rare caddisfly once known from Alabama, Florida, and Oklahoma. NatureServe (2005) states that an inventory of historical sites is badly needed and that if extant populations are found the species should be protected at all costs. It hasn't been seen since 1991. The IUCN Redlist previously categorized it as extinct but it is now listed as unassessed.

The **yellow-sided clubtail** (*Stylurus potulentus*) is a medium-sized slender blue-eyed dragonfly that is mostly black except for the yellow sides of the thorax. Larvae are found in pristine sand-bottomed forest streams and rivers, and adults forage low along shady forest edges. It is known from the Florida panhandle and coastal Mississippi and has a limited range and high susceptibility to alterations in stream flow and water quality. The IUCN Redlist (2007) states that its habitat has been interrupted by pollution, channelization, military bases, shipyards, seafood processing establishments, vacation homes and a major interstate. NatureServe (2009) reports that it is threatened by development, pollution, clearcutting, and pesticides because it is extremely sensitive to any alteration of water quality.