Petition to Reclassify the Southern Population of the Bog Turtle (*Glyptemys muhlenbergii*) as Endangered or Threatened Under the Endangered Species Act

Photo credit: Michael Knoerr

Submitted to the U.S. Secretary of the Interior
acting through the U.S. Fish and Wildlife Service

January 27, 2022

Defenders of Wildlife

NOTICE OF PETITION

January 27, 2022

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Dear Secretary of the Interior:

Pursuant to the Endangered Species Act ("ESA"), 16 U.S.C. §1533(b), the Administrative Procedure Act, 5 U.S.C. § 553(e), and the ESA's implementing regulations, 50 C.F.R. § 424.14, Defenders of Wildlife formally petitions the Secretary of the Interior to reclassify (uplist) the southern population of the bog turtle (*Glyptemys muhlenbergii*) as an endangered or threatened species and to designate critical habitat concurrent with the listing to the extent prudent and determinable. 50 C.F.R. § 424.12.

This Petition sets in motion a specific process, placing definite response requirements on the Secretary of the Interior and the U.S. Fish and Wildlife Service ("FWS"), by delegation. Specifically, FWS 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). FWS must make this initial finding "[t]o the maximum extent practicable, within 90 days after receiving the petition." *Id.* Petitioners need not demonstrate that listing or reclassification is warranted; rather, petitioners must only present information demonstrating that the petitioned action may be warranted. While petitioners believe that the best available scientific and commercial data demonstrates that reclassification of the southern population of the bog turtle as endangered is in fact warranted, there can be no reasonable dispute that the available information indicates that reclassifying this distinct population segment of the species as either endangered or threatened throughout all or a significant portion of its range may be warranted. FWS must promptly make an initial finding on the Petition and commence a status review as required by 16 U.S.C. § 1533(b)(3)(B).

As required by 50 C.F.R. § 424.14(b), Defenders provided written notice (via email) to the state agencies responsible for the management and conservation of the southern population of the bog turtle on June 30, 2021, more than 30 days prior to the submission of this Petition. A copy of the notice accompanies this Petition. *See* 50 C.F.R. § 424.14(c)(9). We anticipate that, in keeping with 50 C.F.R. § 424.14(f)(2), FWS will acknowledge the receipt of this Petition within a reasonable timeframe. As fully set forth below, this Petition contains all the information requested in 50 C.F.R. § 424.14(c)–(e) and 16 U.S.C. § 1533(e). All cited documents are listed in the Literature Cited section; electronic copies of these documents accompany this Petition; and pinpoint citations to these have been provided where appropriate. *See* 50 C.F.R. § 424.14(c)(5)–(6).

Petitioner Defenders of Wildlife ("Defenders") is a non-profit conservation organization dedicated to the protection of all native animals and plants in their natural communities. Defenders' 2019–2028 Strategic Plan identifies environmentally sensitive species as one of several key groups of species whose conservation is a priority for our organization's work,[1] and has been working to protect the bog turtle for years. Defenders uses science, education, litigation, and research to protect wild animals and plants. Known for our effective leadership on endangered species issues, Defenders also advocates for new approaches to wildlife conservation to protect species before they become endangered. Our programs reflect the conviction that saving the biodiversity of our planet requires protecting entire ecosystems and ensuring interconnected habitats. Founded in 1947, Defenders of Wildlife is a 501(c)(3) membership organization with nearly 2.2 million members and supporters.

If you have any questions, please feel free to contact us via the information contained in the signature blocks below.

[1] More information on Defenders' work is available at https://www.defenders.org and Defenders' 2019–2028 Strategic Plan is available at https://defenders.org/sites/default/files/2019-06/Defenders-of-Wildlife-2019-2028-Strategic-Plan.pdf.

Sincerely,

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EXECUTIVE SUMMARY

The bog turtle (*Glyptemys muhlenbergii*) is not only the smallest turtle in North America but has also become one of the rarest.

Due to habitat loss, degradation and fragmentation as well as disease and predation pressures and commercial demand for the rare species, the bog turtle has suffered dramatic population declines. In recent decades, a large percentage of the bog turtle's former habitat has been drained and converted to farmland, making it virtually impossible for this wetland wonder to survive. Invasive plants, such as the Purple Loosestrife are crowding in. And poachers often nab this diminutive species as a favorite of the pet trade.

These threats have resulted in a perfect storm for the bog turtle, which was listed as threatened under the Endangered Species Act ("ESA") in 1997. While the northern population of the bog turtle was listed as threatened, the southern population was only listed based on similarity of appearance and does not receive the same level of protection. This has left the southern population vulnerable to persistent threats that have caused the population's further decline, and current data suggests that the southern population is at considerably greater risk of extirpation than the northern population.

The ESA states that a species shall be determined to be endangered or threatened in all or a significant portion of its range based on any one or combination of five factors. See 16 U.S.C. § 1533(a)(1). The southern population of the bog turtle faces threats under one or more of the five listing factors, and the cumulative effects thereof, that warrant listing it as an endangered or threatened species in all or a significant portion of its range.

Modification of habitat or range. Habitat loss and degradation have significantly contributed to the decline of the southern population of the bog turtle. Wetland alteration, development, road construction, pollution, invasive plant species, succession, overgrazing, and lack of wetlands management have all contributed to the loss of the bog turtle's wetland habitat. These activities have also fragmented remaining bog turtle habitat, further separating bog turtle sites and causing genetic isolation.

Overutilization. Poaching is a major threat to the bog turtle. The species is valued in the commercial pet trade due to its small size and rarity. Poaching also compromises the ability to protect bog turtle habitat and conserve the species. The locations of bog turtle populations are held in secrecy to prevent poachers from snatching the last of these turtles from the wild.

Disease or Predation. Disease and predation compromise bog turtle recovery. While more research needs to be done about disease in wild populations of bog turtles, disease transmission could have measurable effects on mortality and fecundity rates. Bog turtles are also vulnerable to predation by human commensals (animals that flourish in the presence of humans and the landscapes that they alter). Nest predation in particular has been found to be a leading cause of nest failure, further hampering the survival of the species.

Inadequacy of existing regulatory mechanisms. While the southern population of the bog turtle receives some direct protections, these are generally focused on preventing the illegal collection and trade of the species but fail to address the problem of habitat degradation and loss. The patchwork of laws

and regulations have proven inadequate to conserve this species as demonstrated by its severe decline.

Other natural or manmade factors. There are other factors that may affect the continued existence of the southern population of the bog turtle. Climate change is one factor that impacts the species both directly and indirectly. Rising temperatures not only harm bog turtles but significantly affect their delicate habitat.

Cumulative effects. The cumulative and synergistic effects of the numerous threats that the southern population of the bog turtle faces, compounded by its low reproductive output, has brought the species to the point where ESA reclassification may be warranted and constrains the species' ability to recover quickly from dramatic population declines.

Based on the factors outlined above, the southern population of the bog turtle warrants reclassification under the ESA.

I. INTRODUCTION

Defenders formally petitions the Secretary of the Interior ("Secretary"), acting through the U.S. Fish and Wildlife Service ("FWS"), to reclassify (i.e., uplist) the southern population of the bog turtle (*Glyptemys muhlenbergii*) as endangered or threatened under the Endangered Species Act ("ESA") and to designate critical habitat for the species within the United States to the extent prudent and determinable. *See* 16 U.S.C. §§ 1531–1544; 50 C.F.R.§ 424.12. Currently, the southern population of the bog turtle is classified as threatened based on similarity of appearance to the northern population of the bog turtle. *See* 62 Fed. Reg. 59,605 (Nov. 4, 1997).

In reviewing the southern population of the bog turtle's status, FWS must analyze whether the species warrants listing as endangered or threatened throughout all or any significant portion of its range. 16 U.S.C. § 1532(6), (20).[2]

If FWS determines to list the southern population as threatened, Defenders petitions the agency to promulgate a final 4(d) rule to confer full take protections on the species concurrent with final listing. *See* 16 U.S.C. § 1533(d). Those protections are necessary and advisable to provide for the conservation of the species. Further, if the southern population of the bog turtle is listed as endangered or threatened, Defenders also petitions FWS to promulgate a 4(e) rule for species similar in appearance to the bog turtle. As set forth in 50 C.F.R. § 424.14(j), "[t]he Services will conduct a review of petitions to . . . adopt a rule under section 4(d) [or] 4(e) . . . of the [ESA] in accordance with the Administrative Procedure Act (5 U.S.C. [§] 553) and applicable Departmental regulations, and take appropriate action."

This Petition is submitted pursuant to the ESA, 16 U.S.C. § 1533(b)(3)(A), the ESA's implementing regulations, 50 C.F.R. § 424.14, and the Administrative Procedure Act, 5 U.S.C. § 553(e). As required by 50 C.F.R. § 424.14(b), Defenders provided written notice (via email) to the state agencies responsible for the management and conservation of the southern population of the bog turtle on June 30, 2021, more than 30 days prior to the submission of this Petition. A copy of the notice accompanies this Petition. *See* 50 C.F.R. § 424.14(c)(9). We anticipate that, in keeping with 50 C.F.R. § 424.14(f)(2), FWS will acknowledge the receipt of this Petition within a reasonable timeframe. As fully set forth below, this Petition contains all the information requested in 50 C.F.R. § 424.14(c)–(e) and 16 U.S.C. § 1533(e). All cited documents are listed in the Literature Cited section; electronic copies of these documents accompany this Petition; and pinpoint citations to these have been provided where appropriate. *See* 50 C.F.R. § 424.14(c)(5)–(6).

II. GOVERNING PROVISIONS OF THE ENDANGERED SPECIES ACT

A. Species and Distinct Population Segments

The ESA defines the term "species" to include "any subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature." 16 U.S.C. § 1532(16). FWS and the National Marine Fisheries Service ("NMFS") have

[2] Should FWS determine to reclassify the southern population as threatened or endangered, then Defenders requests that FWS analyze whether listing (threatened) or uplisting (endangered) of the species as a whole is appropriate.

published a joint DPS policy, 61 Fed. Reg. 4722 (Feb. 7, 1996), which allows the agencies to protect and conserve vertebrate species, such as the bog turtle, under the ESA on a regional basis. This DPS policy provides criteria for DPS analysis. To satisfy the DPS criteria, a vertebrate species population must be discrete from other populations of the species and significant to the species. FWS had used these criteria to identify northern and southern DPSs of the bog turtle.

B. Significant Portion of a Species' Range

The ESA defines an "endangered species" as any species that is "in danger of extinction throughout all or a significant portion of its range," 16 U.S.C. § 1532(6), and a "threatened species" as one that "is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." 16 U.S.C. § 1532(20).

In 2014, FWS and the National Oceanic and Atmospheric Administration ("NOAA") issued their most recent policy on the interpretation of the "significant portion of its range" ("SPR") language. 79 Fed. Reg. 37,577 (July 1, 2014). The policy's definition of "significant portion" provides that "a portion of the range of a species is 'significant' if the species is not currently endangered or threatened throughout all of its range, but the portion's contribution to the viability of the species is so important that, without the members in that portion, the species would be in danger of extinction, or likely to become so in the foreseeable future, throughout all of its range." *Id.* at 37,579. Courts have since deemed the SPR policy's definition of "significant" to be "inconsistent with the ESA." *See*, *e.g.*, *Ctr. for Biological Diversity v. Everson*, 435 F. Supp. 3d 69, 92 (D.D.C. Jan. 28, 2020) (citations omitted). Further, because of the numerous legal challenges to and vacatur of different aspects of the SPR policy, it cannot be relied upon. *See*, *e.g.*, *id.* at 98 (vacating the provision of the final SPR policy that provides "if the Services determine that a species is threatened throughout all of its range, the Services will not analyze whether the species is endangered in a significant portion of its range"); *Friends of Animals v. Ross*, 396 F. Supp. 3d 1, 10 (D.C. Cir. 2019) (citations omitted) (vacating and setting aside the listing decision because the agency relied on the now-vacated SPR policy).

Therefore, under any reasonable interpretation of the ESA, FWS must consider whether a species is endangered throughout all or a significant portion of its range or threatened throughout all or a significant portion of its range. If FWS determines that the petitioned species is endangered in a significant portion of its range, then the species should be listed as endangered throughout its range. If FWS determines that the petitioned species is threatened in a significant portion of its range (and not endangered in any significant portion of its range), then the species should be listed as threatened throughout its range. *See generally Defenders of Wildlife v. Norton*, 258 F.3d 1136, 1141–42 (9th Cir. 2001); 79 Fed. Reg. at 37,579–80 (citing *Norton*, 258 F.3d 1136 (giving operational meaning to the words on either side of the "or")).

C. Listing Factors

FWS must make its determination of whether a species is endangered or threatened based solely on one or more of the five factors set forth in 16 U.S.C. § 1533(a)(1):

> (A) the present or threatened destruction, modification, or curtailment of its habitat or range;

(B) overutilization for commercial, recreational, scientific, or educational purposes;
(C) disease or predation;
(D) the inadequacy of existing regulatory mechanisms; or
(E) other natural or manmade factors affecting its continued existence.

16 U.S.C. § 1533(a)(1)(A)–(E); 50 C.F.R. § 424.11(c)(1)–(5).

D. 90-Day and 12-Month Findings

"To the maximum extent practicable," FWS is required to determine "whether the petition presents substantial scientific or commercial information indicating that the petitioned action may be warranted" within 90 days of receiving a petition to list a species. 16 U.S.C. § 1533(b)(3)(A). This is referred to as a "90-day finding." A "negative" 90-day finding ends the listing process and is a final agency action subject to judicial review. 16 U.S.C. § 1533(b)(3)(C)(ii). A "positive" 90-day finding leads to a formal, more comprehensive "status review" and a "12-month finding" determining, based on the best available scientific and commercial data, whether listing the species is warranted, not warranted, or warranted but precluded by other pending listing proposals for higher priority species. 16 U.S.C. § 1533(b)(3)(B). "Not warranted" and "warranted but precluded" 12-month findings are also subject to judicial review. 16 U.S.C. § 1533(b)(3)(C)(ii).

The ESA's implementing regulations define "substantial information," for the purpose of a 90-day finding, as "credible scientific or commercial information in support of the petition's claims such that a reasonable person conducting an impartial scientific review would conclude that the action proposed in the petition may be warranted." 50 C.F.R. § 424.14(h)(1)(i).

> [FWS's] determination as to whether the petition provides substantial scientific or commercial information indicating that the petitioned action may be warranted will depend in part on the degree to which the petition includes the following types of information:
>
> (1) Information on current population status and trends and estimates of current population sizes and distributions, both in captivity and the wild, if available;
> (2) Identification of the factors under section 4(a)(1) of the Act that may affect the species and where these factors are acting upon the species;
> (3) Whether and to what extent any or all of the factors alone or in combination identified in section 4(a)(1) of the Act may cause the species to be an endangered species or threatened species (i.e., the species is currently in danger of extinction or is likely to become so within the foreseeable future), and, if so, how high in magnitude and how imminent the threats to the species and its habitat are;
> (4) Information on adequacy of regulatory protections and effectiveness of conservation activities by States as well as other parties, that have been initiated or that are ongoing, that may protect the species or its habitat; and
> (5) A complete, balanced representation of the relevant facts, including information that may contradict claims in the petition.

50 C.F.R. § 424.14(d).

E. Reasonable Person Standard

Establishing the "reasonable person" standard for the substantial information determination, the ESA's implementing regulations and relevant case law demonstrate that "a petition need not establish a 'strong likelihood' or a 'high probability' that a species is either threatened or endangered to support a positive 90-day finding." *See* 79 Fed. Reg. 4877 (Jan. 30, 2014); *see also* 50 C.F.R. § 424.14(h)(1); *Am. Stewards of Liberty v. U.S. Dep't of the Interior*, 370 F. Supp. 3d 711, 717, 726 (W.D. Tex. 2019) ("Though 'substantial scientific and commercial information' may seem like a high bar, . . . the Service's regulations indicate otherwise . . . ."). In reviewing negative 90-day findings, the evidentiary threshold at the 90-day review stage is much lower than the one required under a 12-month review.

Courts have characterized the 90-day finding determination as a mere "threshold determination" and have held that it contemplates a "lesser standard by which a petitioner must simply show that the substantial information in the Petition demonstrates that listing of the species may be warranted." *See Humane Soc'y of the U.S. v. Pritzker*, 75 F. Supp. 3d 1, 15 (D.D.C. 2014) (quoting *Colo. River Cutthroat Trout v. Kempthorne*, 448 F. Supp. 2d 170, 176 (D.D.C. 2006)); *see generally* 16 U.S.C. § 1533(b)(3)(A). Accordingly, a petition does not need to establish that there is a high likelihood that a species is either endangered or threatened to trigger a positive 90-day finding.

F. Best Available Scientific and Commercial Data

FWS is required to make a 90-day finding on the Petition based solely on the best available scientific and commercial data. *See* 16 U.S.C. § 1533(b)(1)(A); 50 C.F.R. § 424.11(b). Therefore, FWS cannot deny listing merely because there is little information available, if the best available information indicates that a species may warrant listing as endangered or threatened under any one or any combination of the five ESA listing factors. This is particularly important during the 90-day review because, as noted above, FWS must make a positive 90-day finding and commence a status review when a "reasonable person" would conclude, based on the available evidence, that listing may be warranted.

1. International Scientific and Commercial Data

The International Union for Conservation of Nature ("IUCN") is the world's oldest and largest global environmental network and has become a leading authority on the environment. It is a neutral, democratic membership union with more than 1,400 government and non-governmental organization ("NGO") members, and more than 18,000 volunteer scientists and experts active in more than 160 countries (IUCN webpage 2022). Its work is supported by about 900 professional staff and has offices in more than 50 countries, plus hundreds of partners in public, NGO, and private sectors around the world (IUCN webpage 2022).

As part of its work, the IUCN compiles and updates the IUCN Red List, which "has evolved to become the world's most comprehensive information source on the global extinction risk status of animal, fungus[,] and plant species" (IUCN Red List webpage 2022). The IUCN Red List assessments are recognized internationally, are relied on in a variety of scientific publications, and are used by numerous governmental organizations and NGOs. The IUCN Red List has also been used to inform multilateral agreements, such as the Convention on International Trade in Endangered

Species of Wild Fauna and Flora ("CITES"), the Convention on the Conservation of Migratory Species of Wild Animals ("CMS"), and the Convention on Biological Diversity.

As a result of the scientific rigor with which Red List species extinction risk determinations are made, both FWS and NMFS have utilized IUCN Red List data and listing determinations when making ESA listing decisions even though the criteria differ from the ESA's statutory requirements for listing a species as endangered or threatened. *See* 50 C.F.R. § 424.11(f). This is because the IUCN Red List is considered a credible source of scientific data that meets the "best scientific and commercial data" requirement of the ESA. *See* 16 U.S.C. § 1533(b)(1)(A).

The IUCN Red List has assessed the bog turtle as a "critically endangered" species (van Dijk 2011, at 1). Notably, the assessment was made August 1, 2010 and published in 2011, and threats to the species as well as population decline have continued since (van Dijk 2011, at 1). The IUCN specifically stated that:

> The Bog Turtle, *Glyptemys muhlenbergii*, has lost the great majority of its suitable habitat in historic and recent times[.] It has suffered further impact from past collection for the pet trade, fragmentation and degradation of remaining habitats, and possibly roadkill and increased predation rates; while emergence of epidemic disease, and climatic change, are recent developments of unknown but potentially severe future impact. Detailed quantitative range-wide estimates are not available, but overall reduction is likely to have exceeded 80% of habitat and 90% of individuals over the course of the 20th century, with declines stabilized in many but not all sites at present, and only localized population increases. Due to the species' highly fragmented occurrence in habitats subject to vegetational succession, intensive management is needed to retain existing populations; creation of alternative sites is challenging; and the species' low reproductive output (on average under four eggs/year per mature female) and relatively late maturity (about six years) means recovery is a slow gradual process at best.

(van Dijk 2011, at 1). Therefore, the IUCN classification and determination constitutes a source of credible evidence to satisfy the reasonable person standard for a positive 90-day finding on this Petition.

2. Species Protected by International Agreement

Pursuant to 50 C.F.R. § 424.11(f), "The Secretary shall give consideration to any species protected under such an international agreement, or by any State or foreign nation, to determine whether the species is endangered or threatened."

> The fact that a species of fish, wildlife, or plant is protected by the Convention on International Trade in Endangered Species of Wild Fauna and Flora . . . or a similar international agreement on such species, or has been identified as requiring protection from unrestricted commerce by any foreign nation, or to be in danger of extinction or likely to become so within the foreseeable future by any State agency or by any agency of a foreign nation that is responsible for the conservation of fish, wildlife, or plants, may constitute evidence that the species is endangered or threatened. The weight given such evidence will vary depending on the international

> agreement in question, the criteria pursuant to which the species is eligible for protection under such authorities, and the degree of protection afforded the species.

50 C.F.R. § 424.11(f). As detailed below in Section IV.D.3.a, the bog turtle is listed under CITES Appendix I. The CITES Appendix I listing and the data supporting the states parties' decision to add the bog turtle to Appendix I constitute a source of credible evidence to satisfy the reasonable person standard for a positive 90-day finding on this Petition.

G. Protective Regulations for Threatened Species

Section 4(d) of the ESA directs FWS to issue regulations that are necessary and advisable to conserve species listed as threatened. *See* 16 U.S.C. § 1533(d). When a species is listed as threatened as opposed to endangered, the prohibitions identified in section 9 of the ESA do not automatically apply to that species. *See* 16 U.S.C. § 1538. Under section 9 of the ESA, it is unlawful to import, export, or take endangered species for any purpose, including commercial activity. The term "take" means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. 16 U.S.C. § 1532(19). The term "harm" is defined as any act which actually kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation which actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering. 50 C.F.R. § 222.102. The ESA prohibits any take of species listed as endangered, but some take of threatened species that does not interfere with survival and recovery may be allowed.

For threatened species, FWS can issue regulations under section 4(d) of the ESA to extend some, or all, of the section 9 prohibitions. In issuing a 4(d) rule, FWS considers the species' biological status, conservation needs, and threats and determines which activities need to be regulated or prohibited in order to conserve the species. Given the numerous threats facing the southern population of the bog turtle, including habitat degradation and poaching for the pet trade, the species should receive full protection under the ESA.

Therefore, pursuant to 50 C.F.R. § 424.14(j), if FWS determines to reclassify the southern population of the bog turtle as threatened, Defenders petitions the agency to promulgate a final 4(d) rule to confer full take protections on the species concurrent with final listing. *See* 16 U.S.C. § 1533(d). Those protections are necessary and advisable to provide for the conservation of the species.

H. Similarity of Appearance Determinations

Section 4(e) of the ESA allows the designation of a species that is not endangered or threatened but closely resembles an endangered or threatened species to be listed if FWS determines that listing is advisable. To address problems associated with similar-looking species, Congress created the Similarity of Appearance clause of the ESA, which states:

> The Secretary may, by regulation of commerce or taking, and to the extent he deems advisable, treat any species as an endangered species or threatened species even though it is not listed pursuant to this section if he finds that—
> (A) such species so closely resembles in appearance, at the point in question, a species which has been listed pursuant to such section that enforcement personnel

> would have substantial difficulty in attempting to differentiate between the listed and unlisted species;
> (B) the effect of this substantial difficulty is an additional threat to an endangered or threatened species; and
> (C) such treatment of an unlisted species will substantially facilitate the enforcement and further the policy of this chapter.

16 U.S.C. § 1533(e).

Most similarity of appearance listings have been the result of either FWS's or NMFS's (collectively, "the Services") own initiative or in response to comments on proposed listing rules. Generally, the Services have referred to a combination of scientific and commercial experts, lay people, and additional scientific information to determine whether a species of similar appearance warrants listing. *See, e.g.*, Final Rule to List the Giant Manta Ray as Threatened Under the Endangered Species Act, 83 Fed. Reg. 2916 (Jan. 22, 2018); Notice of 12-Month Finding on Petition to List the Smooth Hammerhead Shark as Threatened or Endangered Under the Endangered Species Act, 81 Fed. Reg. 41,934 (Jun. 28, 2016).

The factor typically given the most weight is the impact the similarities may have on the enforceability of take penalties, specifically the ability to effectively distinguish between species or parts of species (e.g., fins, oil, meat, leather, etc.). *See, e.g., id.* The Services have listed both separate species as well as subspecies and/or DPSs based on similarity of appearance. *See, e.g.*, Listing the Scarlet Macaw, 84 Fed Reg. 6278 (Feb. 26, 2019) (listing the southern scarlet macaw DPS based on similarity to the northern DPS); Listing the Southern White Rhino (*Ceratotherium simum simum*) as Threatened, 79 Fed. Reg. 28,847 (May 20, 2014) (listing the southern white rhino based on the similarity of appearance of its horn to those of numerous endangered rhino species). If species identification issues exist, FWS can promulgate a 4(e) rule for species similar in appearance to a listed species in order to provide for the conservation of the listed species (*see* Section VII. Similarity of Appearance Determination (petition to adopt a 4(e) rule pursuant to 50 C.F.R.§ 424.14(j)).

III. SPECIES DESCRIPTION

A. Common Name

This Petition will refer to *Glyptemys muhlenbergii* by the common name "bog turtle" or "southern population of the bog turtle" throughout.

B. Taxonomy

The taxonomy of *Glyptemys muhlenbergii* is:

Kingdom	*Animalia*
Subkingdom	*Bilateria*
Infrakingdom	*Deuterostomia*
Phylum	*Chordata*
Subphylum	*Vertebrata*
Infraphylum	*Gnathostomata*
Superclass	*Tetrapoda*
Class	*Reptilia*
Order	*Testudines*
Suborder	*Cryptodira*
Superfamily	*Testudinoidea*
Family	*Emydidae*
Subfamily	*Emydinae*
Genus	*Glyptemys*
Species	*Glyptemys muhlenbergii*

(ITIS webpage 2022). Invalid and/or previous taxonomic synonyms include *Clemmys muhlenbergii*, *Testudo muhlenbergii*, *Emys biguttata*, and *Clemmys nuchalis* (ITIS webpage 2022). The bog turtle was originally listed under the ESA as *Clemmys muhlenbergii*.

In 1997, FWS determined that there are two well-separated (i.e., allopatric) bog turtle populations (Northern Population Recovery Plan 2001, at 2). 62 Fed. Reg. 59,605, 59,605 (Nov. 4, 1997) ("A 250-mile gap within the range separates the species into distinct northern and southern populations." (citations omitted)). Therefore, the agency categorized the "northern population" and the "southern population" into DPSs.

C. Physical Characteristics

The bog turtle is the smallest turtle in North America, reaching only 4 to 5 inches in length in adulthood (N.C. Bog Turtle webpage 2022). Bog turtles have a light or dark brown carapace (top shell), with scutes that have a light center or pattern of lines that radiate outward (N.C. Bog Turtle webpage 2022). There is a distinctive red, orange, or yellow marking on either side of the neck. The plastron (bottom shell) is typically dark brown with black patches and no hinge (N.C. Bog Turtle webpage 2022).

Hatchlings are similar in appearance to adults, with tails that are longer than those of adults. (Northern Population Recovery Plan 2001, at 2). Male bog turtles are characterized by a concave plastron, a proportionately flatter carapace, and a thick, long tail with the vent beyond the posterior carapace margin. (Northern Population Recovery Plan 2001, at 2). Female turtles have a wider carapace for their size, are more highly domed, have flat or slightly convex plastrons, and tails that are shorter and thinner with a vent located beneath the posterior margin of the carapace (Northern Population Recovery Plan 2001, at 2).

Photo credit: Michael Knoerr (adult bog turtle)

Photo credit: Michael Knoerr (bog turtle hatchlings)

D. Habitat and Range

The bog turtle is endemic to the eastern United States (Shoemaker & Gibbs 2013, at 325). The bog turtle's range is highly discontinuous. The northern population extends from Delaware to New York (Rosenbaum et al. 2007, at 332). The southern population extends from Virginia to northern Georgia (Tutterow et al. 2017, at 293 (citing Ernst & Lovich, 2009)). Bog turtles dwell within the Southern Blue Ridge Ecoregion of the Appalachian Mountains as well as the surrounding foothills (Knoerr et al. 2020, at 1). In North Carolina, which contains about 63.9% of the bog turtle's southeast population, they are found in the western portion of the state (Tutterow et al. 2017, at 293).

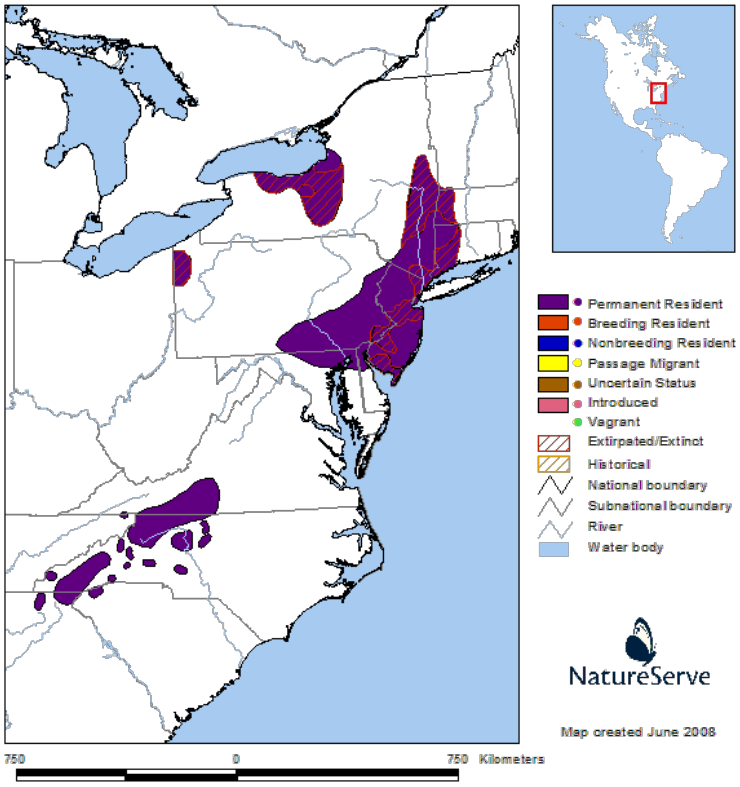

Figure 1. Geographic range of *Glyptemys muhlenbergii* (Tenn. Bog Turtle webpage 2022).

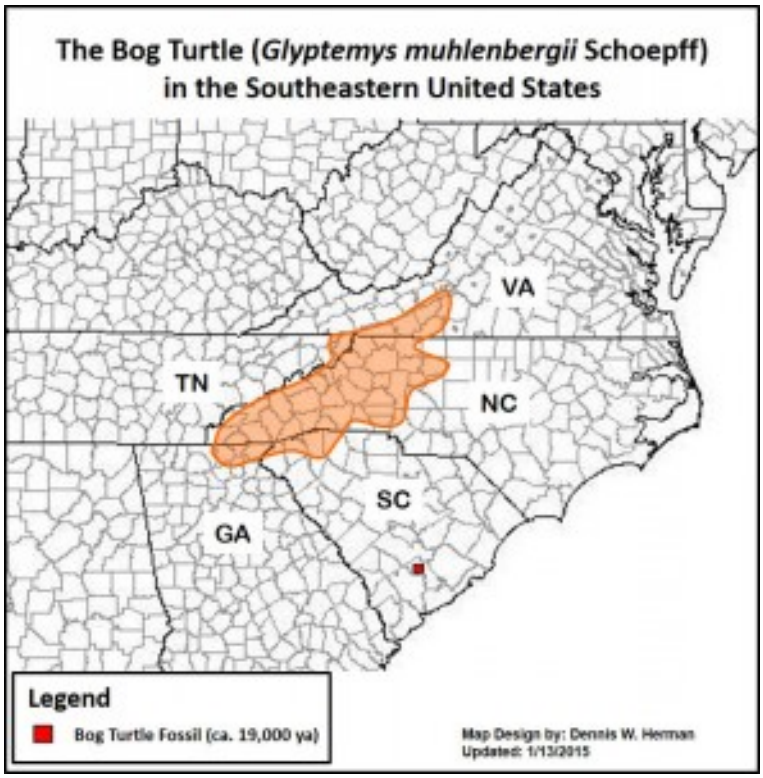

Figure 2. Bog turtle range in the Southeastern United States (Project Bog Turtle webpage 2022).

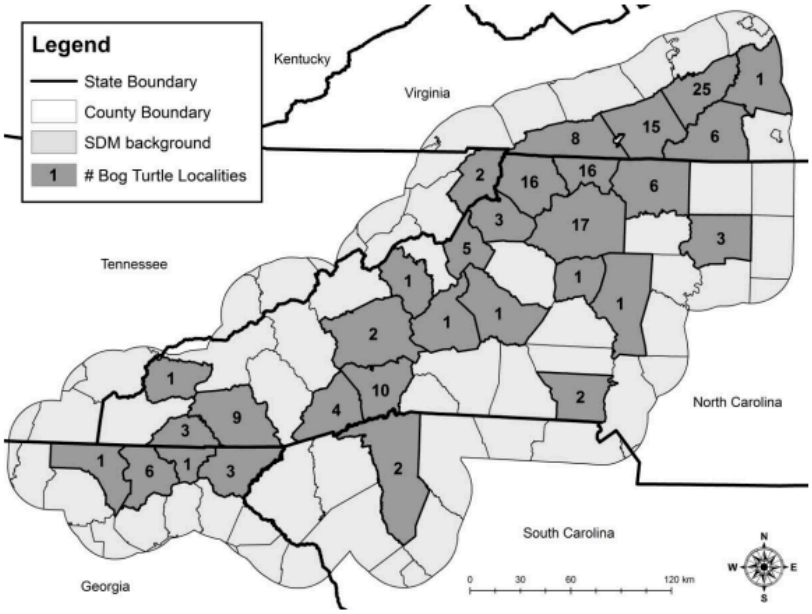

Figure 3. Number of Bog Turtle localities by county for the southern portion of the Bog Turtle range as of 2015. The light gray polygon represents all counties with known bog turtle localities plus a 25 km buffer. (Stratmann 2015, at 7).

The bog turtle is a semi-aquatic species that can be found in wetland habitats such as bogs, fens, swamp forest-bog complex and wet meadows (Knoerr et al. 2020, at 1 (citing Ernst et al. 1994; Buhlmann et al. 2009; Pittman & Dorcas 2009, at 781)). These wetlands have microhabitats necessary to bog turtles for foraging, hibernation, shelter, and basking that include areas that are periodically flooded, saturated areas, and dry pockets (Northern Population Recovery Plan 2001, at 12). Bog turtles require open-canopied, shallowly inundated wetlands with adequate muck (Pittman & Dorcas 2009, at 788; Stratmann et al. 2020, at 332; Stratmann et al. 2016, at 199). These wetland habitats are often small (< 1.0 ha) and can be negatively impacted by anthropogenic habitat modification such as ditching, tiling and ponding; overgrazing; natural and human-accelerated vegetation succession; and harsh environmental conditions such as droughts (Pittman & Dorcas 2009, at 781 (citing Zappalorti 1976; Chase et al. 1989; Ernst et al. 1994)).

Photo credit: Michael Knoerr

Woody vegetation slowly invades open-canopy wetlands if left undisturbed by beaver activity, fire, or periodic wet years and can transition the wetland into a closed-canopy, wooded swampland which is unsuitable for the bog turtle (Northern Population Recovery Plan 2001, at 12 (citing Tryon & Herman 1990; Klemens 1993a)). Moderate grazing from livestock can help maintain bog turtle habitat by controlling woody vegetation growth and creating depressions for standing water (Pittman & Dorcas 2009, at 782 (citing Tesauro & Ehrenfeld 2007)).

E. Feeding

The bog turtle is an omnivorous reptile and feeds on snails, beetles, and worms as well as various plant parts including small berries (N.C. Bog Turtle factsheet 2018). Their diet also consists of frogs, carrion, spiders, ants, flies, millipedes, and other insects (Northern Population Recovery Plan 2001, at 19 (citing Bury 1979; Klemens 1993a)). Bog turtles have also been observed consuming slugs, moss, root hairs, and crayfish (Northern Population Recovery Plan 2001, at 19 (citing Zappalorti & Johnson 1981; Smith 2000). A 2017 study found that bog turtle diet primarily consisted of plant material, beetles, Japanese Beetles, millipedes, caddisfly larvae, ants, weevils, flies, and snails (Melendez et al. 2017, at 274–275).

F. Reproduction and Lifespan

Bog turtles typically become sexually mature at 6 to 7 years of age. They breed in the late spring or early summer and females lay one to six eggs that hatch between August and October (N.C. Bog Turtle factsheet 2018). Nesting usually takes about three to four hours and often occurs in the evening (Northern Population Recovery Plan 2001, at 17 (citing Holub & Bloomer 1977)). Bog turtles can live up to 50 or 60 years of age in protected habitats (N.C. Bog Turtle factsheet 2018; Tutterow et al. 2017, at 298).

G. Population Trends

Bog turtles are one of the most imperiled chelonians in North America (Knoerr et al. 2020, at 1 (citing Seigel & Dodd 2000; Rosenbaum et al. 2007)). Turtles in general are among the most vulnerable vertebrate groups to declines, extirpations, and extinctions, especially those species with specific habitat requirements such as the bog turtle (Tutterow et al. 2017, at 293). Although quantitative range-wide estimates are not available, it is likely that a 90% decline in bog turtle populations has occurred during the twentieth century (van Dijk 2011, at 1).

The estimated total southern population is believed to be between 4,000 and 6,000 individuals, comparatively less than the total northern population of 10,000 to 13,000 individuals (Project Bog Turtle webpage 2022). The southern populations are mostly in the Appalachians where they are restricted to only about 100 active sites (Project Bog Turtle webpage 2022).

Bog turtles normally occur in small, isolated populations of less than 50 individuals (Stratmann et al. 2020, at 332; Rosenbaum et al. 2007, at 332). They are typically sedentary but are known to travel across large areas of land between habitat patches (Pittman et al. 2011, at 1590). Habitat in the Southern Appalachian mountain bogs has declined by 80–90%, with less than 400 hectares of fragmented habitat remaining (Knoerr 2020, at 1; Knoerr 2018, at 2 (citing Weakley & Schafale 1994, Noss et al. 1995, Herman & Tryon 1997)). Habitat fragmentation contributes to population declines for the bog turtle by preventing dispersal and disrupting metapopulation dynamics (Pittman et al. 2011, at 1590 (citing Converse et al. 2005; Lande 1993)). A 2011 capture-recapture study in North Carolina found that the bog turtle population had declined drastically from 1994 to 2007 and the decline was likely at least partially due to vegetative and hydrological changes within the bog, which may have led to a decrease in juvenile recruitment or adult emigration through a fragmented landscape (Pittman et al. 2011, at 1595).

Multiple studies support the suggestion that the southern population of the bog turtle is in decline (Tutterow et al. 2017, at 299; Knoerr et al. 2021; Holden 2021). Using mark-recapture methods from a long-term dataset (>10 years) maintained by the North Carolina Wildlife Resources Commission and Project Bog Turtle, Tutterow et al. (2017) looked at the eight most-intensively sampled North Carolina populations to estimate survival (Tutterow et al. 2017, at 294). Only one of the studied populations produced an adult annual survival estimate above 0.93, suggesting that a high rate of adult mortality is commonplace in most of these populations, and that these populations may be in decline (Enneson & Litzgus 2008; Tutterow et al. 2017, at 298). Models that incorporated site-specific survival estimates from 5 of these North Carolina populations suggested that 3 of the populations were declining by 6–10% annually, and that these populations were declining in part due

to low adult survival and high rates of nest predation (Knoerr et al. 2021). The authors suggested that many other North Carolina populations share demographic characteristics of these declining populations. An additional study in Virginia suggested that the most intensively studied populations in the state declined by ~50% between 1997 and 2020, and that two of those six populations were completely extirpated (Holden 2021). Low annual survival estimates, empirically derived estimates of decline, and significant reductions in abundance (Tutterow et al. 2017; Knoerr et al. 2021, Pittman et al 2011, Holden 2021) suggests that the southern population is in decline.

1. Georgia

The bog turtle is currently known from only eleven localities within the wilds of Georgia (Fannin, Rabun, Towns, and Union counties), though more undoubtedly occur within the rugged terrain of the north Georgia mountains (a reported site in Stephens County is of questionable validity) (Ga. Bog Turtle webpage 2022 (noting 14 element occurrences (EOs) in Georgia)). Within half of these sites the bog turtle is known only from the observation of a single individual, and in three of these sites the associated population is apparently extirpated due to habitat succession and site drainage (Ga. Bog Turtle webpage 2022). The Chattahoochee National Forest harbors two known natural populations, but the future viability of one of these populations is uncertain due to low turtle numbers and limited available suitable habitat (Ga. Bog Turtle webpage 2022). Two populations on private lands are currently thought to contain viable populations and are the source of hatchling turtles for the ongoing headstarting and population establishment project within restored mountain bog habitat on federal land (Ga. Bog Turtle webpage 2022).

2. North Carolina

In addition to the information provided above, a recent study of several bog turtle populations (Tutterow et al. 2017) in North Carolina, reported adult survival probabilities were lower than those of some northern populations of bog turtles (Shoemaker et al. 2013) and closely related species such as the spotted turtle (*Clemmys guttata*) (Knoerr et al. 2020, at 1 (citing Enneson & Litzgus 2008)). Low estimates of apparent adult survival indicate that certain bog turtle populations in North Carolina may be in decline (Knoerr et al. 2020, at 1).

3. South Carolina

There are no known bog turtle populations remaining in South Carolina. Surveys conducted in 2016 and 2020 showed bog turtles were not present at previously known locations and suitable habitat sites (Stratmann et al. 2016, 199–209; Stratmann et al. 2020, 331–39).

4. Tennessee

Only one fen is known to be naturally occupied by bog turtles in Tennessee, and three other fens have been populated with turtles from Zoo Knoxville's reintroduction program (Haislip article 2019; Dresser 2017, at 1–91).

5. Virginia

During 2019 and 2020, Holden (2021) conducted surveys for bog turtles in six wetlands in Floyd County, Virginia, and used the data from those surveys to estimate how many turtles were present in the wetlands (Holden 2021, at 5). Prior to this research, thorough surveys aimed at estimating population abundance had not been conducted in Virginia since the late 1990s (Holden 2021, at 5, 7). Holden's analyses suggest that the total number of bog turtles present across these six sites has declined by approximately 50% since 1997 (Holden 2021, at 5). This decline appears to be caused at least in part by the alteration and loss of habitat at 2 of the 6 sites (Holden 2021, at 5).

IV. THREATS

As demonstrated below, substantial scientific and commercial information indicates that listing the southern population of the bog turtle as endangered or threatened in all or in any significant portion of its range may be warranted. *See* 16 U.S.C. § 1533(b)(1)(3)(A). The species is declining throughout its range and faces threats including habitat loss and degradation as well as poaching for the illegal pet trade (Knoerr et al. 2021, at 2). Existing regulatory mechanisms have proven inadequate to protect the southern population of the bog turtle and its habitat. Without adequate protections, the species' limiting life history characteristics, in combination with the other threats discussed, cause the bog turtle to be in danger of extinction throughout all or a significant portion of its range or likely to become so within the foreseeable future throughout all or a significant portion of its range.

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

Habitat loss and degradation has significantly contributed to the decline of the bog turtle. These are the leading causes of species extinction in North America and among the leading causes of global declines of turtle populations (Knoerr et al. 2020, at 1 (citing Diamond 1984, Noss et al. 1995; Gibbon et al. 2000)).

In the southern portion of the species' range, bog turtles exist within the Southern Blue Ridge Ecoregion of the Appalachian Mountains and surrounding foothills. (Knoerr et al. 2020, at 1). The wetlands they occupy are collectively referred to as Southern Appalachian mountain bogs (Knoerr et al. 2020, at 1). These wetlands are among the most critically endangered ecosystems in the United States (Knoerr et al. 2020, at 1 (citing Noss et al. 1995)). Residential development, road construction, and wetland drainage for agriculture has resulted in an 80–90% decline in Southern Appalachian mountain bogs, and the less than 400 hectares remaining exist in a highly fragmented landscape (Knoerr et al. 2020, at 1 (citing Weakley & Schafale 1994; Noss et al. 1995; Herman & Tryon 1997)). Many remnant bogs are moderately to highly degraded because of such factors (Knoerr et al. 2020, at 1 (citing Lee & Norden 1996; Drexler & Bedford 2002; Bedford & Godwin 2003; Tesauro & Ehrenfeld 2007; Stratmann 2015)).

Wetland alteration, development, road construction, pollution, invasive plant species, succession, and lack of wetlands management have all contributed to the loss of the bog turtle's wetland habitat. These activities have also fragmented remaining bog turtle habitat, further separating bog turtle sites and contributing to genetic isolation.

1. Wetland Alteration

Many historically occupied bog turtle wetlands have been destroyed or seriously degraded by draining wetlands (via ditching and tiling) (Weakley & Schafale 1994, at 373; Noss et al. 1995, at 1–19; Stratmann et al. 2020, at 335, 342; Holden 2021, at 26–31) and ponding (Holden 2021, at 26–31). Area of inundation in some wetlands has also been reduced by degradation to adjacent streams (Holden 2021). Failed stream banks threaten wetland hydrology while stream head-cuts and vertical incision has lowered water tables (Pollock et al. 2014, at 285, 279–90), further reducing the size of wetland habitat suitable to bog turtles (Holden 2021, at 26).

2. Development and Roadways

Habitat loss and fragmentation due to roadways and residential, commercial, and industrial development is a major threat to the bog turtle. Land conversion and landscape fragmentation also increase secondary threats such as genetic isolation, road mortality, and predation by human-commensal mammals on turtles and their nests (Knoerr et al. 2020, at 1 (citing Mitchell & Klemens 2000; Gibbs & Shriver 2002, Marchand & Litvaitis 2004, Steen & Gibbs 2004)).

Roadways break up the bog turtle's habitat making it difficult to move up and downstream. (Kreye & Kreye article 2021). Turtles can also be crushed by vehicles as they cross roadways to get to nesting micro-habitats. (Kreye & Kreye article 2021). Impervious surfaces associated with increased development also impacts water flows and water levels in adjacent bogs. (Kreye & Kreye article 2021).

In studying nest predation of bog turtles in Virginia, Holden (2021) found that "increases in the percent of developed land-use and other metrics of anthropogenic disturbance significantly increased nest predation, while increases in the percent of land-use without roads or buildings significantly decreased nest predation" (Holden 2021, at 63).

3. Pollution

Pollution also poses a threat to the bog turtle and its habitat. Pesticides, runoff, and other forms of agricultural and industrial discharge are all harmful to the bog turtle's watershed habitat and food supply. Fertilizer runoff can lead to uncontrolled algae blooms causing low oxygen levels in the water (Kreye & Kreye article 2021). Herbicides and road salts can also lead to chemical changes in pH, to which bog turtles are particularly sensitive (Kreye & Kreye article 2021). Land-clearing and other disturbance activities cause erosion. Excess soil in our streams from erosion is one of the greatest water pollution problems we have today (FWS Bog Turtle (southern population) webpage 2022).

Further, increased atmospheric nitrogen in portions of the southern Appalachians caused by industrial pollution from manufacturing and power plants along the Ohio and Kanawha rivers can shift dominance of the bog ecosystem away from Sphagnum and towards vascular plants, thereby creating an entirely different ecosystem dominated by woody shrubs (Schultheis et al. 2010, at 420–21 (citing EPA 1998; Bragazza et al. 2006; Bubier et al. 2007; Wiedermann et al. 2007)). Increased nutrients could also lead to invasions of alien plant species, which would further alter bog structure and function (Schultheis et al. 2010, at 421 (citing Tomassen et al. 2004)).

4. Invasive Plant Species

The invasion of non-native plants into its habitat is a large threat to the bog turtles' survival (Shoemaker & Gibbs 2013, at 325 (citing (Tesauro & Ehrenfeld 2007)). Although several plants disrupt its ecosystem, the three primary culprits are purple loosestrife (*Lythrum salicaria*), reed canary grass (*Phalaris arundinacea*), and reeds, which grow thick and tall and are believed to hinder the movement of the turtles. Such plants also out-compete the native species in the bog turtle's habitat, thus reducing the amount of food and protection available to the turtles. The encroachment of tall-growing woody invasive plants crowd out native sedges, grasses, forbs, and sphagnum mosses (Kreye & Kreye article 2021). The purple loosestrife, for example, can dry out large areas of suitable bog turtle habitat and grown in large, compact clumps that are impenetrable to the turtle. Taller, invasive plants also prevent the turtles from getting adequate sunlight for proper basking. (Kreye & Kreye article 2021). This in turn can hindering the turtle's growth and success in reproduction. (Kreye & Kreye article 2021).

5. Natural Vegetation Succession and Livestock Impacts

While succession of open canopy bogs and fens to closed canopy swamp forest bog complexes is a natural phenomenon, the rate by which it is occurring is exacerbated by increased nutrient pollutants (discussed above) and a reduction in a natural disturbance regime. Removal or reductions of herbivores, beaver activity, and fire have increased the rate of wetland succession to closed canopy systems (Weakley & Schafale 1994, at 368, 370, 379–80; Tesauro & Ehrenfeld 2007, at 298 (citing Lee & Norden 1996)). These historical disturbances were critical in creating bog turtle basking and nesting habitat and maintaining/expanding shallow inundated areas (Stratmann et al. 2020, at 332–33). Expansive wetland complexes would have likely existed in a continuum of early-mid-late successional habitat, induced by these small-scale periodic disturbances. Bog turtles would have been able to shift within this mosaic to the early-successional areas, but are now spatially confined to small, isolated fragments, much of which has become overgrown with woody vegetation (Stratmann et al. 2020, at 332, 342; Holden 2021, at 25, 76).

Grazing pressure, particularly by cattle, is known to provide surrogate disturbance to wetlands and acts to suppress tall growing woody and herbaceous vegetation (Tesauro & Ehrenfeld 2007, at 293–300). Over 50% of extant bog turtle sites in Virginia, North Carolina, and Georgia are grazed (Tesauro & Ehrenfeld 2007, at 294 (citing Lee & Norden 1996; Tyron & Herman 1990)). While low intensity grazing operations perform a critical function in maintaining early successional habitat for bog turtles, there is also threat of livestock overgrazing in some populations. High cattle densities can cause direct mortality to turtles and their nests (Ficheux et al. 2014, 342–43), compact soil (Middleton et al. 2006, at 309, 312) and reduce overall suitable habitat for the species.

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

Illegal collection of wild bog turtles for the pet trade is one of the primary threats to the species (FWS Bog Turtle (southern population) webpage 2022; *see also* Ga. Bog Turtle webpage 2022; N.C. Bog Turtle webpage 2022; S.C. Reptile Regulations webpage 2022; Tenn. Bog Turtle webpage 2022; Va. Herpetological Society Bog Turtle webpage 2022). Despite being protected from exploitation

under the ESA, the bog turtle is in high demand in the illegal pet trade due to its small size, attractive coloration, and reputed rarity (van Dijk 2011, at 3–4) and is considered one of the most valuable turtle species native to the United States (Tutterow et al. 2017, at 293 (citing Herman & Tryon 1997; USFWS 1997)). The southern population of the bog turtle is federally protected from poaching as a result of their "similarity in appearance" status to the northern population (Knoerr 2018, at 38). *See* 62 Fed. Reg. 59,605.

Law enforcement officials have recently reported an increase in trafficking of native turtles, including the bog turtle, in the United States (Macdonald blog post 2020). South Carolina, for example, has been a "black market oasis in the Southeast" as, until recently, the laws in place were insufficient to protect native reptiles and amphibians (Liles article 2020 (quoting Senator Thomas McElveen); Center for Biological Diversity press release 2020). An adult bog turtle is worth several thousand dollars on the black market (Turtle Conservancy webpage 2019;). Most native turtles are exported to Asia, but many are sold in the United States, sometimes falsely advertised as "captive-bred" pets (Macdonald article 2020).

Poaching has become such a significant problem for bog turtles that the locations of most known population sites are kept secret by state agencies and special permission or permits are required by researchers to access the sites (Knoerr et al. 2020, at 2; Stratmann et al. 2020, at 333; Tutterow et al. 2017, at 294; van Dijk, at 4).

Over the course of the 2019 and 2020 field seasons, Holden (2021) received anecdotal evidence that wetlands in Floyd County, Virginia had been poached within the past 10–15 years (Holden 2021, at 30). Private landowners told the field researchers that people had taken small turtles out of the wetlands they owned (Holden 2021, at 30). "The removal of even a few individuals, especially adult females, can have long-term impacts on populations due to the life history traits of the species such as their low annual reproductive output (Ernst and Lovich 2009), long generation time (Shoemaker 2011)[,] and apparently small population sizes compared to other turtle species (Tryon 1990, Rosenbaum et al. 2007)" (Holden 2021, at 30; *see also* Liles article 2020). Thus, removal is a site-specific driver of decline in bog turtle populations (Holden 2021, at 38, 119 (noting that "[w]hile habitat alteration and destruction may be relatively easy to observe, other drivers are not as apparent, such as loss of individuals to poaching, or predation via subsidized predators"). For some populations, taking even a few female bog turtles can be the difference in that population continuing to persist (Liles article 2020 (quoting J.J. Apodaca, director of conservation and science for the Amphibian and Reptile Conservancy: "On top of habitat loss, this is the last straw for some of these populations.").

Further, poaching usually ends a turtle's natural life as most turtles cannot be released back into the wild even if seized from traffickers alive (Macdonald blog post 2020 (quoting Noelle Rayman-Metcalf, U.S. Fish & Wildlife Service endangered species biologist)).

Photo of a female bog turtle was confiscated from an individual who collected hundreds of turtles illegally. The turtle will live out the rest of its life in captivity in the care of staff at the Bronx Zoo. D. Boyer WCS/Bronx Zoo (Macdonald blog post 2020).

This is because there is no way to know exactly where the turtles were taken from, and releasing them just anywhere within their range could have unintended genetic consequences for populations that have adapted to survive in certain areas over generations (Macdonald blog post 2020 quoting Noelle Rayman-Metcalf, U.S. Fish & Wildlife Service endangered species biologist)). Partnering conservation genetics laboratories are developing DNA libraries for bog and other turtle species to help biologists determine where seized turtles came from, in the hopes of being able to return them home (Macdonald blog post 2020).

Therefore, illegal collection for the pet trade poses a significant threat to the species.

C. Disease or Predation

As bog turtle populations continue to decrease and become more isolated, they become less resilient and more susceptible to disease and predation. In one study, for example, nest predation was found to be the most significant cause of nest failure (Knoerr et al. 2020, at 6). Most likely disease and/or predation both hamper the survival and recovery of the species, and may compound existing threats from other contributing factors, such as habitat destruction and overutilization.

1. Disease

Bog turtles may suffer from bacterial infections. Reports of die-offs, presumed related to disease, emerged in 2009 (van Dijk 2011, at 4). The extent and severity of epidemic disease has not been documented range-wide (van Dijk 2011, at 4). Brenner et al. 2002 and Carter et al. 2005 reported incidence of bacterial and mycoplasma potential pathogens in North Carolina and Virginia populations (van Dijk 2011, at 4 (citing Brenner et al. 2002, at 315; Carter et al. 2005, at 170–73).

Carter et al. 2005 identifies severe and potentially fatal cases of bacterial pneumonia in wild-caught bog turtles (Carter et al. 2005, at 170–73). The bacteria responsible for the pulmonary infection were

likely a gram-negative organism such as *Pseudomonas* sp. or *Aeromonas* sp. (Carter et al. 2005, at 172). The empty intestinal tract and large gall bladder indicated that one of the bog turtles (a female) had not eaten recently before death (Carter et al. 2005, at 172). The pneumonia may have caused the turtle to stop eating, although female turtles frequently become anorexic around the time of oviposition (Carter et al. 2005, at 172 (citing Fowler 1980)).

Taking disease into consideration, Carter et al. 2005 explained that:

> Although habitat loss and collection of wild animals for the pet trade have been implicated in bog turtle declines (Ernst et al., 1994; Mitchell, 1994; Mitchell et al., 1991), further study is needed to address the importance of all threats, including disease, in declining populations. Disease transmission could potentially have measurable effects on mortality and fecundity rates, yet little is known of their role in wildlife population dynamics (Jacobson, 1997; Jacobson et al., 1995; Flanagan, 2000).

(Carter et al. 2005, at 172). Knoerr et al. 2021 also noted that "[m]any conservation challenges are associated with small and declining populations of rare species. Such species are vulnerable because they are less resilient to disease (De Castro & Bolker, 2005), habitat degradation (Schleuning et al., 2009) and genetic, demographic, and environmental stochasticity (Soule & Simberloff, 1986; Stacey & Taper, 1992; Lande, 1993; Hanski, 1998)" (Knoerr et al. 2021, at 1). Therefore, it is likely that the threat bacterial infections and other diseases pose to the southern population of the bog turtle becomes greater as the small, disjointed population continues to decline.

2. Predation

A host of different animals prey upon bog turtle eggs and/or nests, hatchlings, and adults. Such predators include racoons, skunks, dogs, foxes, mink, muskrats, bullfrogs, snapping turtles, water snakes, egrets, herons, crows, birds of prey, and other large predators (Northern Population Recovery Plan 2001, at 22 (citing Bury 1979)). Due to its relatively small size, the bog turtle may be more vulnerable to predators in comparison to larger turtle species (Northern Population Recovery Plan 2001, at 22). As described in the Recovery Plan for the northern population of the bog turtle:

> Many of the primary predators on bog turtles and their nests are human commensals, i.e., they flourish in the presence of humans and the landscapes that they alter. This is particularly acute for species such as the bog turtle, which occurs primarily in agricultural landscapes where the presence of raccoons, skunks, opossums, and crows can pose a significant threat. How significant a threat these subsidized species pose to bog turtles is hard to determine, although in certain populations it is speculated that predation of adults and eggs is a serious problem.

(Northern Population Recovery Plan 2001, at 22; *see also* van Dijk 2011, at 4). "[I]ncreased predation of eggs and hatchlings from subsidized racoons has been indicated" (van Dijk 2011, at 4).

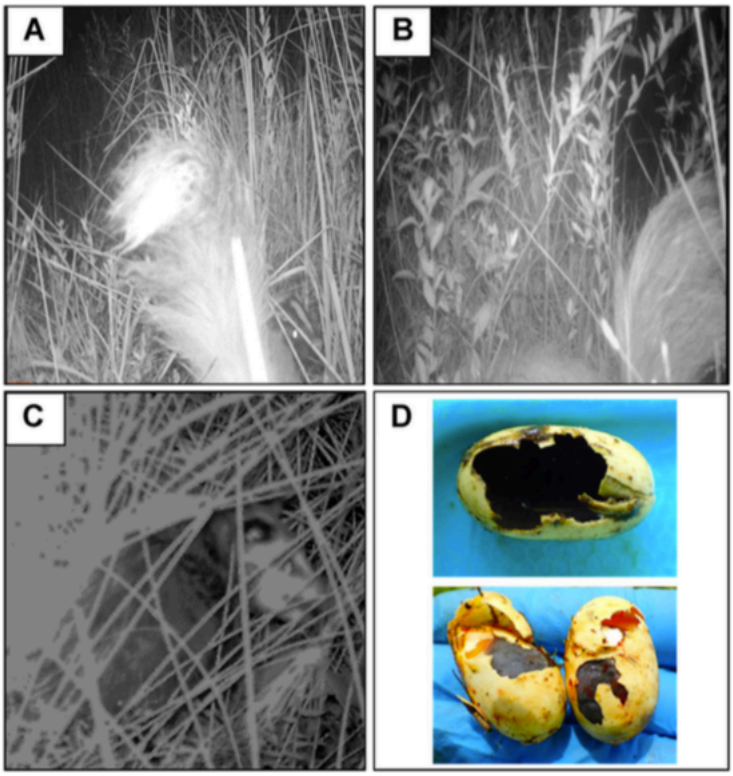

Figure 4. Sample camera trap photos depicting bog turtle nest predation events by striped skunks (A, B) and Virginia opossum (C), western North Carolina, USA, 2016–2017; predation events by small mammals (D) were evident from the damage pattern on eggshells (Knoerr et al. 2020, at 5).

A study done in North Carolina from May 2016 to October 2017 found that nest predation was the most significant cause of nest failure (Knoerr et al. 2020, at 6). Bog turtle nests at 7 sites in western North Carolina were monitored. The wetlands in the study ranged from a 0.2-ha isolated wetland within a residential area to a 3.1-ha wetland within a mosaic of wet meadow, pasture, and woodland (Knoerr et al. 2020, at 2). They found 282 eggs in 83 nests across the 7 sites in both field seasons and found that predation accounted for the greatest source of nest failure. Mesopredators accounted for 68% of predated eggs (Knoerr et al. 2020, at 4). Predators like the northern raccoon, striped skunk, and red fox have been reported as the largest sources of increased bog turtle predation in altered habitats (Knoerr et al. 2020, at 6 (citing Northern Population Recovery Plan 2001)).

The study found that predation was higher where predators had easier access to bog turtle nests. There was more predation in the interior of the wetlands than along the wetland boundaries. This could be because rivulets and rivulet edges reduced emergent vegetation and gave predators easier access to the wetland interior, and some nests in the study were within 2m of rivulets (Knoerr et al. 2020, at 7). They also documented predation events from small predators like the star-nosed mole *(Condylura cistata)*, short-tailed shrew *(Blarina brevicauda)*, American mink *(Neovison vison*), and various mice species (Knoerr et al. 2020, at 7).

D. The Inadequacy of Existing Regulatory Mechanisms

The southern population of the bog turtle is protected to a degree under federal and state endangered species laws and international trade regulations, yet poaching of the species for the

illegal pet trade remains a major threat. These regulatory mechanisms also fail to provide necessary protections for the species' habitat.

> It is the inadequacy and conflicting nature of regulations and screening mechanisms that, in many instances, are failing to halt the loss of bog turtle habitat. The actions of a multiplicity of federal, state, and local agencies that deal with land-use and development issues often have competing purposes, resulting in the incremental loss and destruction of bog turtle habitat as well as the larger, dynamic ecosystems upon which the mosaic of wetlands used by bog turtles depend. Review of site-specific projects and permit applications frequently does not fully consider their landscape scale cumulative impacts.

(Northern Population Recovery Plan 2001, at 21).

Given the species' continuing decline, the patchwork of laws and regulations have proven to be inadequate to protect the southern population of the bog turtle and its habitat.

1. Federal Regulations

a. Endangered Species Act

The southern population of the bog turtle receives some federal protection under the ESA. In 1997, the northern population was listed as threatened and the southern population was listed as threatened based on similarity of appearance. 62 Fed. Reg. 59,605 (Nov. 4, 1997).

At the time of listing, the Service determined to classify the species into two DPSs (i.e., the northern and southern populations) (*see* Section III.B. Taxonomy). In the final listing rule, the Service cited three main factors that weighed on its decision not to grant the southern population the same protections as the northern population: (1) discovery of previously unknown bog turtle sites in North Carolina; (2) limited information regarding threats to the southern population; and (3) inadequate survey coverage within the southern range (Holden 2021, at 2 (citing 62 Fed. Reg. at 59,613)).

Because the southern population is only listed due to similarity of appearance to the northern population, it does not receive the same protections under the ESA. The Service explains that:

> Because individuals from the northern and southern populations are almost identical, a poacher could claim that a turtle he collected from the threatened northern populations was taken from the South. In order to eliminate such confusion for law enforcement personnel, the southern populations was designated as "threatened due to similarity of appearance," which makes the poaching of bog turtles a federal offense anywhere within the species' range. The southern population of the species is not subject to Section 7 consultations requirements under the [ESA].

(FWS Bog Turtle (southern population) webpage 2022). Therefore, while poaching of the southern population is illegal, the species is only federally protected for the purpose of protecting the northern population. Such similarity of appearance determinations are an important enforcement

and protection mechanism under the ESA, however, it does not offer adequate federal protection for the southern population. Importantly, habitat for the southern population is not federally protected under the ESA. Further, as mentioned above, ESA Section 7 consultation is not required for federal actions that may jeopardize the southern population. The northern population receives these protections. In 2001, a recovery plan was compiled for the northern population (Northern Population Recovery Plan 2001), however, there is no recovery plan for the southern population due to its listing status (FWS Bog Turtle (southern population) webpage 2022).

Though the southern population was not given the same protection status as the northern population when the DPSs were listed, the Service notes that "[b]oth populations face similar stressors, with the primary threats being habitat loss due to the draining and filling of wetlands for farming and development; and illegal collection of wild bog turtles for the pet trade" (FWS Bog Turtle (southern population) webpage 2022). Given its declining status, full protection under the ESA should be extended to the southern population of the bog turtle.

b. Commitment to International Wildlife Conventions

Pursuant to 16 U.S.C. 1531(a), the United States has "pledged itself as a sovereign state in the international community to conserve to the extent practicable the various species of fish or wildlife and plants facing extinction . . . ." Relevant to the bog turtle, this includes the Convention on International Trade in Endangered Species of Wild Fauna and Flora ("CITES") (*see* Section IV.D.3. International Protections). CITES is further implemented by the Lacey Act, 16 U.S.C. §§ 3371–3378, which prohibits trade in wildlife, fish, and plants protected under CITES (16 U.S.C. §§ 1531(a)(4), 1537a; 50 C.F.R. § 23.22). CITES, discussed in Section IV.D.3.a. Convention on International Trade in Endangered Species of Wild Fauna and Flora below, is a treaty aimed at ensuring that cross-border trade does not threaten species' survival. The bog turtle was first protected under Appendix II of CITES in 1975 and transferred to Appendix I in 1992.

While these domestic and international regulatory mechanisms are important, they have not removed the incentive to poach bog turtles to satisfy the pet trade demand.

c. Indirect Federal Protections

Though the southern population of the bog turtle is protected under the ESA and similar state and international regulations, this protection often does not extend to the species' habitat. Instead, protection for the bog turtle's habitat is often incidentally provided under other laws and regulations that are indented to protect environmental resources (e.g., wetlands, forests, etc.) (Northern Population Recovery Plan 2001, at 21). Such protections include those provided by the National Environmental Policy Act, Clean Water Act, National Forest Management Act, and The Wilderness Act.

The National Environmental Policy Act ("NEPA"), 42 U.S.C. § 4321 et seq., requires agencies to consider or take a "hard look" at the environmental impacts of any major federal action. This is done through the compilation of either an environmental assessment or environmental impact statement, which are reports that disclose the potential environmental impacts of an action—including impacts on rare and sensitive species such as the bog turtle—and potential alterative actions. However, the law only requires that agencies assess the impacts of the proposed action and

does not require agencies to choose a less environmentally harmful alternative. Because of this, NEPA does not guarantee that the southern population of the bog turtle or its habitat will be protected from federal actions.

Section 404 of the Clean Water Act regulates the discharge of dredge or fill materials into waters of the United States, including wetlands. 33 U.S.C. § 1344. Under the provision, landowners or developers are required to obtain permits from the U.S. Army Corps of Engineers to carry out such activities. Permitted activities can cause the destruction and degradation of bog turtle habitat. Further, certain farming and foresting activities which could affect wetlands, such as minor draining, are exempt from regulation under Section 404(f)(1).

The National Forest Management Act ("NFMA") governs the administration of our nation's forests. As part of that administration, NFMA requires that forest management plans provide for diversity of plant and animal communities, 16 U.S.C. 1604(g)(3)(B). The intent is to provide the ecological conditions (i.e., habitat) necessary to conserve common native species and help recover threatened and endangered or otherwise sensitive species (2012 Planning Rule FAQs webpage 2022). However, under the multiple use mandate for management of Forest Service lands, the agency must balance this objective with other uses, such as timber harvesting, range/grazing, recreation, etc. Therefore, bog turtle habitat may be harmed by authorization of such other uses.

Within the southern population, the U.S. Forest Service manages some bog turtle sites. As of 2014 in North Carolina, approximately 15% of the known occurrences of bog turtles were within the Nantahala and Pisgah National Forests, with approximately 40% of these occurrences (approximately 6% of all North Carolina occurrences) being within a permanently protected area (e.g., designated wilderness, inventoried roadless area) (Forest Service 2014, at 30).

The Wilderness Act created a formal mechanism for designating wilderness on federal public lands to preserve their natural condition and protect species and ecosystems from human influences. While the Wilderness Act serves an important conservation objective, with only a small percent of the remaining southern population of the bog turtle occurring within designated wilderness (Forest Service 2014, at 30), the species does not receive significant protection from this statute.

There are also a few bog turtle sites along the Blue Ridge Parkway that are on land managed by the National Park Service. Per the National Park Service Management Policies (2006), the National Park Service maintains all native plants and animals as part of the natural ecosystem of the parks (NPS Management Policies 2006, at 42 (Section 4.4)). Much of the bog turtle's range in Virginia and northern North Carolina is scattered along a narrow belt located in and along the Blue Ridge Parkway (NPS Blue Ridge Bog Turtle webpage 2022). These wetlands are important for the protection of bog turtles—offering one of the last refuges where both the bog turtle and its habitat are protected (NPS Blue Ridge Bog Turtle webpage 2022). However, the wetlands are not pristine and many have been impacted by past agricultural activities and development (NPS Blue Ridge Bog Turtle webpage 2022). Parkway biologists work with researchers to protect bog turtles and have begun tagging turtles to deter poaching and to help with their recovery (NPS Blue Ridge Bog Turtle webpage 2022). They also anticipate that the return of beavers will increase the number of wetlands and bog turtle habitat (NPS Blue Ridge Bog Turtle webpage 2022). While these few sites are important refuges for bog turtles, they do not provide significant protection for the southern population.

2. State Regulations

The species is protected by legislation or regulation in each of the States where it occurs. Some sites inhabited by bog turtles are under government or nongovernment organization ownership and management, but many sites occur on privately owned lands (van Dijk 2011, at 4). Because state (and federal) laws fail to directly protect the species' habitat wherever it occurs, the southern population of the bog turtle has continued to decline throughout its range.

a. Georgia

The bog turtle is state-listed as endangered in Georgia (Ga. Bog Turtle webpage 2022). The species also has a state rank of S2, which means that the species is imperiled in Georgia because of rarity due to very restricted range, very few populations, steep declines, or other factors making it very vulnerable to extirpation from the state (Ga. Biodiversity Conservation Data webpage 2022). Georgia specifically prohibits the taking of species protected by federal or state law, and bog turtles may not be held as a pet regardless of its origin or morphology (Ga. Turtling Regulations webpage 2022; Ga. Laws Related to Native Wildlife webpage 2022).

In 2003, the Bog Turtle Headstart Program was initiated in Georgia to release juvenile bog turtles into restored mountain bog habitat (Ga. Bog Turtle Headstart Program webpage 2022). The program is an ongoing partnership between the Georgia Department of Natural Resources, Wildlife Resources Division, Georgia Plan Conservation Alliance, Chattahoochee Nature Center, Tennessee Aquarium, Zoo Atlanta, Atlanta Botanical Garden, U.S. Forest Service, and U.S. Fish and Wildlife Service (Ga. Bog Turtle Headstart Program webpage 2022). The effort began with the collection of egg-bearing female bog turtles from wild populations on private lands in Georgia. The females were monitored and their eggs were deposited, incubated, and hatched in captivity (Ga. Bog Turtle Headstart Program webpage 2022). The hatchlings are then raised in captivity for about 22 months until they reach adult size and are ready to release (Ga. Bog Turtle Headstart Program webpage 2022 ("Without hibernation and a continued feeding regime, Headstart bog turtles can reach adult size in two years and are ready for release. Bog turtles in the wild may take 6–8 years to reach adult size.")).

The goal of the Headstart Program is to release approximately 20 juveniles per year to establish a population over a five to ten year period (Ga. Bog Turtle Headstart Program webpage 2022). The bog turtles are released into habitat that has been restored under the Georgia Mountain Bog Enhancement Project and efforts spearheaded by the Georgia Plan Conservation Alliance (Ga. Bog Turtle Headstart Program webpage 2022). Mountain bog restoration is listed as a high-priority conservation action in Georgia's State Wildlife Action Plan (Ga. Mountain Bog Restoration webpage 2022).

Despite these efforts, the Georgia Wildlife Resources Division has acknowledged that "[m]anagement of known bog turtle sites in Georgia is difficult since most occur on private land" (Ga. Bog Turtle webpage 2022). In Georgia, most if not all populations are presumed extinct except for a small number of sites (Holden 2021, at 28 (citing Stratmann et al. 2020)).

b. North Carolina

The bog turtle is state-listed as threatened in North Carolina and identified as a Species of Greatest Conservation Need in North Carolina's Wildlife Action Plan (N.C. Bog Turtle webpage 2022).

Because the bog turtle is state-listed as a threatened species, specimens cannot be collected or taken except under a special endangered species permit issued by the North Carolina Wildlife Resources Commission's Executive Director (N.C. Bog Turtle webpage 2022; N.C. Endangered Species Permit webpage 2022).

The Commission works with federal agencies, private landowners (as roughly 75% of all bog turtle habitat in the Southeast is located on private lands) (N.C. Wildlife Action Plan 2015, at 129), scientists, and conservation organizations to manage bog turtles and their habitat in North Carolina (N.C. Bog Turtle webpage 2022). In the early 1990s, the Commission began surveys for bog turtles to determine their range (N.C. Bog Turtle webpage 2022). Every year since, Commission biologists have conducted surveys and recorded important information on each bog turtle that is captured (e.g., gender, age, shell length, and capture location) (N.C. Bog Turtle webpage 2022).

The Commission also works with Project Bog Turtle, which is a conservation initiative of the North Carolina Herpetological Society that began in the mid-1970s with a bog turtle distribution study (N.C. Bog Turtle webpage 2022). The project aims to educate the public and landowners about bog turtle conservation, survey for bog turtle populations, monitor for illegal collection, and protect and restore suitable bog turtle habitat in North Carolina (N.C. Bog Turtle webpage 2022). In addition to state agencies, many other federal agencies, conservation organizations, and individuals are involved in the project (N.C. Bog Turtle webpage 2022; N.C. Wildlife Action Plan 2015, at 129). Bog turtles captured during project surveys are implanted with Passive Integrated Transponder tags (PIT-tag), which allow biologists to identify an individual turtle if it is recaptured (N.C. Bog Turtle webpage 2022). This helps with estimating population sizes, measuring growth and other vital rates, and preventing the illegal collection of bog turtles (N.C. Bog Turtle webpage 2022; N.C. Wildlife Action Plan 2015, at 129).

Despite these efforts, the Commission recognizes that bog turtles "have been drastically affected by the loss of mountain bogs and by the lack of management in the bogs that remain" (N.C. Wildlife Action Plan 2015, at 133). Active management and protection of their habitat is required in the state, but difficult to implement (N.C. Wildlife Action Plan 2015, at 134). Knowledge gaps regarding the species must also be addressed (N.C. Wildlife Action Plan 2015, at 133). While continuation of existing conservation efforts is important, additional regulations and habitat protections must be implemented.

c. South Carolina

The bog turtle is state-listed as threatened in South Carolina with a state rank of S1 (critically imperiled) (S.C. SWAP 2015, at 2). It is unlawful to take, possess, transport, export, process, sell, or offer for sale or ship, and for any common carrier knowingly to transport or receive for shipment bog turtles, except by permit for scientific and conservation purposes issued by the South Carolina Department of Natural Resources ("SCDNR") (S.C. Reptile Regulations webpage 2022).

Bog turtles were first documented in South Carolina in 1988, and only four specimens have been found in the state (S.C. SWAP 2015, at 2). Surveys for the bog turtle and the green salamander, funded by the SCDNR, were conducted around 2015 (S.C. SWAP 2015, at 12). No occurrences of bog turtles were documented during these surveys (S.C. SWAP 2015, at 12). In South Carolina, most if not all populations are presumed extinct (Holden 2021, at 28 (citing Stratmann et al. 2020)).

In the 2015 State Wildlife Action Plan, SCDNR made conservation recommendations for the species including to protect bog turtle habitat through acquisition or conservation easements, restore bog turtle habitat, educate and work with private landowners in conjunction with Project Bog Turtle, provide bog turtle habitat management recommendations, re-survey all known historical bog turtle sites, and consider captive breeding and reintroduction programs if survey results indicate that bog turtles have been extirpated in South Carolina (S.C. SWAP 2015, at 13).

d. Tennessee

The bog turtle is state-listed as threatened by the Tennessee Wildlife Resources Agency and considered very rare and imperiled by Tennessee Department of Environment and Conservation (Tenn. Bog Turtle webpage 2022). It is illegal to own a bog turtle in Tennessee. However, state listing does not provide any legally actionable state-level protections for bog turtle habitat.

In the Wildlife Resources Agency's 2015 State Wildlife Action Plan, the bog turtle was evaluated and determined to be among the species of the greatest conservation need in the state (Tenn. Reptile Conservation List webpage 2015). The bog turtle also received a state rank of S1 meaning that the species is critically imperiled in the state with five or fewer occurrences statewide, and its bog and fen habitat was listed a priority terrestrial habitat for conservation (Tenn. State Wildlife Action Plan 2015, at 26, 59). In the 2015 Climate Change Vulnerability Assessment for Tennessee Wildlife and Habitats, the bog turtle was the only reptile species identified as moderately vulnerable to climate change, primarily due to its relatively narrow habitat requirements as well as its dependence on other species to generate habitat (Tenn. Climate Change Vulnerability Assessment 2015, at 28). The assessment also noted that species has also been found to have relatively low genetic diversity among its populations, which may limit its adaptive capacity over time (Tenn. Climate Change Vulnerability Assessment 2015, at 28 (citing Rosenbaum et al. 2007)). Efforts to address this problem are being carried out by the Tennessee bog turtle captive breeding and release program, which was initiated nearly 30 years ago by Zoo Knoxville to aid in the conservation of the species (Dresser 2017, at 35; Dresser et al. 2017, at 1191–98).

e. Virginia

The bog turtle is state-listed as endangered in Virginia (Va. Bog Turtle factsheet 2022). Because of the species' protected status, it unlawful to harm, collect, or possess a bog turtle without a permit (Va. Bog Turtle factsheet 2022).

The Virginia Department of Wildlife Resources has a team of bog turtle surveyors (Va. Bog Turtle Surveyors list 2022) and has an initiative called Restore the Wild, which restores and creates vital wildlife habitat, though it is unclear if any of the current restoration projects directly benefit bog turtle habitat (Va. Restore the Wild webpage 2022). Despite their endangered status and measurable declines throughout their range, "there have been no estimates of population size conducted in Virginia in more than two decades which limits managers' ability to infer their population status" (Holden 2021, at 7). Though some bog turtle populations occur on National Park Service property, the majority occur on private lands, which complicates the ability to effectively monitor and manage the species (*see* Va. Herpetological Society Bog Turtle webpage 2022).

3. International Protections

a. Convention on International Trade in Endangered Species of Wild Fauna and Flora

The bog turtle has been protected under CITES since it was first added to Appendix II of CITES in 1975 (Northern Population Recovery Plan 2001, at 22). In 1992, the species was transferred to Appendix I due to increased collection and trade (Northern Population Recovery Plan 2001, at 22 (citing 57 Fed. Reg. 7722 (Mar. 4, 1992); CITES Appendices webpage 2022). Appendix I includes species threatened with extinction and prohibits trade in specimens of these species except when the purpose of the import is not commercial, for example for scientific research (The CITES Appendices webpage 2022).[3] Appendix I listed species are the most endangered among CITES-listed animals and plants (The CITES Appendices webpage 2022).

Despite this longstanding international protection, illegal collection and trade continues to threaten the bog turtle (*see* Section IV.B). Therefore, the CITES listing has proven to be an inadequate regulatory mechanism for protection of the bog turtle.

E. Other Natural or Manmade Factors Affecting Continued Existence

1. Climate Change

The southern population of the bog turtle is particularly sensitive to the effects of climate change (as are bog turtles in general). Rising temperatures may directly affect the bog turtle by shifting the timing of its phenology (i.e., hibernation and activity periods) (Holden 2021, at 119). Climate change also affects the bog turtle's delicate habitat. The IUCN Red List assessment identified climate change and severe weather as an ongoing threat to the species (van Dijk 2011, at 6). Specifically, habitat shifting and alteration may cause slow, significant declines (affecting the whole population, >90%) and droughts may cause fluctuations in bog turtle populations (affecting a minority of the population, 50%) (van Dijk 2011, at 6; *see also* Gibbons 2000, at 653 ("Six significant threats to reptile populations are habitat loss and degradation, introduced invasive species, environmental pollution, disease, unsustainable use, and global climate change[.]")).

In Michael T. Holden's master's thesis, which assesses changes in bog turtle population abundance and factors influencing nest predation in Virginia, he notes that "[i]n this rapidly changing climate, bog turtle activity patterns might be changing" (Holden 2021, at 119). For example, if average temperatures have risen enough due to climate change, this may shift the timing of the bog turtle's spring emergence and peak activity (Holden 2021, at 24 (noting further study of climate data, ambient air temperature/HDD, and soil temperature need to be done to understand potential shifts in the timing of emergence)).

[3] In these exceptional cases, trade may take place provided it is authorized by the granting of both an import permit and an export permit (or re-export certificate). (The CITES Appendices webpage 2022). Article VII of the Convention provides for a number of exemptions to this general prohibition.

Further, the bog habitats in which bog turtles live are at risk due to climate change. A study of the potential impacts of climate change on *Sphagnum* bogs in the southern Appalachian Mountains found that:

> The projected increase in evapotranspiration coupled with nitrogen deposition may lead to the drying up of southern bogs causing: (1) increased decomposition rates, which can lead to the system becoming a carbon source rather than a sink; and (2) local extinction of many bog species, allowing alternative ecosystems to replace the bogs.

(Schultheis et al. 2010, at 417). As the southern population of the bog turtle's survival in the wild is dependent on its habitat, the impacts of climate change on bogs may have a severe and irreversible impact on the species (*see* Gibbons et al. 2000, at 655 ("[A]s bogs disappear in the eastern United States, so too do bog turtles[.]")).

The United Nations Intergovernmental Panel on Climate Change's special report on global warming demonstrated that we are already seeing the consequences of 1°C of global warming above preindustrial levels (IPCC 2018). Such consequences include more extreme weather and temperatures; droughts and flooding; on land, impacts on biodiversity and ecosystems, including species loss and extinction; and other changes (IPCC 2018, at 7–10). Continued warming of 1.5°C or higher will cause long-lasting or irreversible changes to natural habitat and ecosystems (IPCC 2018, at 5). Limiting global warming would require a rapid and significant decline in human-caused greenhouse gas emissions as well as the removal of carbon dioxide from the air (i.e., carbon capture and storage) (IPCC 2018, at 15). While some nations are taking actions to reduce emissions, there is no imminent solution to global climate change or the negative effects of global warming on the bog turtle. Climate change represents a significant manmade threat to species and habitat that will increase the likelihood of the bog turtle's extinction.

2. Synergistic Effects

The synergistic effects of the threats discussed above could cause the extinction of the southern population of the bog turtle. "Like interactions within species assemblages, synergies among stressors form self-reinforcing mechanisms that hasten the dynamics of extinction" (Brook et al. 2008, at 457). The southern population of the bog turtle is already at risk due to its biology (low-fecundity, high egg and hatchling mortality, relatively late maturity, etc.), rendering it more vulnerable to synergistic impacts of threats.

> Traits such as ecological speciali[z]ation and low population density act synergistically to elevate extinction risk above that expected from their additive contributions, because rarity itself imparts higher risk and speciali[z]ation reduces the capacity of a species to adapt to habitat loss by shifting range or changing diet. Similarly, interactions between environmental factors and intrinsic characteristics make . . . low-fecundity species particularly predisposed to anthropogenic threats given their lower replacement rates.

(Brook et al. 2008, at 455 (internal citations omitted)).

As included in Section IV.C.1 above, "[m]any conservation challenges are associated with small and declining populations of rare species" such as the bog turtle (Knoerr et al. 2021, at 1). Such species are vulnerable because they are less resilient to disease, habitat degradation, and genetic, demographic, and environmental stochasticity (Knoerr et al. 2021, at 1 (citing De Castro & Bolker 2005, Schleuning et al. 2009; Soule & Simberloff 1986; Stacey & Taper 1992; Lande 1993; Hanski 1998)).

> Like many turtle species, bog turtles have a life history strategy that balances low fecundity, high egg and hatchling mortality, and relatively late maturity, with the potential long reproductive lifespan of the adults. While populations can increase and thrive in ideal habitat, this reproductive strategy limits the ability of a turtle population to recover quickly if faced with a natural or human-caused disaster or unusually high mortality in older juveniles and adults. In addition, isolation of bog turtle habitats may increase the dangers of limited genetic exchange and inbreeding.

(University of Michigan Museum of Zoology webpage 2022).

Therefore, although some stressors in isolation may not, on their own, significantly increase the extinction pressure that the southern population of the bog turtle faces, the synergistic impacts of multiple threats to the species likely increase the extinction pressure that it faces.

V. CRITICAL HABITAT DESIGNATION

This Petition requests that FWS designate critical habitat, to the extent prudent and determinable, for the southern population of the bog turtle concurrently with a final ESA listing pursuant to 16 U.S.C. § 1533(b)(6)(C); 50 C.F.R.§ 424.12. As part of the critical habitat review, FWS should assess whether the risks associated with designation of critical habitat for the bog turtle outweigh the benefits of such designation. *See* 62 Fed. Reg. 59,605, 59,613 (Nov. 4, 1997) (recognizing the potential risk of illegal collection if bog turtle cites are publicly known). However, because habitat loss and degradation is a major threat to the species, appropriate habitat protections would benefit the species. We therefore request that FWS take this into consideration.

The definitions of the terms "critical habitat" and "conservation" indicate that, in designating critical habitat, FWS must consider these species' ultimate recovery, and not just survival, as a primary purpose of critical habitat designation. *See* 16 U.S.C. § 1532(5)(A) (defining critical habitat to include both occupied and unoccupied habitat that is "essential for the conservation of the species"); 16 U.S.C. § 1532(3) (defining "conservation" as "the use of all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to this chapter are longer necessary"). Accordingly, if critical habitat is designated for the southern population of the bog turtle, it should include all the areas currently or potentially inhabited by the species or utilized for migration between metapopulation sites, and a sufficient amount of other potentially suitable habitat in the United States, to allow the species to recover from its endangered, or threatened, status.

VI. PROTECTIVE REGULATIONS FOR THREATENED SPECIES

Pursuant to 50 C.F.R. § 424.14(j), if FWS determines to list the southern population of the bog turtle as threatened, we petition the agency to promulgate a 4(d) rule to confer full take protections on the

species concurrent with final listing. Given the bog turtle's biological status and low reproductive rate, the existing regulatory mechanisms that have proven inadequate to conserve the species, and the numerous threats facing the species, including in particular habitat destruction and modification, the southern population of the bog turtle should receive full protection under the ESA to ensure its conservation.

Take protections are paramount to the bog turtle's recovery. There is no 4(d) rule in effect for either the northern or southern populations of the bog turtle, and incidental take is exempted in the southern population. The impacts habitat degradation and illegal collection have on the southern population (as well as the northern population) of the bog turtle will only be compounded by the many other threats and biological challenges facing the species. Therefore, if the southern population of the bog turtle is listed as threatened, the species will require a 4(d) rule that confers full protections under the ESA. Those protections are necessary and advisable to provide for the conservation of the bog turtle.

VII. SIMILARITY OF APPEARANCE DETERMINATION

While the southern population of the bog turtle is the sole subject of this Petition, pursuant to 50 C.F.R. § 424.14(j), we petition that in conjunction with any listing designation for the species, FWS also promulgate a 4(e) rule for similar-looking turtle species. *See* 16 U.S.C. § 1533(e); 50 C.F.R. § 424.14(c)(2) (2016) ("Only one species may be the subject of a petition, which may include, by hierarchical extension based on taxonomy and the Act, any subspecies or variety, or (for vertebrates) any potential distinct population segments of that species."). If the southern population of the bog turtle is listed as threatened or endangered under the ESA, it would be prudent to also protect any unlisted species that closely resembles the bog turtle in order to prevent the possibility of passing off a protected specimen as an unlisted specimen. This would both facilitate enforcement actions and prevent take of the southern population of the bog turtle.

As the northern population of the bog turtle is already listed as threatened under the ESA (and the southern population is currently listed based on similarity of appearance to the northern population), if the southern population is uplisted as endangered or threatened, the Service should consider the protection of both bog turtle DPSs in making a similarity of appearance determination. If the Service determines to list any species that are similar in appearance to the bog turtle, both the southern and northern populations would benefit.

Some states have identified similar-looking species that may be confused with the bog turtle. In Virginia, "Bog Turtles may be confused with small Terrapene Carolina [(*Glyptemys insculpta*)]" (Va. Herpetological Society webpage 2022). Though, notably, Terrapene carolina (also known as the common box turtle) has a hinged plastron and brightly multicolored carapace, and lack the singe, large orange spot behind the head (Va. Herpetological Society webpage 2022). In Georgia, "the common musk turtle (*Sternotherus odoratus*) remotely resembles the appearance of the bog turtle" though the musk turtle lacks the bog turtle's blotch and its plastron is weakly hinged (Ga. Bog Turtle webpage 2022). Spotted turtles (*Clemmys guttata*) may also be confused with the bog turtle (Pa. Bog Turtle factsheet 2007).

Because the bog turtle is one of the rarest turtles in the United States and the species is so commercially coveted in the illegal pet trade, laws banning the collection of bog turtles for sale have done little to stop poaching. A similarity of appearance determination for similar-looking species

may prevent the possibility of passing off a protected bog turtle specimen as an unlisted specimen. Therefore, in order to better protect the southern population (and the northern population) of the bog turtle, Defenders petitions FWS to also protect similar-looking species with a 4(d) rule.

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