

BEFORE THE SECRETARY OF THE INTERIOR

**Petition to Protect the Solstice Creekmussel (*Ligodonta obscura*)
under the Endangered Species Act
and to Concurrently Designate Critical Habitat**



Photo by Brena Jones / NC Wildlife Resource Commission

CENTER FOR BIOLOGICAL DIVERSITY
July 21, 2026

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Dear Secretary Burgum:

Pursuant to Section 4(b) of the Endangered Species Act (ESA), 16 U.S.C. §1533(b); section 553(e) of the Administrative Procedure Act (APA), 5 U.S.C. §553(e); and 50 C.F.R. §424.14(a), the Center for Biological Diversity and Will Harlan hereby petition the Secretary of the Interior, through the U.S. Fish and Wildlife Service (USFWS), to protect the solstice creekmussel (*Ligodonta obscura*) as a threatened or endangered species under the ESA.

This petition requests listing of the solstice creekmussel based on the threats posed by limited range, small population size, urban and agricultural development, water pollution, changing hydrology as a result of climate change, habitat fragmentation and degradation, and the inadequacy of existing regulatory mechanisms for protecting this species. Petitioner also requests that critical habitat be designated concurrently with the listing, pursuant to 16 U.S.C §1533(a)(3)(A) and 50 C.F.R. §424.12.

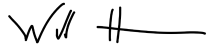
The USFWS has jurisdiction over this petition. This petition sets in motion a specific process, placing definite response requirements on USFWS. USFWS must issue an initial finding as to whether the petition “presents substantial scientific or commercial information indicating that the petitioned action may be warranted.” 16 U.S.C. §1533 (b)(3)(A). USFWS must make this initial finding “(t)o the maximum extent practicable, within 90 days after receiving the petition.”

The Center for Biological Diversity (“Center”) is a non-profit, public interest environmental organization dedicated to the protection of native species and their habitats through science, policy, and environmental law, supported by more than 1.8 million members and supporters. The Center works to secure a future for all species, great or small, hovering on the brink of extinction.

We submit this petition on behalf of our staff and members who hold an interest in protecting the solstice creekmussel.

Submitted this 21st day of July, 2026

Sincerely,

A handwritten signature in black ink, appearing to read 'Will Harlan', with a stylized flourish at the end.

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I. EXECUTIVE SUMMARY

The solstice creekmussel (*Ligodonta obscura*) is a critically imperiled and recently discovered freshwater mussel currently found only in one waterway in central North Carolina. This species' existence is mainly threatened by pollution from urban and agricultural development and changes in hydrology due to dam presence and climate change. This means that threats, including development of land upstream, pose a risk to ensuring this endemic species has suitable habitat, ensuring its existence. With only 43 individuals recorded in the wild, the solstice creekmussel is a highly rare species. With limited state and federal protection, and the extensive threats faced by freshwater ecosystems, this newly discovered species urgently needs the protection afforded under the Endangered Species Act.

II. INTRODUCTION

The southeastern United States is home to one of the most biodiverse freshwater mussel habitats in the world (Perkins et al. 2025, p. 246). The freshwater mussel fauna of the Uwharrie region of central North Carolina, home to the solstice creekmussel, is no exception, with a combination of unique morphologies representing both well-known, wide-ranging species and narrowly endemic species (Perkins et al. 2025, p. 246). However, freshwater mussels are among the most imperiled animals in the world, with many species already lost to extinction (Garber, 2024). In North Carolina, approximately 70% of the state's 65 native mussel species are considered rare and in need of conservation (Duke Forest, 2025). The solstice creekmussel is particularly rare, with its extraordinarily narrow distribution in only one stream in central North Carolina, making it especially vulnerable to extinction.

Freshwater mussels, including the solstice creekmussel, provide an essential ecological role in freshwater ecosystems. As filter feeders, freshwater mussels filter pollutants and process nutrients increasing water quality. Freshwater mussels also serve as ecosystem engineers, stabilizing stream beds and preventing erosion of streams banks (Pandolfo et al., 2024, p. 2). Given their critical role providing ecosystem services, conserving freshwater mussel species, like the solstice creekmussel, will support habitat preservation and improve the quality of their entire freshwater ecosystem.

III. BIOLOGY

a. Taxonomy

Ligodonta obscura is a species of freshwater mussel commonly known as the solstice creekmussel.

Kingdom	<i>Animalia</i>
Phylum	<i>Mollusca</i>
Class	<i>Bivalvia</i>
Order	<i>Unionida</i>

Family	<i>Unionidae</i>
Genus	<i>Ligodonta</i>
Species	<i>Obscura</i>

Table 1. Taxonomy of *Ligodonta obscura* (Integrated Taxonomic Information System, last visited Apr. 30, 2026).

b. Species Description

Solstice creekmussels are freshwater bivalves with dark gray, ringed shells. Solstice creekmussels exhibit bilateral symmetry, with soft bodies and hard shells composed of two mirrored halves, joined dorsally at a hinge. The mussels range from roughly 25mm - 40mm in length and 5mm - 15mm in height (Perkins et al. 2025, p. 253-55).

Freshwater mussel shell morphology can vary even among organisms of the same species, in part due to landscape-scale factors including water chemistry, streambed substrate composition, and streambed depth (Perkins et al. 2025, p. 246). This tendency for variation can make species identification challenging. It wasn't until recent developments that the solstice creekmussel was formally identified as a genetically unique taxon after years of misclassification (Whelan et al., 2023, p. 651). In fact, the solstice creekmussel was determined to be so distinct that it deserved its own genus (Warner, 2025).



Figure 1. Image of solstice creekmussels taken during field surveys with researcher's hand for scale (Perkins et al., 2025, p. 248).

c. Ecology

Freshwater mussels are one of the most threatened animal groups in the world but are vital to ecosystem health. Freshwater mussels, like the solstice creekmussel, are considered ecosystem engineers as they filter water, remove impurities and stabilize streambeds. As filter feeders,

mussels support healthy rivers by straining the water for phytoplankton, diatoms, and other microorganisms, effectively cleaning the water (Defenders of Wildlife, last visited May 25, 2026). As a result of this feeding mechanism, mussels are considered indicator species for stream health, as populations will struggle when the water is too polluted with either sediment, excess nutrients, or harmful toxins (Warner, 2025). In addition to filtering water, mussels provide a food source to many other aquatic and terrestrial species. Not only do the mussels themselves feed mammal species, such as muskrats and raccoons, but also their natural waste provides a food source for aquatic invertebrates (Ciccotto, last visited May 25, 2026). Mussels also play a role in shaping the physical features of a stream. The solstice creekmussel, and other freshwater mussels, bury themselves in soft stream substrates which can stabilize stream bottoms and banks, reducing erosion rates (Ciccotto, last visited May 25, 2026). Mussel shells also provide habitat to various algae and other species (Ciccotto, last visited May 25, 2026).

Mussels reproduce sexually, with most species releasing eggs and sperm directly into the water for external fertilization. Most species of bivalve spawn in warmer weather during spring or summer, making the solstice creekmussel a rare outlier as it typically spawns in December or January (Perkins et al. 2025, p. 254). In fact, the common name “solstice creekmussel” was given to this species in recognition of their unusual reproductive period, which coincides roughly with the winter solstice (Perkins et al., 2025, p. 246). Solstice creekmussels typically produce one generation per year (Perkins et al. 2025, p. 257). Growth rings found on solstice creekmussels suggest that they are relatively short-lived for mussels, with a typical lifespan of 9 to 10 years (Perkins et al. 2025, p. 257).

d. Habitat Requirements

Solstice creekmussels are found within the composite sand/gravel substrates of freshwater rivers, including low-flow river and creek beds or shallow pools. Solstice creekmussel individuals were typically observed partially buried in river-bottom substrate but were sometimes found in swift-moving riffles (*NatureServe*, 2025).

Solstice creekmussels are filter feeders, consuming microscopic food particles suspended in water such as phytoplankton, algae, and fine organic detritus. Due to this specialized feeding method, and because the mussels are by nature confined to fragmented freshwater locales, the health of a given solstice creekmussel population is directly linked to the health of its freshwater ecosystem (*Perkins et al.*, 2025, p. 254).

e. Current and Historic Range

Currently, the solstice creekmussel is known only to be found in a freshwater river in central North Carolina within the Yadkin-Pee Dee River System. With surveys indicating that the solstice creekmussel is only found in this one stream, researchers have classified this species as highly vulnerable and at immediate conservation risk.

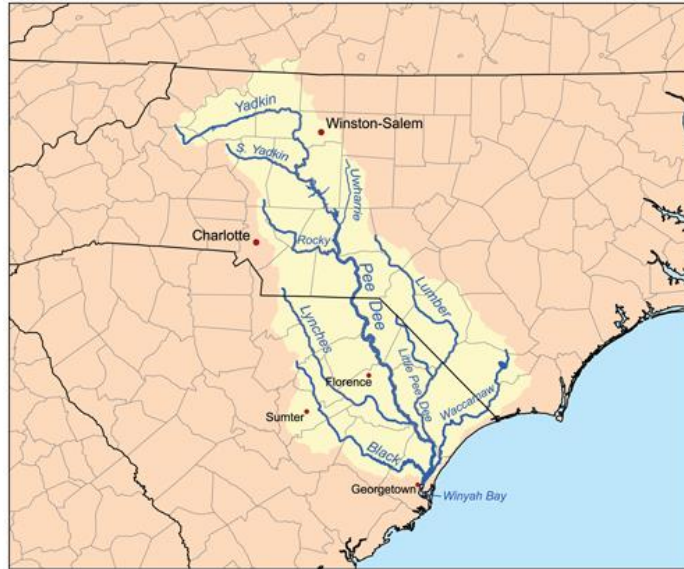


Figure 2. Map of the Yadkin-Pee Dee River System in central North Carolina and South Carolina, U.S.A.

From 2016-2022, a total of 141 surveys were conducted and only 43 live solstice creekmussel individuals, at 11 different sites, were observed from one contiguous 7.15 km reach in Little River, a direct tributary on the eastern edge of the Pee Dee River in Randolph County, North Carolina. As indicated in Figure 3 below (colored red and labeled B), solstice creekmussels have only been surveyed in the 7 km stretch of the Little River in North Carolina (Perkins et al., 2025, p.250–52). Historical collections are represented by only three specimens, at the North Carolina Museum of Natural Science, from an approximately 6 km reach of Barnes Creek (indicated in Figure 3 with the red dashed line), a tributary draining to the Uwharrie River, a major tributary to the Pee Dee River, in Montgomery County, North Carolina. No live specimens have been recovered from Barnes Creek since 2010.

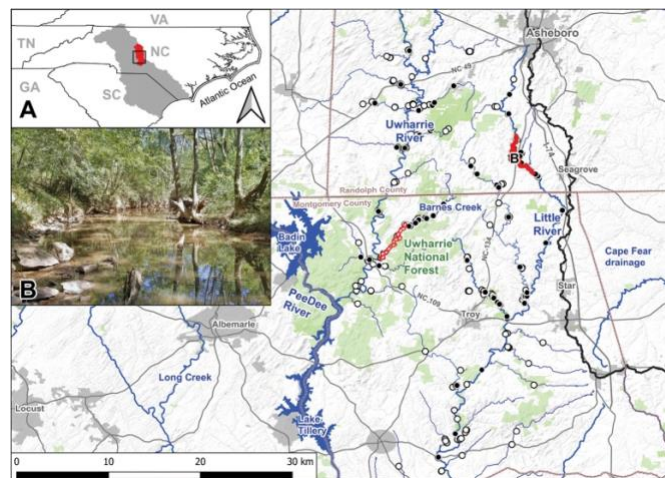


Figure 3. Image depicting a terrain map of survey locations for freshwater mussel surveys conducted from 2016-2022 in red (A) and photograph showing an example of a typical habitat preferred by mussels of this type (B). (Perkins et al., 2025, p. 250).

Since the discovery of solstice creekmussels, researchers have observed a decline in the population. This species is now found in only a 4-mile stretch of the Little River (Warner, 2025).

Currently, solstice creekmussels are not known to be found in any other locations locally or globally, nor is the species known to be represented in additional museum collections (*Perkins et al.*, 2025, p.250–54). The microendemic status of this species is a major warning sign in terms of conservation risk.

IV. POPULATION STATUS

The solstice creekmussel is extremely rare globally. The species has been documented in only two stream reaches in the Uwharrie region of North Carolina, the Little River and historically Barnes Creek (*Perkins et al.*, 2025, p. 250). Due to this extreme rarity, and freshwater mussels' general sensitivity to environmental fluctuations, the solstice creekmussel is considered critically imperiled (*NatureServe*, 2026).

Because of its limited range, and the species' recent discovery and classification, population trends are unavailable but likely declining based on lack of recent detections in Barnes Creek (*NatureServe*, 2026). The solstice creekmussel is considered ecologically fragile and highly vulnerable to extirpation from environmental or stochastic events (*Perkins, et al.* 2025). This extremely rare and vulnerable status, in conjunction with known threats, makes the species warranted for listing under the Endangered Species Act.

V. THREATS

A. Present or Threatened Destruction, Curtailment, or Modification of Habitat or Range

1. Urban and Agricultural Development in Central North Carolina

Pollution caused by urban development and agricultural runoff in central North Carolina threatens the survival of the solstice creekmussel. The Yadkin-Pee Dee River System, where the current known population of solstice creekmussels is found, has been experiencing habitat degradation due to pollution, sedimentation, and urban expansion (Greene, 2025). This river system is exposed to various forms of pollution, including agricultural runoff, wastewater treatment plants, stormwater runoff from urban spaces, and industrial waste (Wells, 2025).

Agricultural and urban development have contributed significantly to the degradation of central North Carolina's rivers, thereby degrading solstice creekmussel habitat. Nearly one-third of the Yadkin-Pee Dee River watershed is used for agriculture, and while just thirteen percent of land is currently developed, that number is rapidly increasing. Half of the Yadkin-Pee Dee River Basin is covered in forested lands, with most forestland privately owned. Forests are being cleared to make way for new urban and agricultural developments, which increases stormwater runoff and the risk of poor waste management, contaminating nearby streams (American Rivers, last visited May 26, 2026). This trend is occurring in the upper portion of the river basin as the demand for development is increasing in Winston-Salem and the greater Charlotte area (Wells, 2025). It is estimated that by 2030 the river basin's population will grow from approximately 2.7 million residents to 3.9 million, roughly a 47% increase (North Carolina Department of Environmental Quality, last visited May 26, 2026). To accommodate this growth, lands will be cleared and replaced with impervious surfaces, leading to an increase in polluted stormwater

runoff. Further, changes in land use for urbanization often pollute nearby rivers by accelerating soil erosion, creating excessive silt (Bandurin, 2022).

Additionally, an increase in residential capacity will require additional services from wastewater treatment plants, which already contribute to the pollution of the Yadkin-Pee Dee River Basin. Rivers within this basin have been contaminated by mercury and nutrient and bacterial pollutants from wastewater treatment plants, in addition to large-scale agricultural operations (Wells, 2025). This increase in nutrient and bacterial pollutants has led to harmful overgrowth of algae. Algal blooms can have severe impacts on river ecosystems by blocking sunlight from penetrating the water's surface, reducing growth of underwater plants, and depleting oxygen levels in the water, hindering survival of aquatic life, and therefore jeopardizing the solstice creekmussel's survival (Wells, 2025).

In addition to wastewater treatment plants, other industrial facilities, including coal-fired power plants, have contributed significant pollution within the river basin through coal ash and other hazardous wastes, with contaminated areas often necessitating clean-up plans (Wells, 2025). The river basin has also been found to be contaminated with per- and polyfluoroalkyls, known as PFAS or forever chemicals. (North Carolina State University, 2020). All of these contaminants pose significant threats to freshwater mussels because these species are filter feeders, continually exposing individuals to these pollutants. Mussels thrive in clean water, making healthy waterways essential to their survival.

2. Dams Within the Solstice Creekmussel's Watershed

The survival of the solstice creekmussel is also threatened by impacts from dams along Yadkin-Pee Dee River Basin waterways. For example, the Yadkin River, located in the same river system as the only river where solstice creekmussels are found, has been significantly impacted by numerous dams, with the southern portion alone altered by as many as six dams, creating multiple reservoirs (American Rivers, last visited June 1, 2026). The abundance of dams creates habitat fragmentation for many aquatic species, including freshwater mussels, by restricting movement. Further, dams cause habitat degradation by altering water levels, reducing streamflow and function. Reduced streamflow often results from water diversions by dams for human use, and when combined with warming waters and changing precipitation patterns due to climate change, this reduction has and will continue to threaten freshwater mussel populations (Xerces Society, last visited June 1, 2026).

Population isolation and altered river flow resulting from dams increases vulnerability to acute and chronic pollution from sources such as spills, stormwater runoff, and underregulated waste management of agricultural operations (American Rivers, last visited June 1, 2026).

3. Climate Change

Climate change poses significant threats to the survival of the solstice creekmussel. Freshwater ecosystems not only face anthropogenic changes to river temperature and hydrology but are also particularly vulnerable to present and future environmental changes, including changes in hydrology such as precipitation amounts and warming waters (Xerces Society, last visited June 1, 2026). Climate change is predicted to increase both the frequency and magnitude of floods and droughts. Central North Carolina has already experienced more frequent flooding

and drought conditions and is expected to increasingly face climate events as climate change is causing greater hurricane activity and associated rainfall. These changes have already begun to exacerbate water quality and quantity issues along North Carolina rivers (American Rivers, last visited June 1, 2026). These hydraulic changes, in addition to increasing river temperatures, may alter nutrient cycling, decrease habitat availability, degrade water quality, and potentially introduce parasites and pathogens into freshwater ecosystems, degrading habitat health for not only solstice creekmussels but all aquatic species (Pandolfo et al., 2024, p. 2). These environmental changes particularly threaten species with limited movement, like freshwater mussels, making it nearly impossible for such species to adapt to accelerated changes (Garber, 2024).

In addition to changes in hydrology, climate change has increased the threat of harmful algal blooms along the Yadkin-Pee Dee River Basin. By altering weather patterns, climate change has resulted in longer, hotter summers, creating ideal conditions for algal blooms to thrive (Wells, 2025). Algal blooms degrade aquatic habitats by reducing available sunlight and oxygen. Also, by increasing the frequency of climate disasters, climate change has increased the frequency of disaster recovery, sometimes requiring large debris moving machinery, threatening freshwater mussel populations through crushing (Lohmeyer, 2025).

B. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

Currently, there are no commercial uses specifically targeting the solstice creekmussel. Additionally, there does not appear to be any recreational, scientific, or educational uses significantly affecting the population of solstice creekmussels. While there does not seem to be a current threat of overutilization, as of 2022 there were only 43 solstice creekmussel individuals recorded (*Perkins et al.*, 2025, p.250–52). With a significantly low number of individuals, the solstice creekmussel may be threatened by overutilization with even the slightest change in these uses.

C. Disease and Predation

While there are no indications that the solstice creekmussel specifically is at undue risk of adverse predation, this species is vulnerable given its low population size and limited range. All mussel species, including the solstice creekmussel, are vulnerable to the introduction of invasive species due to risk from competition and disease (Xerces Society, last visited June 1, 2026).

In terms of predation, the reintroduction and natural expansion of river otter populations can decimate small mussel populations and the solstice creekmussel's limited range renders this species intrinsically vulnerable to predation risk (Roberts et al. 2020, p. 283). In some areas freshwater mussels make up roughly one-quarter of the diet of river otters (Parise 2021, p. 42).

Additionally, as a sensitive species to environmental changes, freshwater mussels are prone to hypoxia stemming from increased amounts of total dissolved solids in their environment and from increased algal populations which can increase vulnerability to disease (Wells, 2025).

D. Inadequacy of Existing Regulatory Mechanisms

1. Federal Mechanisms

a. Endangered Species Act

The solstice creekmussel is not adequately protected under any existing regulatory mechanism and warrants listing under the Endangered Species Act. Of approximately 300 native freshwater mussels in the United States and Canada, more than 70 percent are classified as endangered, threatened, or of special concern (Williams, 1992 p. 6). Because of the extremely limited known scope of habitat for the solstice creekmussel and threats to its continued existence, including the general proclivity of freshwater mussels to be susceptible to significant declines from even minor ecological changes, the solstice creekmussel is in urgent need of protection under the ESA.

b. National Environmental Protection Act

The National Environmental Protection Act (NEPA) requires that federal agencies adhere to standards that consider their actions' effects on the environment. (National Environmental Policy Act of 1969, 42 U.S.C. §§ 4321–4370h (2018)). These federal agencies are required to complete environmental assessments and environmental impact statements that require them to disclose potentially adverse effects they have on the environment, including potentially adverse effects on the ecological health of any present endangered or threatened species' habitats. However, because the solstice creekmussel is not listed under the ESA, NEPA does not provide any procedural protection for this species.

c. National Forest Management Act

The National Forest Management Act of 1976 (NFMA) establishes a plan for maintaining the multiple uses of U.S. National Forest land, with one function being to “provide for diversity of plant and animal communities[.]” 16 U.S.C. § 1604(g)(3)(B). Additional requirements for land management based on NFMA state compliance with ecosystem integrity and diversity requirements as needing to “...maintain the diversity of plant and animal communities and support the persistence of most native species in the plan area.” (Section 219.9, National Forest Management Act of 1976).

Considering that the Barnes Creek location (see Figure 3) of presumed solstice creekmussel habitat is within the Uwharrie National Forest and given the potential further discovery of habitats for the solstice creekmussel in that locality, it is possible that the NFMA may theoretically provide some baseline protection for this species. However, it is unlikely that this law would be adequate for protecting this mussel, as the law is geared towards conserving forested areas, and there is no guarantee that any future discovered mussel habitats would be in forested areas, nationally protected or otherwise. Moreover, while the Yadkin-Pee Dee River Basin has some land that lies within federal protection, most of the watershed's forestland is privately owned, meaning it is likely that if additional mussel populations were discovered the nearby lands would not be under any federal mandates (American Rivers, last visited June 1,

2026). In fact, the Little River, where solstice creekmussels are currently found, is outside federally owned land (See Figure 4).

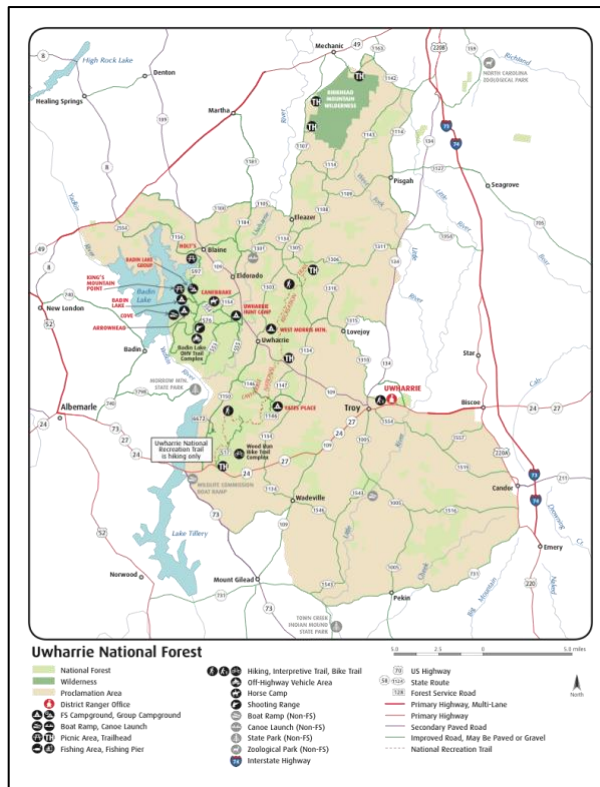


Figure 4. Map of Uwharrie National Forest in central North Carolina (U.S. Forest Service, last visited June 2, 2026).

2. State Mechanisms

a. North Carolina

The solstice creekmussel is listed as “Significantly Rare” by North Carolina’s *Natural Heritage Program* (NC Parks). However, this designation does not confer any legal protection for the species. North Carolina has not enacted any specific policies to protect the mussel since its recent discovery, rendering state protection insufficient to ensure the continued existence of the solstice creekmussel.

VI. REQUEST FOR CRITICAL HABITAT DESIGNATION

The Center for Biological Diversity formally requests that the Service designate critical habitat for *Ligodonta obscura* concurrently with listing as an endangered or threatened species, as required by the ESA (16 U.S.C. 1533(a)(3A)). Critical habitat as defined by Section 3 of the ESA is:

- (i) the specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the provisions of section 1533 of this title, on which are found those physical or biological features (I) essential to the

conservation of the species and (II) which may require special management considerations or protection; and

(ii) specific areas outside the geographical area occupied by the species at the time it is listed in accordance with the provisions of section 1533 of this title, upon a determination by the Secretary that such areas are essential for the conservation of the species.

(16 U.S.C. 1532(5)).

Critical habitat should include all existing habitat of *Ligodonta obscura* and areas with potential for recovery and determined to be important to the survival and recovery of this species. At minimum, the Service should designate the Little River and connecting rivers within the Yadkin-Pee Dee River Basin as critical habitat.

VII. CONCLUSION

The solstice creekmussel faces escalating risks of extinction within its already highly narrow range of a single river. While climate change presents significant threats to the freshwater ecosystem of the solstice creekmussel, pollution from urban and agricultural developments and habitat fragmentation and hydrology alteration from dams present the most immediate and severe danger to this species' survival.

Existing state and federal regulatory frameworks do not adequately protect the solstice creekmussel. With only one population, this endemic species is extremely vulnerable and clearly warrants listing as endangered under the Endangered Species Act, as it faces a serious risk of extinction. Without adequate protection this species could be lost.

We strongly urge the Service to swiftly list the solstice creekmussel as endangered under the Endangered Species Act with critical habitat protections.

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